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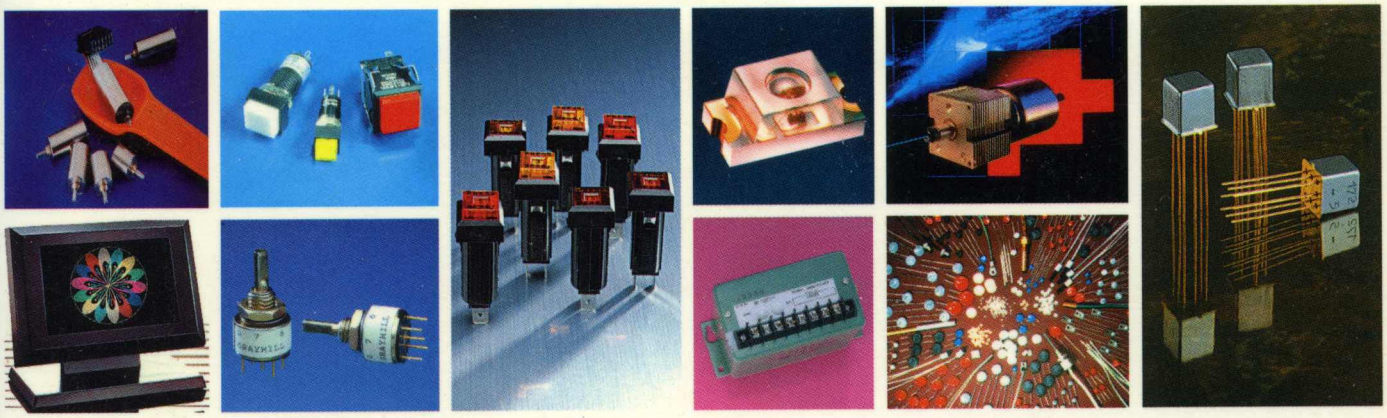
electronic engineers master catalog

VOLUME B



electromechanical, electro-optical, and military components

34th EDITION

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2475 Fiber Optic Equipment & Accessories
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Hearst Business Communications, Inc.

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how to use eem

The 34th edition of EEM is arranged in four volumes each composed of related Product Sections. For user convenience, each volume contains its own Product Index and Directory (green pages) and its own Manufacturers and Sales Offices Directory (yellow pages). Every Product Heading and every manufacturer of electronic products is listed in each volume. Where, however, the Product Section is assigned to a volume other than that in use, a cross reference is made to the appropriate volume for further information.

To locate a specific product. Start by choosing the volume whose title describes the class of electronic product you are seeking. If you are not sure which volume is appropriate, pick up the first one at hand and look up the product heading in the green pages. There you will find either a list of that product's manufacturers or you will be referred to the proper volume. All products are identified by their generic terms. Please read the instructions on the first page of each section. Manufacturers with catalog data pages in this edition of EEM appear in boldface type and page numbers are shown. Manufacturers appearing in lightface type have submitted verifying evidence that they supply the products shown. When you have located a product of interest, turn to the page(s) shown for further information. You will find these pages in each volume in the appropriate sections.

product selection guides

There are 35 Product Selection Guides included in this edition of EEM. They are located on the first pages of the Product Section to which they apply. Use these guides for basic selection parameters and then go to the EEM pages shown in the guide for more detailed information.

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*A Product Selection Guide precedes these Product Sections

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Princeton, NJ 08540
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FAX: (215) 941-0335

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advertisers' index

To find a specific manufacturer's data pages, an alphabetical index of EEM participants appears in EEM starting on page A•4 of Volume A and on pages B•4, C•4 and D•4 of the other volumes.

trademark and logofinder directories

A comprehensive Trademark Directory is included with Volume C. The EEM Logofinder shows the symbols and graphics used by manufacturers as identifiers on their products. Use these pages to locate manufacturers of specific trademarks and logos.

manufacturers' index

In the EEM yellow pages you will find pertinent details on all manufacturers listed in EEM including local sales offices and/or distributors. Please refer to the detailed instructions on the first page of the EEM yellow pages for additional information.

to order a product found in eem

When you have located the product that suits your needs, call the manufacturer or the local sales rep or distributor as shown in the EEM yellow pages. Give the EEM data page number and specs from that page. You and the supplier will be talking on the same wave length which should simplify your ordering and buying.

to file manufacturers' catalogs and data

The EEM File System is revised and updated to reflect changes in EEM itself. Each new EEM File System contains a complete Product Index. This index tells you where to file which catalog. It also contains a cross reference identifying what should be filed in each section. In order to use the EEM File System all you need is a supply of standard letter size, third-cut manila file folders. You then use the pressure sensitive labels which are supplied with the system to go into as much detail as you want or need.

Each label fits the third-cut file folder exactly. There are over 300 of these labels in each system: one for the index, one each for the EEM Product Sections, 24 for the alphabetical file of multiproduct catalogs, plus more than 200 additional labels for system expansion. The EEM File System also includes Cross Reference Cards so you can quickly and easily find multiproduct catalogs. The EEM File System is complete and can save you countless hours of time and thousands of dollars. Send your check for $25.00 to: EEM File System, 645 Stewart Ave., Garden City, NY 11530 and we'll absorb postage and handling. Send a purchase order and add $5.00 for postage and handling. NY, CA and MA residents, please add sales tax.

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All products are listed alphabetically by their generic names and then by subclassification. For example, look for "Fiber Optic Connectors" under "Connectors, Fiber Optic" or for "Digital Panel Meters" under "Meters, Panel (Digital)."

Following each product heading is a four-digit number directing you to the Product Section where these products are usually cataloged. If that Product Section is not in the EEM volume you are using, a "See Vol. A, B, C, or D" will direct you to the proper volume for your product classification. No numbers appear with cross-reference headings.

Under each product heading whose Product Section appears in the volume you are using, the names of the manufacturers who supply the product are shown in alphabetical order with EEM catalogers shown first in boldface type with appropriate page numbers. Other manufacturers are shown in light face type. The symbol (§) indicates that these products are available from local distributors. The symbol (†) indicates that the product is available to MIL specifications.

Abrasives-5400 — *See Vol. C*

Absorbers, Microwave-3450 — *See Vol. A*

Accelerometers-5500

Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200 .... D•1234
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 ... B•1892-1895
Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. B•1921
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ... B•1949
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1947
§† Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-8-SENS-IT .. B•1957
† Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... B•1959
A. L. Design, Inc., Buffalo, NY 14217 716-875-6240
Alpha-M Corp., Dallas, TX 75229 214-406-0424
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 ..... 408-730-4573; 1-800-828-3547
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4410
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342 818-362-7151
§ Endevco Corporation, Allied Signal Aerospace Co., San Juan Capistrano, CA 92675 714-493-8181
† EVI, Inc., Columbia, MD 21046 301-290-9550
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
§ HBM, Inc., Marlboro, MA 01752 508-624-4500
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
† Kelmet, Inc., San Dimas, CA 91773 714-599-0954
Kinemetrics/Systems, Kinemetrics, Inc., Pasadena, CA 91107 818-795-2220
§† Kistler Instruments Corp., Amherst, NY 14221-2171 716-691-5100
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
Metrix Instrument Co., Houston, TX 77043 713-461-2131
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
NMB Technologies, Chatsworth, CA 91311 818-341-3355
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
† Pind Testers Inc., Irvine, CA 92718 714-380-1551
Sensotec, Inc., Columbus, OH 43212 614-486-7723
† Sensym, Inc., Sunnyvale, CA 94089 408-744-1500
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400
† Sundstrand Data Control Inc., Sundstrand Corporation, Redmond, WA 98073-9701 206-885-3711
§† Systron-Donner Inertial Div., Concord, CA 94518 415-671-6400
§ Terra Technlg. Corp., Redmond, WA 98052 206-883-7300
Unholtz-Dickie Corp., Wallingford, CT 06492 203-265-3929
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Acoustic Systems (MIL)-2440

† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000

AC Power Protection Equipment — See Line Conditioners (Vol. D)

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Actuators, Servo, Linear-4900 — *See Vol. D*

Actuators, Servo, Rotary-4900 — *See Vol. D*

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Adapters/Connectors, T.V. to Peripheral Equipment-2100 — *See Vol. C*

Adapters, GPIB, IEEE 488-2100 — *See Vol. C*

Adapters, Fiber Optic-2475

DDK Electronics, Inc., Markham, Ont., CANADA L3R 9T2, 416-470-1346 ..... C•1337-1345
AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
§ GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† INTELCO, Acton, MA 01720 508-264-4485
† Light Control Systems Inc., M/A COM Inc., Tyngsboro, MA 01879 508-649-9870
† Lightwave Communications, Inc., Ridgefield, CT 06877 203-438-3591
† 3M Photodyne Products, Dynatel Systerms Division, Camarillo, CA 93010 ..... 805-388-8378;800-426-8688
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
Telebyte Technology, Inc., Greenlawn, NY 11740 ..... 516-423-3232;800-835-3298

Adapters, Meter, Current Measurement-2900 — *See Vol. D*

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Adapters, Wall Plug-in — See Power Supplies, Plug-in (Vol. D)

Adapters, Waveguide-3450 — *See Vol. A*

Adapters, RF (MIL)-2440

ABL Electronics Supply, Inc., Yorktown Hgts., NY 10598, 914-962-2253 ..... **C•1155**

§ **Pomona Electronics, Pomona, CA 91766, 714-623-3463** .. **C•1495-1496,1498-1499**

Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910

§† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272

§ Coax Connection, Yorktown Hgts., NY 10598 ..... 914-962-2303;800-431-2103

Concord Electronics Corporation, New York, NY 10012 1-212-777-6571

§ E-Z Hook, Tektest Inc., Arcadia, CA 91006 818-446-6175

§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101 617-890-4750

† Millivac Instruments, Inc., Schenectady, NY 12301 518-355-8300

† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666

† Pasternack Enterprises, Irvine, CA 92713 714-261-1920

§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK

Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428

Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610

§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Air Cleaners & Filters (Shielded & Unshielded)-2600 — *See Vol. C*

Air Conditioners (For Equipment)-2600 — *See Vol. C*

Alarms & Alarm Systems-2200 — *See Vol. D*

Alarms, Controls, Photoelectric-3700

Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154, 617-894-8700 ..... **D•1099**

§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600** .. **B•1320-1321**

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **D•1060**

AES Corp., Peabody, MA 01960 508-535-7310

† Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220

§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000

ASC Systems, St. Clair Shores, MI 48080 313-882-1133

Enerco, Inc., Seattle, WA 98108 206-762-1422

§ Heath Co., St. Joseph, MI 49085 616-982-3200

§ Hughey & Phillips, Inc., Simi Valley, CA 93065 805-581-5591

Lark Electronics, Inc., New York, NY 10040 212-569-0430

§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773

§ Rodann Electronics Mfg. Co., Brea, CA 92621 ..... 714-529-1301;800-366-7010

Scanning Devices, Inc., Waltham, MA 02154 617-891-8991

§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717

§ Sofrel, Inc., Eden Prairie, MN 55344 ..... 612-937-8835;1-800-8-SOFREL

Star Micronics, Inc., OEM Division, Piscataway, NJ 08854 908-572-9512

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Altimeters-2900 — *See Vol. D*

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† Systems Research Laboratories, Arvin/Calspan, Dayton, OH 45440 513-426-6000

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Compliance Design Inc., Boxboro, MA 01719 508-264-4668
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-4858 818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Rantec Microwave & Electronics, Esco Electronics, Chatsworth, CA 91311 818-885-8223
† Sabre Communications Corp., Sioux City, IA 51102 712-258-6690
Schaffner EMC, Inc. Instr. Div., Union, NJ 07083 ..... 908-851-0644;800-367-5566
ST Research Corporation, Newington, VA 22122 703-550-7000
† Tecom Industries, Inc., Chatsworth, CA 91311 818-341-4010
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831

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Antenna Sets (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§ Antenna Research Associates, Beltsville, MD 20705 301-937-8888
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
§ Eaton Corp., Electronic Instrument Div., Los Angeles, CA 90066 213-322-3061
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-4858 818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
Schaffner EMC, Inc. Instr. Div., Union, NJ 07083 ..... 908-851-0644;800-367-5566
ST Research Corporation, Newington, VA 22122 703-550-7000
† Tecom Industries, Inc., Chatsworth, CA 91311 818-341-4010
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831

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§† Adams-Russell, Inc., Div. of M/A COM, INC., Amesbury, MA 01913 508-388-5210
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§† Centurion International, Inc., Lincoln, NE 68504 402-467-4491
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498 319-395-1000
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-4858 818-882-6333
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
† Microwave Applications Group, Santa Maria, CA 93455 805-928-5711
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Sabre Communications Corp., Sioux City, IA 51102 712-258-6690
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
† Tecom Industries, Inc., Chatsworth, CA 91311 818-341-4010
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 ..... 805 987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Antenna Systems (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§ Antenna Research Associates, Beltsville, MD 20705 301-937-8888
Compliance Design Inc., Boxboro, MA 01719 508-264-4668
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-4858 818-882-6333
† Electronic Space Systems Corp., Concord, MA 01742 508-369-7200
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000
† MDM, Inc., Chatsworth, CA 91311 818-700-8400
† Microwave Applications Group, Santa Maria, CA 93455 805-928-5711

Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Rantec Microwave & Electronics, Esco Electronics, Chatsworth, CA 91311 818-885-8223
† Sabre Communications Corp., Sioux City, IA 51102 712-258-6690
ST Research Corporation, Newington, VA 22122 703-550-7000
† Tecom Industries, Inc., Chatsworth, CA 91311 818-341-4010
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
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GRIM Corporation, Medford, NJ 08055-0968, 609-267-7950 ..... D•1075
§† MCG Elctrns., Deer Park, NY 11729, 516-586-5125 ..... B•1375
§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170 ..... B•1385
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•1153,2128-2129
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
Amber Inds., Inc., Dallas, TX 75379 214-490-9801
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
§† EFI Elctrns., Salt Lake City, UT 84119 ..... 801-977-9009;800-221-1174
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
§† General Semiconductor Ind., Inc., Square D Company, Tempe, AZ 85281 602-968-3101
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§† Joslyn Electronic Systems, Goleta, CA 93116 ..... 800-752-8068; 805-968-3551
Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
Optrex/Satori, Torrance, CA 90503 213-214-1791
§† Power Integrity Corp., Greensboro, NC 27429-0682 ..... 919-379-9773;800-237-6260
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501

Artificial Loads — See Dummy Loads (Vol. D)

Assemblers/Disassemblers, Network-1900 — *See Vol. D*

Assembly & Fabrication Services (Incl. R & D) — See Services, Assembly & Fabrication (Vol. D)

Attenuators, Audio-1300 — *See Vol. D*

Attenuators, Audio (T, L, LL Pads)-4750 — *See Vol. A*

Attenuators, Coaxial-3450 — *See Vol. A*

Attenuators, Decade-3450 — *See Vol. A*

Attenuators, Fiber Optic-2475

AOFR, Inc., Richardson, TX 75081 214-644-1394
Aster Corporation, Milford, MA 01757 508-478-5995
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§ Contact East, N. Andover, MA 01845 508-682-2000
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† INTELCO, Acton, MA 01720 508-264-4485
† Light Control Systems Inc., M/A COM Inc., Tyngsboro, MA 01879 508-649-9870
3M Photodyne Products, Dynatel Systerms Division, Camarillo, CA 93010 ..... 805-388-8378;800-426-8688
† 3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920

Attenuators, Fixed-3450 — *See Vol. A*

Attenuators, IF-1900 — *See Vol. D*

Attenuators, Impedance Matching-3450 — *See Vol. A*

Attenuators, Logarithmic-3450 — *See Vol. A*

Attenuators, Microwave-3450 — *See Vol. A*

Attenuators, Programmable-3450 — *See Vol. A*

Attenuators, RF-1900 — *See Vol. D*

Attenuators, Step-3450 — *See Vol. A*

Attenuators, Switch Operated-3450 — *See Vol. A*

Attenuators, Switchable-3450 — *See Vol. A*

Attenuators, Turret-3450 — *See Vol. A*

Attenuators, Variable-3450 — *See Vol. A*

Attenuators, Voltage Controlled-3450 — *See Vol. A*

Attenuators (MIL)-2440

EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521 ..... D•1715
† Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... A•1747
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749
HC Power Inc., Irvine, CA 92714-5716, 714-261-2200 ..... D•1785
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1789
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§† Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
§† Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404-9978 ..... 407-848-4311;800-888-8763

Attenuators (MIL), Fiber Optic-2440

§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459

Attenuators (MIL), Inductive-2440

† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761

Audible Alarms & Transducers-Also see Piezoelectric Ceramics; Transducers, Audio-1300 — *See Vol. D*

Autoclaves-2550 — *See Vol. D*

Automated Wafer Fabrication Systems — See Machines, Accessories, Semiconductor Machine (Vol. D)

Awls-5400 — *See Vol. C*

Backpanel Interconnect Systems-3200 — *See Vol. C*

Backplane Wiring Services — See Services, Backplane Wiring (Vol. D)

Baffles, Speaker-1300 — *See Vol. D*

Ballasts — See Resistors, Ballast (Vol. A)

Ballasts, Lighting, Magnetic-1850 — *See Vol. A*

Baluns — See Transformers, Matching (Vol. A)

Bargraphs — See Meters, Bargraph (Vol. D)

Barrier Blocks & Strips — See Terminal Blocks (Vol. C), Terminal Strips (Vol. C)

Barriers, Intrinsic Safety-2100 — *See Vol. C*

Bars, Shorting-3200 — *See Vol. C*

Baths, Controlled Temperature (Air & Liquid)-4100 — *See Vol. D*

Baths, Ultrasonic — See Cleaners, Ultrasonic (Vol. D)

Batteries, Alkaline Manganese-3900 — *See Vol. D*

Batteries, Carbon Zinc-3900 — *See Vol. D*

Batteries, Gelled Electrolyte-3900 — *See Vol. D*

Batteries, Lead Acid-3900 — *See Vol. D*

Batteries, Lead Dioxide-3900 — *See Vol. D*

Batteries, Lithium-3900 — *See Vol. D*

Batteries, Lithium Manganese Dioxide-3900 — *See Vol. D*

Batteries, Lithium Thionyl Chloride-3900 — *See Vol. D*

Batteries, Mercury-3900 — *See Vol. D*

Batteries, Mercury Oxide-3900 — *See Vol. D*

Batteries, Nickel Cadmium-3900 — *See Vol. D*

Batteries, Rechargeable-3900 — *See Vol. D*

Batteries, Silver Cadmium-3900 — *See Vol. D*

Batteries, Silver Oxide-3900 — *See Vol. D*

Batteries, Silver Zinc-3900 — *See Vol. D*

Batteries, Solar — See Cells, Photovoltaic (Vol. B)

Batteries, Standard Cell-3900 — *See Vol. D*

Batteries, Thermal-3900 — *See Vol. D*

Batteries, Thin Format-3900 — *See Vol. D*

Batteries, Zinc Air-3900 — *See Vol. D*

Batteries, Zinc Carbon-3900 — *See Vol. D*

Batteries, Zinc Chloride-3900 — *See Vol. D*

Batteries, Zinc Oxide-3900 — *See Vol. D*

Batteries (MIL)-2440

Eagle-Picher, Joplin, MO 64801, 417-623-8000 ..... D•1448-1450
 # Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639 ..... D•1452
Gates Energy Products, Inc., Gainesville, FL 32602, 904-462-3911 .. D•1458-1465
Lyntronics, Inc., Deer Park, NY 11729, 516-243-6397 ..... D•1467
§† Power Conversion, Inc., Hawker Siddeley Group, Ltd.-London, England, Saddle Brook, NJ 07662, 201-796-4800 ..... D•1481-1482
SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331 ..... D•1486
Tadiran Electronic Industries, Inc., Port Washington, NY 11050, 516-621-4980 ..... D•1493
Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198 619-480-4445
Battery Specialities, Costa Mesa, CA 92626 ... 714-755-0888;1-800-352-3706 (Toll free in CA)
Catalyst Research, Mine Safety Appliances Co., Inc., Owings Mills, MD 21117 301-356-2400
East Penn Manufacturing, Lyon Station, PA 19536 215-682-6361
House of Batteries, Costa Mesa, CA 92627 ..... 714-642-8222;800-432-3385
Power-Pak, Inc., Morton Grove, IL 60053 708-966-6000
Pro Battery, Inc., Atlanta, GA 30340 800-451-7171
Yardney Technical Products, Inc., Pawcatuck, CT 06379 203-599-1100

Battery Chargers — See Chargers, Battery (Vol. D), Power Supplies, Plug-in (Vol. D)

Battery Holders — See Connectors, Battery (Vol. C), Retainers, Battery (Vol. C)

Battery Plugs — See Connectors, Battery (Vol. C)

Beads, Shielding, Ferrite — See Shielding, Beads, Ferrite (Vol. C)

Beam Splitters-3700

Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
Fiberguide Industries Inc., Stirling, NJ 07980 908-647-6601
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
† Oxley Inc., Branford, CT 06405 203-488-1033
† Plumer Precision Optics, Pennsburg, PA 18073 215-679-6272
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† UCE, Inc., Norwalk, CT 06854 203-838-7509

Bearings-2500 — *See Vol. C*

Beepers — See Bells, Buzzers, Gongs, Sirens & Aural Warning Devices (Vol. D)

Bells, Buzzers, Gongs, Sirens & Aural Warning Devices-2200 — *See Vol. D*

Belts, Dial Drive — See Cords & Cable, Dial Drive (Vol. C)

Belts, Drive-2500 — *See Vol. C*

Benches, Consoles, Tables (Work Stations, Lab & Shop)-Also See Enclosures, Equipment and Panel Mounting-1400 — *See Vol. C*

Bends & Twists, Microwave-3450 — *See Vol. A*

Bezels, Shielded & Unshielded-2400 — *See Vol. C*

Bimetals, Thermostatic-5300

Hold-Heet Products Corp., Chicago, IL 60640, 312-728-4454;312-728-4455 ..... B•1501
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 ..... B•1391,1865
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1867-1868
Chace Precision Metals, Inc., Reidsville, NC 27320 919-342-2381
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
Thermik Corp., Thermik Sensor Technics, GmbH, New Bern, NC 28562 919-636-5720

Bins, Part Storage-1400 — *See Vol. C*

Bins, Static Conductive-1400 — *See Vol. C*

Blackbody Radiation Sources-2900 — *See Vol. D*

Blowers, Centrifugal-2600 — *See Vol. C*

Blowers, Scroll (Squirrel Cage)-2600 — *See Vol. C*

Blowers, Tangential-2600 — *See Vol. C*

Board Computers & Subassemblies, Multibus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, EXORBUS Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, PC Bus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, Q Bus/Unibus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, S100 Bus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, STD Bus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, VXI Bus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, VME Bus Compatible-2025 — *See Vol. D*

Boards, Adapter, IBM PC-2000 — *See Vol. D*

Boards, Circuit, Clad-1700 — *See Vol. C*

Boards, Circuit, Molded-1700 — *See Vol. C*

Boards, Circuit, Unclad-1700 — *See Vol. C*

Boards, Display, Graphic-2450

Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
§ AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
§ Ampro Computers,Inc., Sunnyvale, CA 94086 408-522-2100
Applied Data Systems, Baltimore, MD 21202 ..... 800-541-2003;410-576-0335
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
Avelem, Gargilesse, FRANCE 36190 33-54478672
† Aydin Corp., Horsham, PA 19044 215-657-7510
C & C Technology Inc., West Chicago, IL 60185 708-231-0015
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
Dataq Instruments, Inc., Akron, OH 44311 ..... 216-434-4284 ; 800-553-9006
Digital Equip., Marlborough, MA 01752
DOW SWITCH, Wilmington, MA 01887 617-935-6395
† DY-4 Systems Inc., Nepean, Ont., CANADA K2H 9J4 613-596-9911
§ Dynatech Computer Company, Mountain View, CA 94039-7400 415-964-7400
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108 203-528-9821
Enterprise Systems Corp., Dover, NH 03820 603-742-7363
General Digital Corp., Enfield, CT 06082 203-741-7171
§ IDEAssociates, Inc., Billerica, MA 01821 508-663-6878
Industrial Computer Source, San Diego, CA 92111 619-279-0084
Ironics Incorporated, Ithaca, NY 14850 607-277-4060
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915 508-927-6575
§ Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Mauell Corp., Dillsburg, PA 17019-0339 717-432-8686
§ Metra Instruments, Inc., San Jose, CA 95131 408-432-1110
Micro Industries, Westerville, OH 43081 614-895-0404
Parsytec Inc., West Chicago, IL 60185 708-293-9500
PERX,Inc., Corte Madera, CA 94925 415-927-0155
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
Raster Graphics, Inc., Bend, OR 97701 503-388-2584
Redlake Corp., Morgan Hill, CA 95037 408-779-6464
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Vicom Systems, Inc., Fremont, CA 94538 415-498-3200
§ Western Digital Corp., Irvine, CA 92718 714-932-6000
XYZ Electronics, McCordsville, IN 46055 317-335-2128

Boards, Integrated Circuit — See Boards, Plug-in (Vol. C)

Boards, Plug-in-3200 — *See Vol. C*

Boards, Plug-in, Extender-3200 — *See Vol. C*

Boards, Plug-in, Interface-3200 — *See Vol. C*

Boards, Plug-in, Memory-3200 — *See Vol. C*

Boards, Plug-In, Multifunction I/O Boards-2000 — *See Vol. D*

Boards, Plug-in Processor-1900 — *See Vol. D*

Boards, Plug-in, Prototype-4200 — *See Vol. C*

Boards, Prewired, High Density-3200 — *See Vol. C*

Boards, Printed Circuit — See Circuits, Printed, Rigid (Vol. C)

Boards, Programming-3200 — *See Vol. C*

Bobbins, Winding, Coil & Transformer-Also See Coil Assemblies & Forms-2500 — *See Vol. C*

Bolometers, Infrared-2900 — *See Vol. D*

Bolometers, Microwave-2900 — *See Vol. D*

Bolts-2500 — *See Vol. C*

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Books — See Technical Books (Vol. D)

Boosters, Low Line Voltage, Automatic — See Regulators & Stabilizers, Voltage (Vol. D)

Boxes, Decade — See Decade Boxes (Vol. D)

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Boxes, Metal & Plastic — See Enclosures (Various types) (Vol. C)

Boxes, Power Outlet — See Boxes, Junction, Outlets & Wall Plates (Vol. C)

Boxes, Shipping (Reusable) — See Enclosures, Shipping (Vol. C)

Brackets, Antenna — See Mounts, Antenna (Vol. D)

Braid, Cable-Also See Wire Shielding-6000 — *See Vol. C*

Brakes, Clutches, Electromechanical-3500

Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ..... B•1279
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1920, D•2243
Regdon Solenoid, Inc., Westmont, IL 60559, 708-789-0600 ..... B•1634,1637
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1318
† Caribbean Assemblies, Inc., Winterspring, FL 32708 407-327-0602
† Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081 201-467-8100
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
§ Machine Components Corp., Plainview, NY 11803 516-694-7222
§† PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272

Brakes, Magnetic-3500

Magtech Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581 ..... B•1294
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1298,1920, D•2243
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1304
Regdon Solenoid, Inc., Westmont, IL 60559, 708-789-0600 ..... B•1637
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1031
§ Ambi-Tech Inds., Hillsdale, NJ 07642 201-666-0504
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
§ Eaton Corporation, Electric Drives Division, Kenosha, WI 53141 414-656-4011
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081 201-467-8100
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
Infranor, Naugatuck, CT 06770 ..... 203-729-8258;800-BE-SERVO
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11040 516-328-3300
§† PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
§ Square D Co., Palatine, IL 60067 708-397-2600
§† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300

Brakes, Mechanical-3500

Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1298, D•2243
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1304
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
Jan Hardware Mfg. Co., Melville, NY 11747 718-361-0800
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
§ PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
§† Sterling Instruments, New Hyde Pk, NY 11040 516-328-3300
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk, NY 11040 ..... 516-328-0200;328-3300
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

Brazing Paste, Silver, Copper & Nickel-4600 — *See Vol. C*

Breadboard Assemblies-4200 — *See Vol. C*

Breadboards & Breadboard Kits — See Kits, Breadboarding (Vol. C)

Bridge Rectifiers, Silicon-Also See Rectifiers, Bridges & Assemblies-4800 — *See Vol. A*

Bridges, Admittance-2900 — *See Vol. D*

Bridges, Antenna — See Bridges, RF (Vol. D)

Bridges, Audio-1900 — *See Vol. D*

Bridges, Capacitance-2900 — *See Vol. D*

Bridges, Deviation-2900 — *See Vol. D*

Bridges, Dissipation Factor-2900 — *See Vol. D*

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Bridges, LCR-2900 — *See Vol. D*

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Bridges, Megohm — See Bridges, Resistance (Vol. D)

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Bridges, Synchro & Resolver-2900 — *See Vol. D*

Bridges, Telephone/Data-1900 — *See Vol. D*

Bridges, Temperature-2900 — *See Vol. D*

Bridges, Wheatstone-2900 — *See Vol. D*

Brushes & Brush Assemblies-3500

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230 ..... B•1238-1242
† Fabricast, S. El Monte, CA 91733, 818-443-3247 ..... B•1263
† Graphite Metallizing Corp., Yonkers, NY 10702, 914-968-8400 ..... B•1271
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751 ..... B•1218-1220,1284,1286
† Danmar Inds., Moorpark, CA 93021 1-805-529-3788,1-800-666-6268
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-574-5400
§† Eraser Co., Syracuse, NY 13221 315-454-3237
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
† Gordon Brush Mfg. Co., Inc., Los Angeles, CA 90021-1786 213-627-6889
Helwig Carbon Products, Inc., Milwaukee, WI 53224 414-354-2411
Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
† Kirkwood Industries Inc., Cleveland, OH 44135 216-267-6200
Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
† Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
† Micro-Products Engineering Co., Newark, NJ 07108 201-824-8467
The J. M. Ney Company, Bloomfield, CT 06002 203-242-2281
Stackpole Carbon Company, St. Marys, PA 15857 814-781-1234
§† Superior Carbon Products, Inc., Walnut Grove, MS 39189 601-253-2442
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§ Tech Spray, Inc., Amarillo, TX 79105 806-372-8523
† Unit Industries, Fullerton, CA 92631 714-871-4161

Buffers, Data — See Spoolers, Printer Buffers (Vol. D)

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Bumpers-2500 — *See Vol. C*

Burnishers, Contact-5400 — *See Vol. C*

Burnishers, Flexible Head-5400 — *See Vol. C*

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Bus Bars & Systems-3200 — *See Vol. C*

Bus Compatible Instruments — See Instruments, Test and Measuring, GPIB Compatible (Vol. D)

Bushings, Glass, Plastic, Metal, Rubber, etc.-2500 — ***See Vol. C***

Busses, Multibus, Q Bus, S100 Bus, STD Bus — See Board Computers & Subassemblies (Vol. D)

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Cabinets & Accessories, Metal — See Enclosures, Equipment & Panel Mounting (Vol. C)

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Cable, Battery Booster-6000 — ***See Vol. C***

Cable, Coaxial-6000 — ***See Vol. C***

Cable, Communication-6000 — ***See Vol. C***

Cable, Computer-6000 — ***See Vol. C***

Cable, Data Transmission-6000 — ***See Vol. C***

Cable, Dial — See Cords & Cable, Dial Drive (Vol. C)

Cable, FEP Insulated-6000 — ***See Vol. C***

Cable, Fiber Optic-2475

Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1217
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751 ..... B•1218
Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1225
§ S.I. Tech, Batavia, IL 60510, 708-232-8640 ..... B•1231
§ AMP, Harrisburg, PA 17105 ..... 717-564-0100;800-522-6752
Andrew Corp., Orland Pk., IL 60462 800-255-1479
§† AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
§† Berk-Tek Inc., New Holland, PA 17557-9722 717-354-6200
§† BIW Cable Systems, Inc., N. Dighton, MA 02764 508-822-6600
§ Brand-Rex, BICC, Willimantic, CT 06226-1128 203-456-8000
Cabletron Systems, Inc., Rochester, NH 03867 603-332-9400
§ Cablex, Inc., Englewood, CO 80112 303-792-5760
§ Canada Wire and Cable Limited, Don Mills, Ontario, CANADA M3C 3J4 416-424-5000
CICOIL CORP., Valencia, CA 91355-3428 805-295-1295
Clifford of Vermont, Inc., Bethel, VT 05032 ..... 802-234-9921;800-451-4381
§ Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ COMCAB, Nashport, OH 43830 614-828-2468
Computer System Products, Minneapolis, MN 55447 ..... 612-476-6866;800-422-2537
§† Cooper Industries/Belden Div., Richmond, IN 47375 ..... 317-983-5200;800-BELDEN-1
§ CSD Industries, Inc., dba C Enterprises , San Marcos, CA 92069 ..... 619-744-8182; 800-334-3815;800-423-3345
§ Custom Cable Corp., Westbury, NY 11590 516-334-3600
§ Daburn Electronics & Cable Corp., Northvale, NJ 07647 201-768-5400
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Dymec Inc., Winchester, MA 01890 617-729-7870
† Electroweave, Inc., Worcester, MA 01604 508-752-8932
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
Fiberguide Industries Inc., Stirling, NJ 07980 908-647-6601
Fiberoptics Technology, Inc., Pomfret, CT 06258 ..... 203-928-0443, 800-433-5248
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080 201-769-3200
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
W. L. Gore & Assocs., Inc., Phoenix, AZ 85044 602-438-2017
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§† Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
ICS Electronics Corp., Milpitas, CA 95035-5545 408-263-5500
§† Light Control Systems Inc., M/A COM Inc., Tyngsboro, MA 01879 508-649-9870
† Lightwave Communications, Inc., Ridgefield, CT 06877 203-438-3591
† Manage, Inc., Fibre Optics Eletrns. Sys. Grp., Chicopee, MA 01014 413-592-9123
§ Math Assocs., Westbury, NY 11590 516-334-6800
3M-Electronic Products Division, Austin, TX 78769-2963 ..... 1-800-225-5373 Sls. & Prod. Info.
† 3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Minnesota Wire & Cable, St. Paul, MN 55108-2721 ..... 612-642-1800 ; 1-800-258-6922(MWCC)
Montrose Products Company, Intercole, Auburn, MA 01501 508-791-3161
§ Olympic Wire & Cable, Fairfield, NJ 07006 201-227-7996
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
† Optical Cable Corp., Roanoke, VA 24022-1967 1-800-622-7711
§ Pan International (USA), Inc., Rancho Cucamonga, CA 91730 714-945-1365
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
§† Remee Products Corp., Florida, NY 10921 914-651-4431
Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
SinoTECH, Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
§† SpecTran Corp., Sturbridge, MA 01566 508-347-2261
§† Standard Wire & Cable Co., Rancho Dominguez, CA 90220 ..... 213-609-1811; 800-326-0006
§ Storm Products Co., Hinsdale, IL 60521 708-323-9121
§ Thomas & Betts Corporation, Electronics Div., Greenville, SC 29616-2401 803-676-2900
† United Wire & Cable Corp., Worcester, MA 01604 508-757-3872
Volpi-MFG-USA, Auburn, NY 13021-1289 315-255-1737
§† Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187 315-685-8945
§† Western Electronic Products Co., San Clemente, CA 92672 714-492-4677
§† Whitmor Wire & Cable, Valencia, CA 91355 805-257-2400
† Woven Electronics, Woven Electronics Corporation, Simpsonville, SC 29681 803-963-5131

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§† Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886 ..... C•1716
Caton Connector Corp., Kingston, MA 02364, 617-585-4315 ..... C•1314-1315
Connectronics Corp., Toledo, OH 43607, 419-537-0020 ..... C•1328
§ Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412, 708-455-8830 ..... C•1726
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400 .. C•1748
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680, 714-669-9473 .... C•1682
† Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571 ..... C•1404-1405
§† Judd Wire Inc., Turners Falls, MA 01376, 413-863-4357 ... B•1020-1021, C•1764
National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611 ..... C•1776,1779-1784
§ Pomona Electronics, Pomona, CA 91766, 714-623-3463 ..... C•1495-1496
§† Quality Microwave Interconnects, Inc., Wilmington, MA 01887, 508-988-9090 ..... A•1824-1826
Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761 ..... C•1819

† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... C•1820
Weico Wire & Cable, Inc., Edgewood, NY 11717, 516-254-2970 .... C•1843-1846
ABL Electronics Supply, Inc., Yorktown Hgts., NY 10598 914-962-2253
† Accurate Electronics Corp., Elyria, OH 44036 ..... 216-366-6330;1-800-325-8979
Adirondack Wire & Cable, ACS Industries Inc., Woonsocket, RI 02895 1-401-769-1600
† Advance Wire & Cable, The Advance Group, Belmont, CA 94002 415-592-4550
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
Alpha Wire Corp., Elizabeth, NJ 07207-0711 908-925-8000
American Assembly Inc., Florida, NY 10921 914-651-3433
† American Insulated Wire Corp., Leviton Mfg. Co., Pawtucket, RI 02862 ... 401-726-0700
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
Amphenol Interconnect Products, Endicott, NY 13760 607-754-4444
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
† Assembly Specialists, Chelmsford, MA 01824 508-250-5900
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
† Automation Elctrns., R.J.A. Inds., Inc., Chatsworth, CA 91311 818-998-5124
§ Berk-Tek Inc., New Holland, PA 17557-9722 717-354-6200
§† Brand-Rex, BICC, Willimantic, CT 06226-1128 203-456-8000
§ Burton Electrical Engineering, Wyle Laboratories, El Segundo, CA 90245 213-322-0615
CableStar, Incorporated, Glasgow, KY 42141 800-338-8223
† Cable Systems, Inc., Everett, MA 02149 617-389-7080
† Cabletest Products Co., Malden, MA 02148 617-665-2932
Cabletron Systems, Inc., Rochester, NH 03867 603-332-9400
§ Cablex, Inc., Englewood, CO 80112 303-792-5760
† CAD Engrg. & Assembly Inc., Mentor, OH 44060 216-255-7744
† Cardinal Control Co., Kensington, CT 06037 203-828-6379
† CICOIL CORP., Valencia, CA 91355-3428 805-295-1295
# Clifford of Vermont, Inc., Bethel, VT 05032 ..... 802-234-9921;800-451-4381
† Coaxitube Corp., Salisbury, MD 21801 301-546-3911
Comm/Scope, Inc., Network Cable Div., Claremont, NC 28610 ..... 704-324-2200; 800-982-1708
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
†# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379 508-580-0111
Computer System Products, Minneapolis, MN 55447 ..... 612-476-6866;800-422-2537
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
§ Cooner Wire Co., Chatsworth, CA 91311 818-882-8311
Cooper Industries/Belden Div., Richmond, IN 47375 .... 317-983-5200;800-BELDEN-1
† CSD Industries, Inc., dba C Enterprises , San Marcos, CA 92069 ..... 619-744-8182; 800-334-3815;800-423-3345
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 617-273-5800
† De Anza Mfg. Svcs. Inc., Sunnyvale, CA 94089 408-734-2020
§† Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ..... 708-459-1000; 800-323-0198
† Diagostic Instrument Corp., Ayer, MA 01432 508-772-4572
† Dilwol Wire & Cable Inc., Burlington, Ont., CANADA L7T 2X5 416-681-2343
† Electro Prep Inc. & N-E-D Cable, Wareham, MA, MA 02571 508-291-2880
† Electro-Support Systems, Temecula, CA 92390 714-676-2751
†# ELMEC, Inc., Technautic Corp., Chandler, AZ 85226 602-961-7100
† Excel Specialty Corp., Chicago, IL 60660 312-262-4781
† The First Electronics Corp., Boston, MA 02125 617-288-2430
† Gavitt Wire & Cable, Brookfield, MA 01506 508-867-6476
† W. L. Gore & Assocs., Inc., Phoenix, AZ 85044 602-438-2017
† W.L. Gore & Assocs., Newark, DE 19714 302-738-4880
† GSI Corp., Timonium, MD 21093 410-252-1768
ITT Sealectro, Inc., New Britian, CT 06051 203-223-2700
Judd Wire Inc., San Marcos, CA 92069 619-744-7720
† Kaman Instrumentation, Colo Springs, CO 80907 1-719-599-1892
† Lamtech Electronics, Garland, TX 75042 214-272-3504
† Lynn Electronics, Feasterville, PA 19047 ..... 215-677-6700;800-523-6075
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
§ Markel Corp., Norristown, PA 19404 215-272-8960
§† 3M-Electronic Products Division, Austin, TX 78769-2963 ..... 1-800-225-5373 Sls. & Prod. Info.
§† Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
Mueller Elec. Co., Cleveland, OH 44114 216-771-5225
National Telephone & Electronics Inc., Miami, FL 33172 305-592-0551
Nu Data, Inc., Little Silver, NJ 07739 908-842-5757
† Olympic Wire & Cable, Fairfield, NJ 07006 201-227-7996
Pan International (USA), Inc., Rancho Cucamonga, CA 91730 714-945-1365
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Precision Interconnect, Portland, OR 97224 503-620-9400
§† Precision Tube, N. Wales, PA 19454 215-699-5801
† Product Technology, Inc., Irvine, CA 92714 714-474-8998
† Reactel, Inc., Rockville, MD 20850 301-279-5535
Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO 519-696-2616
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Storm Products Co., Hinsdale, IL 60521 708-323-9121
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
† Techdyne, Inc., Lance Wire & Cable Div., Hamden, CT 06514 203-288-5571
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
Techrand Corp. of America, Muskegon, MI 49444 616-798-2930
Telco Intercontinental, Houston, TX 77095 713-855-2218
† Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584 309-693-3300
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047 818-707-2020
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 213-316-9984
† Victor Elec. Wire & Cable, W. Warwick, RI 02893 .. 401-821-1700;SALES 401-821-7800
§† Western Electronic Products Co., San Clemente, CA 92672 714-492-4677
† Western Reserve Electronics, Twinsburg, OH 44087 216-425-4951
Whitmor Wire & Cable, Valencia, CA 91355 805-257-2400
§† Wilco Wire & Cable Co., Inc., San Jose, CA 95133 408-926-8880
† Wire-Pro, Inc., Salem, NJ 08079 ..... 609-935-7601;609-935-7651
† Zippertubing Co., Los Angeles, CA 90061 213-321-3901

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§† AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Berk-Tek Inc., New Holland, PA 17557-9722 717-354-6200
CICOIL CORP., Valencia, CA 91355-3428 805-295-1295
Clifford of Vermont, Inc., Bethel, VT 05032 ..... 802-234-9921;800-451-4381
† Daburn Electronics & Cable Corp., Northvale, NJ 07647 201-768-5400
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-574-5400
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
Montrose Products Company, Intercole, Auburn, MA 01501 508-791-3161
† Optical Cable Corp., Roanoke, VA 24022-1967 1-800-622-7711
§ Symbicon Assoc. Inc., Amherst, NH 03031 603-673-8898

Cable (MIL), Flat-2440

ABL Electronics Supply, Inc., Yorktown Hgts., NY 10598, 914-962-2253 ..... C•1710
† GSI Corp., Timonium, MD 21093, 410-252-1768 ..... C•1755-1756
§ 3M-Electronic Products Division, Austin, TX 78769-2963, 1-800-225-5373 Sls. & Prod. Info. ..... C•1463
† Advanced Circuit Technology, Nashua, NH 03062 ..... 603-880-6000;800-234-FLEX
§† Alpha Wire Corp., Elizabeth, NJ 07207-0711 908-925-8000
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
Amphenol Interconnect Products, Endicott, NY 13760 607-754-4444
Amphenol Spectra-Strip/ITD, Hamden, CT 06514 203-281-3200
† Berk-Tek Inc., New Holland, PA 17557-9722 717-354-6200
§† Brand-Rex, BICC, Willimantic, CT 06226-1128 203-456-8000
§† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§ Cablex, Inc., Englewood, CO 80112 303-792-5760
† CICOIL CORP., Valencia, CA 91355-3428 805-295-1295
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647 201-768-5400
Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ..... 708-459-1000; 800-323-0198
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-574-5400
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Flex-Link Products, Inc., San Fernando, CA 91340 818-898-1451
† W. L. Gore & Assocs., Inc., Phoenix, AZ 85044 602-438-2017
† W.L. Gore & Assocs., Newark, DE 19714 302-738-4880
Omega Engineering, Stamford, CT 06907 800-826-6342
§† Panduit Corp., Tinley Park, IL 60477-0981 800-777-3300
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
† Tech Laboratories Inc., Palisades Pk, NJ 07650 201-944-2221
† Temp-Flex Cable, Inc., S. Grafton, MA 01560 508-839-5987
† Weico Wire & Cable, Inc., Edgewood, NY 11717 516-254-2970
§ Wilco Wire & Cable Co., Inc., San Jose, CA 95133 408-926-8880
† Wire-Pro, Inc., Salem, NJ 08079 ..... 609-935-7601;609-935-7651

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ABL Electronics Supply, Inc., Yorktown Hgts., NY 10598, 914-962-2253 ..... C•1710-1712
§† Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886 ..... C•1717,1719-1720
Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412, 708-455-8830 ..... C•1737-1738
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400 .. C•1749
† GSI Corp., Timonium, MD 21093, 410-252-1768 ..... C•1755,1757
Judd Wire Inc., Turners Falls, MA 01376, 413-863-4357 ..... B•1020, C•1764
National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611 ..... C•1777-1780,1785
†# Quality Microwave Interconnects, Inc., Wilmington, MA 01887, 508-988-9090 ..... A•1824-1826
Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761 ..... C•1819
† Weico Wire & Cable, Inc., Edgewood, NY 11717, 516-254-2970 .... C•1845-1846
§† Brand-Rex, BICC, Willimantic, CT 06226-1128 203-456-8000
Carol Cable Co. Inc., Pawtucket, RI 02862 401-728-7000
CICOIL CORP., Valencia, CA 91355-3428 805-295-1295
§† Comm/Scope, Inc., Network Cable Div., Claremont, NC 28610 ..... 704-324-2200; 800-982-1708
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
† Danmar Inds., Moorpark, CA 93021 1-805-529-3788,1-800-666-6268
Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ..... 708-459-1000; 800-323-0198
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
† W. L. Gore & Assocs., Inc., Phoenix, AZ 85044 602-438-2017
† W.L. Gore & Assocs., Newark, DE 19714 302-738-4880
Kaman Instrumentation, Colo Springs, CO 80907 1-719-599-1892
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
† Plastoid Corporation, Hamburg, NJ 07419 201-827-7141
Remee Products Corp., Florida, NY 10921 914-651-4431
§† Specialty Cable Corporation, Wallingford, CT 06492 ..... 800-456-SPEC
† Storm Products Co., Hinsdale, IL 60521 708-323-9121
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
§† Teledyne Thermatics, Teledyne Inds., Inc., Elm City, NC 27822 919-236-4311
Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584 309-693-3300
§† Western Electronic Products Co., San Clemente, CA 92672 714-492-4677
† Whittaker Corp., Electronic Resources Div., Simi Valley, CA 93063 805-584-4100

§ Wilco Wire & Cable Co., Inc., San Jose, CA 95133 408-926-8880
† Wire-Pro, Inc., Salem, NJ 08079 ..... 609-935-7601;609-935-7651

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§† ASC, Ogallala, NE 69153, 308-284-3611 ..... A•1012-1018
§ Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ..... A•1019
§† Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... A•1052-1053
CSI Capacitors, CSI Technologies, San Marcos, CA 92069, 619-747-4000 ..... A•1055
† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1056
§† Electronic Concepts, Inc., Eatontown, NJ 07724, 908-542-7880 .... A•1058-1063
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705, 714-979-4440 ..... A•1065
Illinois Capacitor, Inc., Lincolnwood, IL 60645, 708-675-1760 ..... A•1068
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... A•1079
† Johanson Dielectrics, Inc., Burbank, CA 91505, 818-848-4465 ..... A•1081
§† Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1080
† Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 ..... A•1082-1083
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1098,1100-1106
§ MP/Capar, Multi Products International, West Paterson, NJ 07424, 201-890-1344 ..... A•1107
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1109,1111
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... A•1115-1119
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1120-1122
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1026-1027
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102, 508-339-8900 ..... A•1138
§ Tansitor Electronics, Bennington, VT 05201, 802-442-5473 ..... A•1143
Wesco Electrical Co., Greenfield, MA 01301, 413-774-4358 ..... A•1150-1151
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
† AVX Corporation, Myrtle Bch., SC 29577 803-448-9411
AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
† Cera-Mite Corp., Grafton, WI 53024 414-377-3500
§† Component Research Co. Inc., Santa Monica, CA 90404 213-829-3615
† Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
§† Electron Products, Irwindale, CA 91706 818-960-2299
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292

Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
† KD Components, Inc., Santa Ana, CA 92707 714-545-7108
† Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
Microcap, Inc., A MicroSemi Company, Escondido, CA 92025 619-480-1906
Multi Products International, West Paterson, NJ 07424 201-890-1344
§† Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
Presidio Components, Inc., San Diego, CA 92121 619-578-9390
† Rogers Corp., Rogers, CT 06263 203-774-9605
SFE Technologies, San Fernando, CA 91340 818-365-9411
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Southern Electronics, F-Dyne, Burbank, CA 91502 818-845-2458
† Spectrum Control, Inc., Erie, PA 16505 814-455-0966
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400

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Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ..... A•1019
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705, 714-979-4440 ..... A•1065
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... A•1079
Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1080
Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 .... A•1083
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1104
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1026-1027
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1140-1141
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-475-7831
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
S & El Manufacturing, Northridge, CA 91324 818-349-4111
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400
† Voltronics Corporation, E. Hanover, NJ 07936 201-887-1517

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§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1687
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1166
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374 .. B•1728
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1022,1174
† Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1025,1179
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188,1191-1195
§ Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244, 603-464-5533 ..... B•1204-1207
§ Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 .. B•1209
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
§ Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
§† Atlantic Optical Moulding, Webster, MA 01570 508-943-1746
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§† Dialight Corporation, Manasquan, NJ 08736 908-223-9400
Display Devices, Inc., Encinitas, CA 92023 619-753-0113
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electrical Industries Corp., Murray Hill, NJ 07974 908-464-3200
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
§† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§ George Risk Industries, Inc., Kimball, NE 69145 308-235-4645
§ Inter-Market, Glenview, IL 60025 708-729-5330
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634 312-282-4040
§† Keystone Electronics Corp., Astoria, NY 11105-2017 718-956-8900
§† Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
Schott Electronics, Seymour, CT 06483 203-881-0102
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§† Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§ Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240

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§† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
† Cole-Flex Corporation, West Babylon, NY 11704 516-249-6150
† Presidio Components, Inc., San Diego, CA 92121 619-578-9390

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§ Data Instruments, Inc., Acton, MA 01720, 508-264-9550 ..... B•1891
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 ..... B•1892-1893,1898-1899
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† A. L. Design, Inc., Buffalo, NY 14217 716-875-6240
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
BLH Electronics, Inc., Canton, MA 02021-9111 617-821-2000
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§† Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
DJ Instruments, Inc., N. Billerca, MA 01862 508-667-5301
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
HBM, Inc., Marlboro, MA 01752 508-624-4500
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
§† Interface, Inc., Scottsdale, AZ 85260 602-948-5555
§† Kistler-Morse, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
Omega Engineering, Stamford, CT 06907 800-826-6342
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
Sensor Developments Inc., Lake Orion, MI 48361 313-391-3000
Sensotec, Inc., Columbus, OH 43212 614-486-7723

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† Centronic, Inc., The Morgan Crucible Company, Spec. Matls. & Tech Division, Newbury Park, CA 91320-1702, 805-499-5902 ..... B•1322
§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1319
† Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1342-1344
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1345
A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
† Infrared Industries, Inc., Orlando, FL 32826 407-282-7700
† Optoelectronics/Textron, Petaluma, CA 94975-0039 707-763-5900
§ Raytheon Co., Quincy, MA 02169 617-479-5300
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

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§† Optek Technology Inc., Carrollton, TX 75006, 214-323-2200 ..... B•1333
Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1344
A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
EG & G Vactec, St. Louis, MO 63132 314-423-4900
GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500

Silonex Inc., Plattsburgh, NY 12901 518-561-3160
§Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586

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†**Centronic, Inc., The Morgan Crucible Company, Spec. Matls. & Tech Division, Newbury Park, CA 91320-1702, 805-499-5902** ..... **B•1322**
§**EG & G Vactec, St. Louis, MO 63132, 314-423-4900** ..... **B•1319**
§**Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511, 201-348-5266** ..... **D•1471-1475**
§**Sanyo Energy Corp., San Diego, CA 92073, 619-661-6620** ..... **D•1489**
†**Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884** ..... **B•1342,1344**
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... **B•1345**
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
†Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
†Dionics, Westbury, NY 11590 516-997-7474
East Penn Manufacturing, Lyon Station, PA 19536 215-682-6361
†EG & G Judson, Montgomeryville, PA 18936 215-368-6900
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
Energy, Ltd., Bladensburg, MD 20710 301-699-1144
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Hoppecke Battery Systems, Inc., Bulter, NJ 07405 201-492-0045
§Johnson Controls Battery Group, Inc., Milwaukee, WI 53212 414-961-6500
Marktech International Corp., Latham, NY 12110 518-786-6591
Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
†Silicon Sensors, Dodgeville, WI 53533 608-935-2707
†Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§Xenotronix Inc., Valencia, CA 91355 805-257-4793

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†**Tenney Engineering, Union, NJ 07083, 908-686-7870** ..... **D•1205**
†Bemco, Simi Valley, CA 93065 805-583-4970
†Cincinnati Sub-Zero Prods., Cincinnati, OH 45241 513-772-8810
Cooke Vacuum Prods., Inc., Norwalk, CT 06854 203-853-9500
§†Despatch Industries, Minneapolis, MN 55418 612-781-5363
Nordion International, Kanata, Ontario, CANADA K2K 1X8 613-592-2790
Ransco Industries, Inc., Sub. Despatch Ind., Inc., Oxnard, CA 93033 805-487-7777

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†**Tenney Engineering, Union, NJ 07083, 908-686-7870** ..... **D•1205**
†Ark Elctrns. Corp., Southampton, PA 18966 215-322-6510
†Bemco, Simi Valley, CA 93065 805-583-4970
†FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
†Ransco Industries, Inc., Sub. Despatch Ind., Inc., Oxnard, CA 93033 805-487-7777
†Thermotron Industries, A Venturedyne, Ltd. Co., Holland, MI 49423 616-393-4580

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†**Optima Electronic Packaging Systems, Tucker, GA 30084-5088, 404-496-4000** ..... **C•1064-1065,1069**
†**STRONGBOX, Culver City, CA 90231-2726, 213-305-8288** ..... **C•1108-1109**
†Diagostic Instrument Corp., Ayer, MA 01432 508-772-4572
†General Technology Corp., Albuquerque, NM 87109 505-345-5591
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
Prototek, Inc., Hamilton, OH 45015 513-874-5094
†Trilobyte Computer Corporation, San Leandro, CA 94577 415-895-1100

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†**Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630** ..... **A•2134**
§†**Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-515-1720** ..... **A•1166**
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†**Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•1193**
§†**Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301** ..... **A•1195,1198-1199**
§†**Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600** ..... **A•1205**
Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... **A•1208**
§†**Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ... **A•1212,2279,2286**
†**NWL Transformers, Bordentown, NJ 08505, 609-298-7300** ..... **D•1915**
†**Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1236**
†**Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700** ..... **A•2371**
§†**RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1254**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1255,1258**
†**Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790** ..... **A•1269**
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
†Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
†Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
§†Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
†Bicron Electronics, Canaan, CT 06018 203-824-5125
§†Capcon, Inc., New York, NY 10001 212-243-6275
†Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
†Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
#Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
†Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
†Gavagan Electronics, Danbury, CT 06810 203-748-5248
§†Jeffers Electronics, Nogales, AZ 85621 602-281-4925
†Magnecomp, Inc., Pickens, SC 29671 803-878-4700
†Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
†Magnetico Inc., Holtsville, NY 11742 516-654-1166
†Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
†PTC Transformers, Bordentown, NJ 08505 609-298-8200
†Torotel Prods. Inc., Grandview, MO 64030-3199 816-761-6314
†Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†#United States Electronics, Springfield, NJ 07081 201-912-0111
†Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
†Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

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†DARE Electronics, Inc., Troy, OH 45373 513-335-0031
†Duplicon, Inc., S. Boston, MA 02127 617-269-5859
†Solid State Electronics Corp., Northridge, CA 91324 818-993-8257

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† **Airpax-Cambridge Division, A North American Philips Co., Cambridge, MD 21613, 301-228-4600** ..... **B•1348**
§ **Altech Corp., Somerville, NJ 08876, 908-707-8484** ..... **B•1349, C•1168**
§ **Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281** ..... **B•1356-1359**
† **E-T-A Circuit Breakers, Chicago, IL 60648, 708-647-8303** ..... **B•1361-1364**
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... **B•1367**
§† **Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4800** ..... **B•1368-1371**
§† **Mechanical Products Inc., Jackson, MI 49204, 517-782-0391** ..... **B•1378-1381**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000** ..... **B•1565**
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† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621** ..... **B•1568**
§ **Schurter, Inc., Petaluma, CA 94952, 707-778-6311** ..... **B•1389**
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§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
† Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
§ Curtis Industries, Milwaukee, WI 53219-0910 414-649-4200
§ Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101 718-937-8000
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Entrelec Div/GEC Alsthom International, Inc., Irving, TX 75038 214-550-9025
Fuses Unlimited, D.E.I., Van Nuys, CA 91406 818-786-8111
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
International Microelectronics, Arlington, TX 76003 817-561-2244
§ Klockner Moeller, Franklin, MA 02038 508-520-7080
§ Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Nedco Electronics, Inc., Morton Grove, IL 60053 312-967-0500
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
† Pyle-National, Inc. LPL Co., Chicago, IL 60651 ..... 312-342-6300 x210
RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ..... 609-866-8888;800-257-8384
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 708-397-2600
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
§ Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
§ Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
§ USD Products , Div. of Bussmann, Chicago, IL 60656 708-867-4600
§ Weber, Inmark Corporation-Importer, Norwalk, CT 06850 203-866-8474
Weber U.S., Inc., Weber AG, Malvern, PA 19355 215-651-0770

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§ **Mechanical Products Inc., Jackson, MI 49204, 517-782-0391** ..... **B•1378,1381**
† Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
Elgin Electronics, Erie, PA 16509-3570 814-864-4921
§ Square D Co., Palatine, IL 60067 708-397-2600
† Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548 904-243-3722
Weber U.S., Inc., Weber AG, Malvern, PA 19355 215-651-0770

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Littelfuse, Inc., Des Plaines, IL 60016, 708-824-1188;708-824-0400 .. **B•1372-1373**
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§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
GRIM Corporation, Medford, NJ 08055-0968 609-267-7950
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
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§† **Panduit Corp., Tinley Park, IL 60477-0981, 800-777-3300** ..... **C•1800**
§† All-States, Inc., Chicago, IL 60640 312-728-0525
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
§† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§† Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647 201-768-5400
§† Heyco Molded Products, Inc., Kenilworth, NJ 07033 ..... 908-245-0033;800-526-4182
† NMC Fastening Systems, Nylon Molding Corp., Monrovia, CA 91016 818-357-0901
§† Tyton Corp., Milwaukee, WI 53223 ..... 414-355-1130;800-535-5552

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§ **Bel Fuse, Jersey City, NJ 07302, 201-432-0463** ..... **B•1352,1354**
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§† **FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594** ..... **B•1365**
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§† **Littelfuse, Inc., Des Plaines, IL 60016, 708-824-1188;708-824-0400** ..... **B•1372**
Mechanical Products Inc., Jackson, MI 49204, 517-782-0391 ..... **B•1381**
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§ Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... **A•1628, C•1503-1506**
† **Shogyo International Corp., Great Neck, NY 11021, 516-466-0911** ..... **C•1821**
§ **Wickmann USA, Inc., Wickmann-Werke GmbH, Atlanta, GA 30331, 404-699-7820** ..... **B•1392-1394**
Accurate Electronics Corp., Elyria, OH 44036 ..... 216-366-6330;1-800-325-8979
§ Acme Model Engineering Co., Ridgefield, NJ 07657 201-943-7650
AMP, Harrisburg, PA 17105 ..... 717-564-0100;800-522-6752
§† Atlee Inc., North Andover, MA 01845 508-681-1003
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Augat/RDI, Carol Stream, IL 60188 708-682-4100
Autoswage Products, Shelton, CT 06484 203-929-1401
§† Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§† Bussmann:Cooper Industries, St. Louis, MO 63178 314-394-2877
§ Components Corp., Denville, NJ 07834 201-627-0290
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§ Daburn Electronics & Cable Corp., Northvale, NJ 07647 201-768-5400
Doran Manufacturing Co., Cincinnati, OH 45225 513-681-5424
EG & G Birtcher, EG & G, Inc., El Monte, CA 91734-1268 818-442-2572
§† Electronic Essentials, Woodside, NY 11377 718-898-8300
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Ercona, Patchogue, NY 11772 516-758-0700
§ Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
† Fuses Unlimited, D.E.I., Van Nuys, CA 91406 818-786-8111
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Gould Shawmut, Newburyport, MA 01950 ..... 508-462-6662/3131
§ Heyco Molded Products, Inc., Kenilworth, NJ 07033 ..... 908-245-0033;800-526-4182
§ ideal Industries, Sycamore, IL 60178 815-895-5181
International Microelectronics, Arlington, TX 76003 817-561-2244
§† Keystone Electronics Corp., Astoria, NY 11105-2017 718-956-8900
§ Marathon Special Prods., Marathon Electric, Bowling Green, OH 43402 419-352-8441
§ McKenzie Technology, Fremont, CA 94538 415-651-2700
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Richco Plastic Co., Chicago, IL 60680 312-539-4060
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
Schaffner EMC, Inc. Instr. Div., Union, NJ 07083 ..... 908-851-0644;800-367-5566
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311

Seastrom Manufacturing Co., Inc., Glendale, CA 91201 213-245-9121
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
† Tech-Etch, Inc., Plymouth, MA 02360 508-747-0300
§ USD Products , Div. of Bussmann, Chicago, IL 60656 708-867-4600
§ Weidmuller Inc., Richmond, VA 23236 804-794-2877
§† Zierick Manufacturing Corp., Mt. Kisco, NY 10549 ..... 914-666-2911;800-882-8020

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§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1365
† Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571 ..... C•1404
Atlee Inc., North Andover, MA 01845 508-681-1003
Autosplice, Inc., San Diego, CA 92121 619-535-0077
§ Bussmann:Cooper Industries, St. Louis, MO 63178 314-394-2877
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
† Mueller Elec. Co., Cleveland, OH 44114 216-771-5225
§† Panduit Corp., Tinley Park, IL 60477-0981 800-777-3300

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§† Berg, W. M., Inc., East Rockaway, NY 11518 516-599-5010
§ Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081 201-467-8100
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
† Globe Motors, Dayton, OH 45404 513-228-3171
§ Jan Hardware Mfg. Co., Melville, NY 11747 718-361-0800
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11040 516-328-3300
§ PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
§† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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Magtech Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581 ..... B•1294
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† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1031,1318
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
§ Eaton Corporation, Electric Drives Division, Kenosha, WI 53141 414-656-4011
§ Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081 201-467-8100
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
Infranor, Naugatuck, CT 06770 ..... 203-729-8258;800-BE-SERVO
† Machine Components Corp., Plainview, NY 11803 516-694-7222
† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11040 516-328-3300
§† PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
§† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300

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Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... D•2243
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§† Berg, W. M., Inc., East Rockaway, NY 11518 516-599-5010
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11040 516-328-3300
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660** ..... **A•1159-1161,1163**
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† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•1193**
§ **Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301** ..... **A•1196**
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§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ... **A•1212,2279,2286**
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† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1236**
† **Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501** ..... **A•1248**
† **Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700** ..... **A•2371**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1254**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1255-1257,1260**
† **Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777** ..... **A•1262,1265-1267**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1276**
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† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Tamura Corporation of America, Carson, CA 90746-3518 213-638-1790
TDS, Tang Ind., Elk Grove Village, IL 60007 ..... 1-800-323-6648;312-806-7240
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... **A•1156-1158,2160**
§† **Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-515-1720** ..... **A•1165,1167**
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† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•1193**
§† **Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301** ..... **A•1195-1196,1198-1199**
§† **Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600** ..... **A•1202-1205**
EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 ..... **B•1462-1463**
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† **Hisonic, Inc., Olathe, KS 66061, 913-782-0012** ..... **A•2234**
§ **Nytron Inductors, Inc., Darlington, SC 29532, 803-393-5421** ..... **A•1214-1232, B•1023**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1236**
† **Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501** ..... **A•1248**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1254**
† **Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777** ..... **A•1262,1265-1267**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1274-1276**
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† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§† Associated Spring, Barnes Grp., Bristol, CT 06010 203-583-1331
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
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† Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
Lenox-Fugle Electronics, S. Plainfield, NJ 07080 908-756-1164
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
TDS, Tang Ind., Elk Grove Village, IL 60007 ..... 1-800-323-6648;312-806-7240
§† Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Cold-Cathode Readout Tubes — See Tubes, Readout (Vol. A)

Cold Plates — See Thermal Platforms (Vol. D)

Collection Systems (MIL)-2440

Accu Data, Inc., Springville, UT 84663-0963 801-377-9156
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
† E-Systems, Greenville Div., Greenville, TX 75403-6056 903-455-3450
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000

Collector Rings — See Slip Rings (Vol. B)

Collimators-2900 — ***See Vol. D***

Combiners, Microwave — See Couplers, Microwave (Vol. A)

Communications Intelligence (Comint) Systems (MIL)-2440

† **GRIM Corporation, Medford, NJ 08055-0968, 609-267-7950** ..... **D•1070**
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33418 407-622-3715
California Microwave, Sunnyvale, CA 94086 408-732-4000
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
† E-Systems, Greenville Div., Greenville, TX 75403-6056 903-455-3450
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
† Locus, Inc., State College, PA 16804 814-466-6275
† Locus, Kaman, State College, PA 16804 814-466-6275
M/A-COM Government Products, Inc., Hunt Valley, MD 21030 301-771-0077
New Wave Instruments, Provo, UT 84604 801-373-4909
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Communications Systems, FM-1900 — ***See Vol. D***

Communications Systems, Laser-1900 — ***See Vol. D***

Communications Module, Power Line LANs-1900 — ***See Vol. D***

Communication Systems, Megalinks-1900 — ***See Vol. D***

Communication Systems, Megaplex-1900 — ***See Vol. D***

Communications Systems, Microwave-3450 — ***See Vol. A***

Communications Systems, Multiplex-1900 — ***See Vol. D***

Communications Systems, Telemetering-1900 — ***See Vol. D***

Communications Systems, Telephone-1900 — ***See Vol. D***

Communicators, Digital-1900 — ***See Vol. D***

Commutators-3500

MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ..... **B•1297**
Servo-Tek Products Co., Hawthorne, NJ 07506, 201-427-3100 ..... **B•1310**
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Danmar Inds., Moorpark, CA 93021 1-805-529-3788,1-800-666-6268
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 708-949-8505
† Kirkwood Industries Inc., Cleveland, OH 44135 216-267-6200
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Serial Lab Prods., Inc., Marlboro, MA 01752 617-481-1684
Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221

Comparators, Analog — See Comparators, Voltage (Vol. D)

Comparators, Attenuation-3450 — ***See Vol. A***

Comparators, Capacitance — See Bridges, Capacitance (Vol. D)

Comparators, Digital-2900 — ***See Vol. D***

Comparators, Dimension Calibrators-4100 — ***See Vol. D***

Comparators, Frequency-2900 — ***See Vol. D***

Comparators, Impedance — See Bridges, Impedance (Vol. D)

Comparators, Inductance — See Bridges, Inductance (Vol. D)

Comparators, Optical-2900 — ***See Vol. D***

Comparators, Phase-2900 — ***See Vol. D***

Comparators, Resistance — See Bridges, Resistance (Vol. D)

Comparators, Voltage-2900 — ***See Vol. D***

Component Handling Equipment, Surface Mount-4100 — *See Vol. D*

Compounds, Encapsulating, Molding, Potting-Also See Plastic Raw Materials-1600 — *See Vol. C*

Compounds, Insulating-3100 — *See Vol. C*

Compression Systems, Image-2000 — *See Vol. D*

Computer-Aided Design Services — See Computers, CAD, CAM, & CAD/CAM (Vol. D), Services, Computer-Aided Design (Vol. D)

Computer Interfaces — See Interfaces, Computer

Computer Logic Circuits — See Cards, Logic (Vol. D), Circuits, Hybrid (Vol. A), Integrated Circuits (Vol. A), Modules, Logic (Vol. A)

Computer Systems, Ruggedized-2000 — *See Vol. D*

Computer Tape Recorders — See Recorders, Computer Data (Vol. D)

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Computers, CAD, CAM, & CAD/CAM-2025 — *See Vol. D*

Computers, Digital, Micro-2025 — *See Vol. D*

Computers, Digital, Mini-2025 — *See Vol. D*

Computers, Hybrid, Analog/Digital-2025 — *See Vol. D*

Computers, Mainframe-2025 — *See Vol. D*

Computers, Micro-2025 — *See Vol. D*

Computers, Micro, Ruggedized, for Industrial Applications-2000 — *See Vol. D*

Computers, Mini, High End-2025 — *See Vol. D*

Computers, Mini, Low End-2025 — *See Vol. D*

Computers, Mini, Midrange-2025 — *See Vol. D*

Computers, Personal-2025 — *See Vol. D*

Computers, Personal, Laptop-2025 — *See Vol. D*

Computers, Small Business-2025 — *See Vol. D*

Computer Sets (MIL), Digital Data-2440

Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Dianachart Inc., Rockaway, NJ 07866 201-625-2299
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
† NAVAN Corporation, Media, PA 19063 215-543-8066
† Racal-Guardata, Inc., Herndon, VA 22070 703-471-0892
† Trilobyte Computer Corporation, San Leandro, CA 94577 415-895-1100

Computer Systems (MIL)-2440

Allen Systems, Columbus, OH 43221 614-488-7122
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Codar Technology, Inc., Longmont, CO 80503 303-776-0472
§† Compucart, Versa Tec, Tampa, FL 33601-2095 ..... 800-237-9024;813-251-2431
§ Cyber Sys., Inc., Anaheim, CA 92806 ..... 714-722-2051;714-634-2800
Data Engineering, Inc., Margate, FL 33063-3206 305-971-0400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† DY-4 Systems Inc., Nepean, Ont., CANADA K2H 9J4 613-596-9911
§† Dynatech Computer Company, Mountain View, CA 94039-7400 415-964-7400
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
Industrial Computer Source, San Diego, CA 92111 619-279-0084
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
Innovative Electronics, Inc., Dynatech Corporation, Miramar, FL 33025 .. 305-432-0300
† NAVAN Corporation, Media, PA 19063 215-543-8066
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630 714-527-0561
Serial Lab Prods., Inc., Marlboro, MA 01752 617-481-1684
† Trilobyte Computer Corporation, San Leandro, CA 94577 415-895-1100
Zendex Corp., Dublin, CA 94568 415-828-3000

Computing Equipment, Peripheral — See Converters, Digital To Paper Tape (Vol. D), Printers (Vol. D), Terminals, Data Display (Vol. D), etc.

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Conditioners, Power Line — See Regulators & Stabilizers, Voltage (Vol. D), Line Conditioners (Vol. D)

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Conductive Fabrics, Films & Tapes — See Fabrics, Conductive (Vol. C)

Conductive Floor Coatings & Cleaners-1600 — *See Vol. C*

Conductive Plastic Materials & Parts-4525 — *See Vol. C*

Conduit, Electrical-6000 — *See Vol. C*

Connecting Blocks, Data-2100 — *See Vol. C*

Connecting Blocks, Modular Telephones-2100 — *See Vol. C*

Connector Adapters-2100 — *See Vol. C*

Connector Assemblies, IEEE 488-GPIB-2100 — *See Vol. C*

Connector Backshells-2100 — *See Vol. C*

Connector Blocks, Mother Board-2100 — *See Vol. C*

Connector Boxes & Strips, Power Outlet-2500 — *See Vol. C*

Connectors, AC Power-2100 — *See Vol. C*

Connectors, Antenna — See Connectors, RF, Coaxial & Triaxial (Vol. C)

Connectors, Audio-2100 — *See Vol. C*

Connectors, Back Panel — See Connectors, Wirewrap (Z-3 Level) (Vol. C)

Connectors, Battery-2100 — *See Vol. C*

Connectors, Cable-2100 — *See Vol. C*

Connectors, Circular, MS/AN-2100 — *See Vol. C*

Connectors, Data-2100 — *See Vol. C*

Connectors, DIN-2100 — *See Vol. C*

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Connectors, Edgeboard — See Connectors, Printed Circuit, Card Edge (Vol. C)

Connectors, Elastomeric-2100 — *See Vol. C*

Connectors, Fiber Optic-2475

ADC Telecommunications, Inc., Minneapolis, MN 55435, 612-835-6800 ..... **C•1157-1159**
DDK Electronics, Inc., Markham, Ont., CANADA L3R 9T2, 416-470-1346 ..... **C•1337-1345**
DuPont Connector Systems, DuPont Elctrns., Wilmington, DE 19880-0019, 800-237-2374 ..... **C•1350**
§ **Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065, 805-522-7958** ..... **C•1397**
§ **Richard Hirschmann of America Inc., Riverdale, NJ 07457, 201-835-5002** ..... **C•1398**
§† **Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727** ..... **B•1217**
§ **LEMO U.S.A., Inc., Santa Rosa, CA 95406, 707-578-8811, 800-444-LEMO (5366)** ..... **C•1427**
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751 ..... **B•1218**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 ..... **C•1460**
§ **MOLEX, Inc., Lisle, IL 60532, 708-969-4550** ..... **C•1474**
§ **I I Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1** ..... **B•1196,1198**
§ A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1866
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
§† AMP, Harrisburg, PA 17105 ..... 717-564-0100;800-522-6752
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
§ Amphenol, Bendix Connector Operations, Sidney, NY 13838 607-563-5011
§† AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
Braxton Mfg., Watertown, CT 06795 203-274-6781
Cabletron Systems, Inc., Rochester, NH 03867 603-332-9400
Clifford of Vermont, Inc., Bethel, VT 05032 ..... 802-234-9921;800-451-4381
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379 508-580-0111
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
§ CSD Industries, Inc., dba C Enterprises , San Marcos, CA 92069 ..... 619-744-8182; 800-334-3815;800-423-3345
§ Daitron, Inc., Tigard, OR 97223 503-620-2879
§ Dynacast Inc., Yorktown Heights, NY 10598 914-962-6300
§ Electronic Components & Matls. Div., GTE Products Corp., Warren, PA 16365 814-723-2000
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Ercona, Patchogue, NY 11772 516-758-0700
§ Erni Components, Richmond, VA 23236 804-794-6367
Fiberguide Industries Inc., Stirling, NJ 07980 908-647-6601
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080 201-769-3200
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
§† Greenwich Instruments USA, Charlotte, NC 28205 704-376-1021
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§ Harting Elektronik, Inc., Hoffman Estates, IL 60195 ..... 708-519-770C
§ Hewlett-Packard Co., Cupertino, CA 95014 ..... 800-752-090C
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
† Hughes Aircraft Co., Connecting Devices Div., Irvine, CA 92714 714-660-5701

ITT Cannon, Santa Ana, CA 92705-5684 714-557-4700
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
§ KEL Connectors, Inc., KEL Corp., Sunnyvale, CA 94086 408-720-9044
Kyocera America, Inc., San Diego, CA 92123 619-576-2766
† Light Control Systems Inc., M/A COM Inc., Tyngsboro, MA 01879 508-649-9870
§ Math Assocs., Westbury, NY 11590 516-334-6800
† 3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
§ Methode Electronics, Inc., Chicago, IL 60656 708-867-9600
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
Mueller Elec. Co., Cleveland, OH 44114 216-771-5225
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
Oxley Inc., Branford, CT 06405 203-488-1033
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Radiall, Inc., Stratford, CT 06497 203-386-1030
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
§ RMS Company, Connector Division, Minneapolis, MN 55432 612-786-1520
§† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
Sabritec, Irvine, CA 92714 714-660-1970
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 213-517-7770
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
Siltronics Ltd., Dover, MA 02030 617-329-4068
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Souriau, Inc., Valencia, CA 91355 805-257-4830
§† SpecTran Corp., Sturbridge, MA 01566 508-347-2261
Swiss Jewel Company, Philadelphia, PA 19106 ..... 215-925-2867;800-922-0118
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Thomas & Betts Corporation, Electronics Div., Greenville, SC 29616-2401 803-676-2900

Connectors, Filtered, EMI/RFI-Also See Gaskets, Shielding, RF-2100 — *See Vol. C*

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Connectors, Fused-2100 — *See Vol. C*

Connectors, Heavy Duty, Power-2100 — *See Vol. C*

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Connectors, Hermetically Sealed, Pressurized, or Waterproof-2100 — *See Vol. C*

Connectors, High Density, Multipin-2100 — *See Vol. C*

Connectors, High Voltage (1,000 Volts & Over)-2100 — *See Vol. C*

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Connectors, Integrated Circuit — See Sockets, Integrated Circuit (Vol. C)

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Connectors, Lead Frame-2100 — *See Vol. C*

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Connectors, Mini-DIN — See Connectors, DIN (Vol. C)

Connectors, Missile (Umbilicals, Interstage, Post Boost)-2440

Connectronics Corp., Toledo, OH 43607, 419-537-0020 ..... C•1328
† Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761 ..... C•1513
† Alden Products Co., Brockton, MA 02403 508-583-0160
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
§† Amphenol, Bendix Connector Operations, Sidney, NY 13838 607-563-5011
# Array Connector Corporation, Miami, FL 33152-1250 305-591-7530
Burndy Corporation, An FCI Company, Norwalk, CT 06852 203-838-4444
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428 612-537-1010
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
† Hughes Aircraft Co., Connecting Devices Div., Irvine, CA 92714 714-660-5701
§ Hugin Industries Inc., Los Altos, CA 94022 415-961-2950
Hypertronics Corp., Hudson, MA 01749 ..... 508-568-0451;800-225-9228
† ITT Cannon, Santa Ana, CA 92705-5684 714-557-4700
§ ITT Sealectro, Inc., New Britian, CT 06051 203-223-2700
† Kemlon Products & Development Company, Houston, TX 77021 713-747-5020
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
ODU-USA, Inc., ODU-KONTAKT GmbH, Camarillo, CA 93012 805-484-0981
§ PCD, Peabody, MA 01960 508-532-8800
† Pyle-National, Inc. LPL Co., Chicago, IL 60651 ..... 312-342-6300 x210
† Sabritec, Irvine, CA 92714 714-660-1970
§† Souriau, Inc., Valencia, CA 91355 805-257-4830
† Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584 309-693-3300
§† Viking Electronics, Inc., Chatsworth, CA 91311 818-341-4330

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Connectors, Printed Circuit Board, Programmable-2100 — *See Vol. C*

Connectors, Piggy Back — See Connectors, Wirewrap (Z-3 Level) (Vol. C)

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Connectors, Printed Circuit, Card Edge-2100 — *See Vol. C*

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Connectors, Splicing-2100 — *See Vol. C*

Connectors, Stripline-2100 — *See Vol. C*

Connectors, Surface Mount-2100 — *See Vol. C*

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Connectors, Test-2100 — *See Vol. C*

Connectors, Thermocouple-2100 — *See Vol. C*

Connectors, Video-2100 — *See Vol. C*

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Connectors, Zero & Low Insertion Force-2100 — *See Vol. C*

Connectors & Terminals, Push-on, Quick Disconnect-2100 — *See Vol. C*

Connectors (MIL), Fiber Optic-2440

† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
† BTC Electronic Components, Old Bridge, NJ 08857, 908-679-9300 .. C•1296-1306
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
† 3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450

Connectors (MIL), Flat Cable-2440

AirBorn, Inc., Addison, TX 75001-0519, 214-931-3200 ..... C•1160
§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
† BTC Electronic Components, Old Bridge, NJ 08857, 908-679-9300 .. C•1296-1306
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1010-1011, C•1332-1333
LMI Connectors Inc., Champlain, NY 12919, 518-298-5360 ..... C•1445
§† Panduit Corp., Tinley Park, IL 60477-0981, 800-777-3300 ..... C•1482
Superior Electric, Bristol, CT 06010, 203-582-9561 ..... C•1537
§† Alpha Wire Corp., Elizabeth, NJ 07207-0711 908-925-8000
Amphenol Spectra-Strip/ITD, Hamden, CT 06514 203-281-3200
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Autosplice, Inc., San Diego, CA 92121 619-535-0077
Autoswage Products, Shelton, CT 06484 203-929-1401
Beau Products Div., Vernitron Corp., Laconia, NH 03247 603-524-5101
§ Carrot Components Corporation, Camarillo, CA 93012 805-484-0540
Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 708-455-8830
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135 408-922-9000
§† 3M-Electronic Products Division, Austin, TX 78769-2963 ..... 1-800-225-5373 Sls. & Prod. Info.
§ Robinson Nugent, Inc., New Albany, IN 47150 812-948-0564
Souriau, Inc., Valencia, CA 91355 805-257-4830
† Star-Tron Corporation, Providence, RI 02909 401-274-5090
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
TELTEC, INC., Minneapolis, MN 55425 612-854-9632
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
§ Thomas & Betts Corporation, Electronics Div., Greenville, SC 29616-2401 803-676-2900

Connectors (MIL), Power-2440

† BTC Electronic Components, Old Bridge, NJ 08857, 908-679-9300 .. C•1296-1306
Caton Connector Corp., Kingston, MA 02364, 617-585-4315 .. C•1311-1312,1315
§† Panduit Corp., Tinley Park, IL 60477-0981, 800-777-3300 ..... C•1802
Pomona Electronics, Pomona, CA 91766, 714-623-3463 ..... C•1493,1495
§ Superior Electric, Bristol, CT 06010, 203-582-9561 ..... C•1537
U.S. Terminals Inc., Cincinnati, OH 45243, 513-561-8145 ..... C•1563
† Alden Products Co., Brockton, MA 02403 508-583-0160
Amphenol Canada Corporation, An LPL Company, Scarborough, Ontario, CANADA M1B 2X6 416-291-4401

§ Anderson Power Products, Div. of High Voltage Engineering, Boston, MA 02135 617-787-5880
† Burndy Corporation, An FCI Company, Norwalk, CT 06852 203-838-4444
Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428 612-537-1010
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Hypertronics Corp., Hudson, MA 01749 ..... 508-568-0451;800-225-9228
§ Ideal Industries, Sycamore, IL 60178 815-895-5181
§† ITT Cannon, Santa Ana, CA 92705-5684 714-557-4700
§† 3M-Electronic Products Division, Austin, TX 78769-2963 ..... 1-800-225-5373 Sls. & Prod. Info.
Mueller Elec. Co., Cleveland, OH 44114 216-771-5225
ODU-USA, Inc., ODU-KONTAKT GmbH, Camarillo, CA 93012 805-484-0981
† Pyle-National, Inc. LPL Co., Chicago, IL 60651 ..... 312-342-6300 x210
Sabritec, Irvine, CA 92714 714-660-1970
Souriau, Inc., Valencia, CA 91355 805-257-4830
§ Thomas & Betts Corporation, Electronics Div., Greenville, SC 29616-2401 803-676-2900
§† Wire-Pro, Inc., Salem, NJ 08079 ..... 609-935-7601;609-935-7651

Connectors (MIL), Printed Circuit-2440

† AirBorn, Inc., Addison, TX 75001-0519, 214-931-3200 ..... C•1160
§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
Atlee Inc., North Andover, MA 01845, 508-681-1003 ..... C•1679
Beau Products Div., Vernitron Corp., Laconia, NH 03247, 603-524-5101 ..... C•1294
† BTC Electronic Components, Old Bridge, NJ 08857, 908-679-9300 .. C•1296-1306
§ Circuit Assembly Corp., Irvine, CA 92718-2703, 714-855-7887 ..... C•1317
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1010-1011, C•1332-1333
§† Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... C•1335
† DuPont Connector Systems, DuPont Elctrns., Wilmington, DE 19880-0019, 800-237-2374 ..... C•1350
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680, 714-669-9473 .... C•1682
Foxconn International, Hon Hai, Brea, CA 92621, 714-256-1888 ..... C•1373
Oxley Inc., Branford, CT 06405, 203-488-1033 ..... A•1705, B•1025, C•1479
§† Panduit Corp., Tinley Park, IL 60477-0981, 800-777-3300 ..... C•1482,1802
§ Sullins Electronics Corp., San Marcos, CA 92069, 619-744-0125 ... C•1534-1535
§† Texas Instruments, Connector System, Attleboro, MA 02703, 508-699-5269;508-699-3450 ..... C•1150,1551-1555
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047, 818-707-2020 ..... C•1556-1557,1559-1561
§† Alpha Wire Corp., Elizabeth, NJ 07207-0711 908-925-8000
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Autosplice, Inc., San Diego, CA 92121 619-535-0077
Autoswage Products, Shelton, CT 06484 203-929-1401
§† Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000
Components Corp., Denville, NJ 07834 201-627-0290
Crane Electronics, Inc., Cincinnati, OH 45212 800-676-7644
† CTS Corporation, Elkhart, IN 46514 219-293-7511
† CTS Corporation, Microelectronics business unit., New Hope, MN 55428 612-533-3533
† EBY Company, Philadelphia, PA 19124 215-537-4700
EDA Inc., Div. of Connector, La Habra, CA 90631 213-697-7151
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Erni Components, Richmond, VA 23236 804-794-6367
† Hypertronics Corp., Hudson, MA 01749 ..... 508-568-0451;800-225-9228
§† IEH Corp., New York, NY 10012 212-677-1881
§† ITT Cannon, Santa Ana, CA 92705-5684 714-557-4700
§† 3M-Electronic Products Division, Austin, TX 78769-2963 ..... 1-800-225-5373 Sls. & Prod. Info.
§† Methode Electronics, Inc., Chicago, IL 60656 708-867-9600
† Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
† Milross Controls, Inc., Southampton, PA 18966 215-355-0200
Mueller Elec. Co., Cleveland, OH 44114 216-771-5225
† PCD, Peabody, MA 01960 508-532-8800
† Pyle-National, Inc. LPL Co., Chicago, IL 60651 ..... 312-342-6300 x210
Siltronics Ltd., Dover, MA 02030 617-329-4068
Souriau, Inc., Valencia, CA 91355 805-257-4830
† Star-Tron Corporation, Providence, RI 02909 401-274-5090
TELTEC, INC., Minneapolis, MN 55425 612-854-9632
† Teradyne Connection Sys., Teradyne, Inc., Nashua, NH 03060 603-889-5156
§† Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
§ Thomas & Betts Corporation, Electronics Div., Greenville, SC 29616-2401 803-676-2900
§† Wire-Pro, Inc., Salem, NJ 08079 ..... 609-935-7601;609-935-7651

Connectors (MIL), RF-2440

ABL Electronics Supply, Inc., Yorktown Hgts., NY 10598, 914-962-2253 ..... C•1155
§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571 ..... C•1325
Direct Sound Corporation, New York, NY 10011, 212-691-9050 ..... C•1349
Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571 ..... C•1404-1405
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ... C•1468-1469
† North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2312
Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761 ..... C•1513-1514
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047, 818-707-2020 ..... C•1556-1561
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
§† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226 602-940-0740
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428 612-537-1010
§ Coax Connection, Yorktown Hgts., NY 10598 ..... 914-962-2303;800-431-2103
† Compac, Holbrook, NY 11741 516-585-3400
§ Compar, D.G.W. Electronics Corporation, Markham, Ontario, CANADA L3R 4Z4 416-475-8500
Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 708-455-8830
§† Delta Electronics Mfg. Corp., Beverly, MA 01915 508-927-1060
Ei North America, New York, NY 10021 212-517-5622
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
§† ITT Sealectro, Inc., New Britian, CT 06051 203-223-2700
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101 617-890-4750
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
Mueller Elec. Co., Cleveland, OH 44114 216-771-5225
§† Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Pomona Electronics, Pomona, CA 91766 714-623-3463
† Pyle-National, Inc. LPL Co., Chicago, IL 60651 ..... 312-342-6300 x210
† Sabritec, Irvine, CA 92714 714-660-1970
§† Specialty Connector Co., Franklin, IN 46131 317-738-2800
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584 309-693-3300
† Whittaker Corp., Electronic Resources Div., Simi Valley, CA 93063 805-584-4100

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† BTC Electronic Components, Old Bridge, NJ 08857, 908-679-9300 .. C•1296-1306
§ Alusett U.S.A., Inc., Pleasantville, NY 10570 914-737-0120
† Amco Engineering, Schiller Pk., IL 60176 ..... 708-671-6670;800-833-3156
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
§† Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410

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Contactors (MIL)-2440

† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
ICC, Inc., Orange, CA 92665 714-998-8310
† Jennings, San Jose, CA 95122-2696 408-292-4025
The J. M. Ney Company, Bloomfield, CT 06002 203-242-2281
† PCD, Peabody, MA 01960 508-532-8800
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Trumeter Company, Inc., New York, NY 10001 ..... 212-564-0666;800-537-2261

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Contacts (MIL), Assemblies & Holders-2440

† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
Hiram Jones Electronics, No. Hollywood, CA 91605, 213-875-0213 ..... C•1388-1389,1392
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
§† Amphenol, Bendix Connector Operations, Sidney, NY 13838 607-563-5011
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
Autosplice, Inc., San Diego, CA 92121 619-535-0077
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428 612-537-1010
§ Compar, D.G.W. Electronics Corporation, Markham, Ontario, CANADA L3R 4Z4 416-475-8500
† Danmar Inds., Moorpark, CA 93021 1-805-529-3788,1-800-666-6268
Delbert Blinn Co., Pomona, CA 91769 714-629-3900
Deringer Mfg. Co., Mundelein, IL 60060 708-566-4100
ICC, Inc., Orange, CA 92665 714-998-8310
The J. M. Ney Company, Bloomfield, CT 06002 203-242-2281
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
United Foam Plastics, Georgetown, MA 01833 508-352-2200

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§ AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
Apollo Display Technologies, Inc., Holtsville, NY 11742 516-654-1143
§ Cirrus Logic, Inc., Fremont, CA 94538 415-623-8300
General Digital Corp., Enfield, CT 06082 203-741-7171
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310

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Usar Systems, Inc., New York, NY 10012 212-226-2042

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Ballantine Laboratories, Noise Unlimited Inc., Cedar Knolls, NJ 07927 ... 201-984-1900
John Fluke Mfg. Co., Inc., Everett, Wa 98206, WA 98203 206-347-6100

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† **Abbott Electronics, Los Angeles, CA 90034, 213-202-8820** ..... D•1523
Abbott Technologies, Inc. Power Supplies Division, Sun Valley, CA 91352, 818-504-0644,1-800-367-8200,818-841-3630 ..... D•1511
† **Adtech Power Inc., Anaheim, CA 92806, 714-634-9211** ..... D•1580
† **Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-2702** ..... D•1548
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† **Arnold Magnetics, Camarillo, CA 93012, 805-484-4221** ..... D•1599-1603
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† **CEC Electronics Corp., Hauppauge, NY 11788, 516-582-4422** ..... D•1650-1651
† **EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626** ... D•1732-1733
† **Interpoint Corporation, Redmond, WA 98073-9705, 206-882-3100** ..... D•1810-1814,1819-1820
† **Modular Devices, Shirley, NY 11967, 516-345-3100** ..... D•1902-1906
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Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... D•1919
Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885 ..... D•1969
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 ..... D•2049
† **Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222** ..... D•2110,2113
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Abbott Technologies, Inc. Transformer Division, Sun Valley, CA 91352 ... 818-504-0644; 1-800-367-8200;818-841-3630
† ATC Power Systems, Inc., Nashua, NH 03063 603-882-1366
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† EG & G Power Systems, Inc., Covina, CA 91724 818-967-9521
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499 206-657-7474
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221 213-635-9555
† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
Intepro Systems Inc., Billerica, MA 01821 508-663-7555
Interelectronics Corp., Congers, NY 10920 ..... 914-EL8-8000
† Keltec Florida, Inc., Microwave Pro, Ft. Walton Bch., FL 32549-2917 904-244-0043
† Logitek, Inc., Ronkonkoma, NY 11779 516-467-4200
† MagneTek Defense Systems, MagneTek, Inc., Anaheim, CA 92805 714-956-9200
† MIL Electronics, Inc., Nashua, NH 03036 603-882-3200
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
North Hills Electronics, Glen Cove, NY 11542 516-671-5700
† Power Functions Engineering, Garland, TX 75042 214-276-0996
† Rantec Microwave & Electronics, Esco Electronics, Chatsworth, CA 91311 818-885-8223
Rantec Microwave & Elctrns., Inc., Los Osos, CA 93402 805-528-5858
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5 416-630-6108
† Trio Laboratories, Inc., Plainview, NY 11803 516-349-0400
§† Vicor Corp., Andover, MA 01810 508-470-2900

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Abbott Technologies, Inc. Power Supplies Division, Sun Valley, CA 91352, 818-504-0644,1-800-367-8200,818-841-3630 ..... D•1511
Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900 ..... D•2156
Avionic Instruments, Avenel, NJ 07001, 908-382-7100 ..... D•2160,2162
§ **Behlman Electronics, Inc., Ventura, CA 93003, 805-642-0660** ..... D•2174
† **Georator Corp., Manassas, VA 22110-0070, 800-523-9938** .... D•2195,2197-2198
† **Modular Devices, Shirley, NY 11967, 516-345-3100** ..... D•1902-1904
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Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827, D•1877
† Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352 ... 818-504-0644; 1-800-367-8200;818-841-3630
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
† Avtel Div., Unitron Inc., Dallas, TX 75238 214-340-8600
† California Microwave, Sunnyvale, CA 94086 408-732-4000
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† EG & G Rotron, Custom Div., Woodstock, NY 12498 914-679-5201
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221 213-635-9555
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
† MagneTek Defense Systems, MagneTek, Inc., Anaheim, CA 92805 714-956-9200
† Magnum Microwave Corp., Fremont, CA 94538 415-657-9898
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
Pacific Power Source Corp., Huntington Bch., CA 92649 .. 714-898-2691;800-854-2433
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Trio Laboratories, Inc., Plainview, NY 11803 516-349-0400
† Unitron Inc., Dallas, TX 75238 214-340-8600

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§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333

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Couplers, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
† **Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1217**
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751 ..... B•1218,1220,1222-1223**
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1339
AOFR, Inc., Richardson, TX 75081 214-644-1394
Aster Corporation, Milford, MA 01757 508-478-5995
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Computrol:An AEG Co., Ridgefield, CT 06877 203-431-2000
Corning Incorporated, Opto-Electronics Group, Corning, NY 14831 607-974-7914
Dupont Electro-Optic Products, Dupont Electronics, Research Triangle Park, NC 27709 ..... 1-800-888-LAN1;919-481-5100
Fiberguide Industries Inc., Stirling, NJ 07980 908-647-6601
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ 3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621 714-521-8673
† York Technology, Inc., Burbank, CA 91502 818-955-8927

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North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2312-2313
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
† Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
TRM, Inc., Manchester, NH 03103 603-627-6000
† Werlatone, Inc., Brewster, NY 10509 914-279-6187

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Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1304
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571** ..... A•1313-1315
† **Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248** ..... A•1322
† **CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411** ..... A•1328,1330-1331,1333
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500** ..... A•1368
† **Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000** ..... A•1375
§† **KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825** .. A•1379
† **McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411** ..... A•1381-1383,1386
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1395-1396,1398
Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1402-1403,1405
§† **M-Tron Industries, Yankton, SD 57078, 605-665-9321** ..... A•1408
Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ..... A•1426,1428-1429
† **Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929** ..... A•1448
§† Atomergic Chemetals Corp, Farmingdale, NY 11735-1718 516-694-9000
Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
† CTS Corporation, Elkhart, IN 46514 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
§† NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Q-Tech Corp., Culver City, CA 90232-3510 213-836-7900
Raltron Electronics, Miami, FL 33172 305-593-6033
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-587-1333;800-359-5400
† Sentry Manufacturing Company, Chickasha, OK 73018 405-224-6760
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
† Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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§ Bussmann:Cooper Industries, St. Louis, MO 63178 314-394-2877
INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
Phase Control Electronics, Glendale, NY 11385 718-441-4278
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759

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AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ..... D•1003,1020-1021
DDK Electronics, Inc., Markham, Ont., CANADA L3R 9T2, 416-470-1346 ..... C•1337-1345
† **GRIM Corporation, Medford, NJ 08055-0968, 609-267-7950** ..... D•1071
§† **Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727** ..... B•1217
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751** ..... B•1218-1220,1223
§† **Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998, 213-828-7496** ..... B•1225
† **Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121** ..... B•1229
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1119,1339
§ S.I. Tech, Batavia, IL 60510, 708-232-8640 ..... B•1231
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
Aster Corporation, Milford, MA 01757 508-478-5995
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;in Can.: 1-800 553-2448
AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
Atlantic Scientific Corporation, Melbourne, FL 32901 1-800-544-4737
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Canoga-Perkins Corp., Chatsworth, CA 91311 818-718-6300
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Comdata Corp., Morton Grove, IL 60053 708-470-9600
§ Computrol:An AEG Co., Ridgefield, CT 06877 203-431-2000
§† Cooper Industries/Belden Div., Richmond, IN 47375 ..... 317-983-5200;800-BELDEN-1
Dupont Electro-Optic Products, Dupont Electronics, Research Triangle Park, NC 27709 ..... 1-800-888-LAN1;919-481-5100
Dymec Inc., Winchester, MA 01890 617-729-7870
ETM Electromatic Inc, Newark, CA 94560 415-797-1100
§# Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
† Force, Inc., Christiansburg, VA 24073 703-382-0462
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
§† Greenwich Instruments USA, Charlotte, NC 28205 704-376-1021
H & L Instruments, Burlingame, CA 94010 415-342-7850
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Richard Hirschmann of America Inc., Riverdale, NJ 07457 201-835-5002
§ Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
§ ICS Electronics Corp., Milpitas, CA 95035-5545 408-263-5500
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
Jaycor, San Diego, CA 92138 619-453-6580
KineticSystems, Lockport, IL 60441 815-838-0005
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Lentronics, Prism Systems Inc., Burnaby, B.C., CANADA V5A 1X7 604-421-8733
† Lightwave Communications, Inc., Ridgefield, CT 06877 203-438-3591
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee MA 01014 413-592-9123
† Math Assocs., Westbury, NY 11590 516-334-6600
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Optivision, Inc., Davis, CA 95616 ..... 916-756-4429;800-562-8934
† Ortel Corp., Alhambra, CA 91803 818-281-3636
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
Ross Engineering Corp., Campbell, CA 95009 408-377-4621
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717
Signatron: A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
Soltec Corp., San Fernando, CA 91340-1587 ..... 818-365-6800;800-423-2344
SpecTran Corp., Sturbridge, MA 01566 508-347-2261
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§ Telemet, Geotel Inc., Hauppauge, NY 11788 516-436-7260
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
§ Thomas & Betts Corporation, Electronics Div., Greenville, SC 29616-2401 303-676-2900
§† Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397
Zexco, Van Nuys, CA 91401 818-997-7895

Data Links, Freespace Communications-2475

§ American Laser Systems, Inc., Goleta, CA 93117 805-967-0423
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
HDS Inc., Reston, VA 22091 703-620-6200
† ISC Datacom, ISC Defense & Space, Sunnyvale, CA 94089 408-747-0300
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Zexco, Van Nuys, CA 91401 818-997-7895

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† **Hopper Electronics, Phoenix, AZ 85021, 602-870-3093** ..... D•1175
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751 ..... B•1219
† Alden Electronics, Inc., Westboro, MA 01581 508-366-8851
Cyber Sys., Inc., Anaheim, CA 92806 ..... 714-722-2051;714-634-2800
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
Transmagnetics, Farmingdale, NY 11735 516-293-3100

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Decoders, Video-1900 — *See Vol. D*

Decommutators, PCM-3500

† Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
Loral Data Systems, Sarasota, FL 34230 813-371-0811
† Metraplex Corp., Frederick, MD 21701 301-662-8000

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Decoys (MIL), Buoy-2440

§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100

Decoys (MIL), IR Flare-2440

§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100

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† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1495-1498
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1499
Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 ..... A•1532-1533,1547-1548
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 .... A•1558-1571
† JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ..... A•1572-1575,1577
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1578-1588
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1595
† Technitrol, Philadelphia, PA 19134, 215-426-9105 ..... A•1598-1600,1602-1604, B•1028-1029
Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
§ Datatronics, Inc., Romoland, CA 92380 714-928-7700
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
† Hytek Microsystems, Inc., Carson City, NV 89706 702-883-0820
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291

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Detection & Ranging Systems (MIL)-2440

† Analog Modules, Inc., Longwood, FL 32750 407-339-4355
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
§† Kay-Ray/Sensall, Inc., Mt. Prospect, IL 60056 708-803-5100
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400

Detection Systems, Laser-3700

Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Rodann Electronics Mfg. Co., Brea, CA 92621 ..... 714-529-1301;800-366-7010
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
Spiricon, Inc., Logan, UT 84321 801-753-3729

Detector Arrays, Infrared-3700

† Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1342-1343
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
Dalsa Inc., Waterloo, Ont., CANADA N2V 2E9 519-886-6000
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
§ Marktech International Corp., Latham, NY 12110 518-786-6591
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Ortel Corp., Alhambra, CA 91803 818-281-3636
Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Spiricon, Inc., Logan, UT 84321 801-753-3729
Swan Associates, New Haven, CT 06534 203-387-3917
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

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Detectors, RF-2900 — *See Vol. D*

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Detectors, Corona — See Testers, Corona (Vol. D)

Detectors, Crystal-2300 — *See Vol. A*

Detectors, Fiber Optic-Also See Diodes, PIN-2475

† **Centronic, Inc., The Morgan Crucible Company, Spec. Matls. & Tech Division, Newbury Park, CA 91320-1702, 805-499-5902** ..... **B•1322**
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... **B•1119,1339**
† **Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884** ..... **B•1342-1343**
§ † **I I Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1** ..... **B•1196,1198**
§ A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1866
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
BT & D Technologies, Wilmington, DE 19803 302-479-0300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
Fiberguide Industries Inc., Stirling, NJ 07980 908-647-6601
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
† Ortel Corp., Alhambra, CA 91803 818-281-3636
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 415-471-9717
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Spiricon, Inc., Logan, UT 84321 801-753-3729
Swan Associates, New Haven, CT 06534 203-387-3917
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187 315-685-8945

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Detectors, Gas-2900 — *See Vol. D*

Detectors, Ground Fault-4300

Associated Research, Inc., Lake Bluff, IL 60044, 708-295-3312 ..... **D•1220**
§ **CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518** ..... **A•2194**
Kikusui International Corp., Torrance, CA 90503, 213-371-4662;800-545-8784 ..... **D•1278**
§† **Qualitec Technologies, Inc., Fremont, CA 94538, 415-498-1046** ..... **D•1313**
§ **ROD-L Electronics, Inc., Menlo Park, CA 94025, 415-322-0711;1-800-548-6305** ..... **D•1316-1317**
Shalltronix Corp., Selma, NC 27576, 919-965-6346 ..... **D•1325**
§ AEMC Corporation, Boston, MA 02111 ..... 617-451-0227;800-343-1391
§ Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101 718-937-8000
U.S. Elco Inc., Santa Clara, CA 95054 ..... 1-800-888-ELCO
§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
§ GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford, IL 61109 815-397-7070
3M Dynatel Systems Division, Austin, TX 78769-2963 ..... 512-984-3412;800-426-8688
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
§ Square D Co., Palatine, IL 60067 708-397-2600
§ Sunshine Instruments, Philadelphia, PA 19115 ..... 215-673-5600;800-343-1199
Trinetics Inc., Mishawaka, IN 46545-4899 219-259-8535
Weber U.S., Inc., Weber AG, Malvern, PA 19355 215-651-0770

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Detectors, Infrared-3700

† **Centronic, Inc., The Morgan Crucible Company, Spec. Matls. & Tech Division, Newbury Park, CA 91320-1702, 805-499-5902** ..... **B•1322**
Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... **B•1092**
† **Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884** ..... **B•1342-1343**
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
Process & Analytical Instruments Div., Ametek, Inc., Pittsburgh, PA 15238 412-828-9040
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
† Astro International Corp., League City, TX 77573 713-332-2484
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
† Barnes Engineering Div., EDO Corporation, Shelton, CT 06484 203-926-1777
BT & D Technologies, Wilmington, DE 19803 302-479-0300
Burleigh Instruments, Fishers, NY 14453 716-924-9355
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Data Instruments, Inc., Acton, MA 01720 508-264-9550
§ Dexter Research Ctr., Inc., Dexter, MI 48130 313-426-3921
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
ElectroPhysics Corp., Nutley, NJ 07110 201-667-0170
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 612-443-2500
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
† Infrared Industries, Inc., Orlando, FL 32826 407-282-7700
§ ING. F. P. KOGL, Steyregg, AUSTRIA 732-640-591-0
§ Marktech International Corp., Latham, NY 12110 518-786-6591
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
† Optoelectronics/Textron, Petaluma, CA 94975-0039 707-763-5900
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Ortel Corp., Alhambra, CA 91803 818-281-3636
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
Rodann Electronics Mfg. Co., Brea, CA 92621 ..... 714-529-1301;800-366-7010
§# Milton Roy Co., Environmental, Orange, CA 92665-4134 714-974-5560
† Scientech, Inc., Boulder, CO 80303 ..... 303-444-1361;800-525-0522
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 415-471-9717
† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
Servomex Company, Norwood, MA 02062 617-769-7710
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Spiricon, Inc., Logan, UT 84321 801-753-3729
Swan Associates, New Haven, CT 06534 203-387-3917
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
† Thermometrics, Inc., Edison, NJ 08817-4695 908-287-2870
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586
§ Victory Engineering Corp., Springfield, NJ 07081 201-379-5900

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Detectors (MIL), IR-2440

† **Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1342-1343**
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 800-422-4342
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
§† Laser Precision Corp., Utica, NY 13502 315-797-4449
Spiricon, Inc., Logan, UT 84321 801-753-3729
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500

Detectors (MIL), Radar-2440

§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200

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American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 ..... B•1145
§ **EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1319**
§† **Optek Technology Inc., Carrollton, TX 75006, 214-323-2200 ..... B•1333**
§ **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118**
§ **Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2120, B•1183**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
† **Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1342-1343**
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1345
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§† Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
† Assembly Specialists, Chelmsford, MA 01824 508-250-5900
† Basic Electronics, Inc., Stanton, CA 90680 714-530-2400
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Dalsa Inc., Waterloo, Ont., CANADA N2V 2E9 519-886-6000
† Dionics, Westbury, NY 11590 516-997-7474
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Electronic Devices, Inc., Yonkers, NY 10710 914-965-4400
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 612-443-2500
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
K & M Electronics, W. Springfield, MA 01089 413-781-1350
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
Marktech International Corp., Latham, NY 12110 518-786-6591
† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
† Optoelectronics/Textron, Petaluma, CA 94975-0039 707-763-5900
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§ Pioneer Components, Brooklyn, NY 11234 718-444-3880
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
§ Semtech, Newbury Park, CA 91320 805-498-2111
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
Spiricon, Inc., Logan, UT 84321 801-753-3729
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

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Diodes, Impatt-4800 — *See Vol. A*

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Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034-1035
§ **AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... B•1137-1139**
§† **Data Display Products, El Segundo, CA 90245-4630, 213-640-0442;800-421-6815 ..... B•1142-1144**
§ **Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 ..... B•1145-1150**
§ **EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1319**
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... C•1584
† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ..... B•1073**
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 .. B•1153
† **Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1155-1158**
§ **Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086-1087**
§ **Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1167**
§ **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ..... B•1169**
§ **Kingbright USA Corp., Kingbright Elec. Co., Ltd., Alhambra, CA 91801, 818-281-9788;818-281-9807 ..... B•1170-1172**
† **Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1022,1174**
§ **Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... B•1092-1093**
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1324
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1747-1751**
§† **Optek Technology Inc., Carrollton, TX 75006, 214-323-2200 ..... B•1333**
† **Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1025,1179**
§ **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118**
§ **Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1184,1340**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
† **Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188-1195**
§† **I I Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1196-1197,1199,1201**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1378
Wilbrecht Electronics, St. Paul, MN 55107, 612-222-2791 ..... B•1211-1213
§† A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1866
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Alpha Dist. Corp., Richfield, OH 44286 ..... 216-659-7100; 1-800-628-0841
§ Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
Ei North America, New York, NY 10021 212-517-5622
§ Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
§ Everlight - USA, Glendora, CA 91740 213-697-5067
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Genisco Technology Corp., La Mirada, CA 90638 714-523-7001

§ Globite Sales Ltd/Glowlite Div., Pauls Valley, OK 73075 ... 405-238-5541;800-654-3662
§ Golden Pacific Electronics, Inc, Placentia, CA 92670 ... 714-993-6970
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN ... 0534-52-2141
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 ... 612-443-2500
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 ... 612-443-2500
§ Hewlett-Packard Co., Cupertino, CA 95014 ... 800-752-0900
§† Honeywell Microswitch Div., Richardson, TX 75081 ... 214-470-4271
§ IDEC Corporation, Sunnyvale, CA 94089-2211 ... 408-747-0550
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 ... 818-787-0311
† Imtronics Industries, St. Petersburg, FL 33716 ... 813-572-9010
Inter-Market, Glenview, IL 60025 ... 708-729-5330
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 ... 305-771-7000
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 ... 708-884-8688
§† Lamp Technology, Inc., Bohemia, NY 11716 ... 516-567-1800
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 ... 201-249-7000
§ Laube Technology, Woodland Hills, CA 91367 ... 818-703-1188
§ Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 ... 612-222-2791
§ Leecraft Mfg., Long Island City, NY 11101 ... 718-392-8800
Littelfuse, Inc., Des Plaines, IL 60016 ... 708-824-1188;708-824-0400
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 ... 708-359-2790
§ Marktech International Corp., Latham, NY 12110 ... 518-786-6591
† Math Assocs., Westbury, NY 11590 ... 516-334-6800
§ MG Electronics, Hauppauge, NY 11788 ... 516-582-3400
§ Micro Lamps, Inc., Batavia, IL 60510-1420 ... 708-879-0900
† Micropac Inds., Inc., Garland, TX 75040 ... 214-272-3571
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 ... 203-283-8261
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 ... 408-730-5900
Mouser Electronics, Mansfield, TX 76063 ... 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 ... 201-748-5089
Opto Diode Corp., Newbury Park, CA 91320 ... 805-499-0335
Opto Technology, Inc., Wheeling, IL 60090 ... 708-537-4277
§ Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN ... 03-3471-8548
§ Peter Parts & Assocs., Webster, NY 14580 ... 716-265-2540
§ Pioneer Components, Brooklyn, NY 11234 ... 718-444-3880
Precision Electro-Optics, Inc., Chatham, NJ 07928 ... 201-635-8811
Promax-Johnton Electronic Corp., Irvine, CA 92714 ... 714-975-1245
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
R.F. Electronics, Inc., Irvine, CA 92714-5517 ... 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 ... 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 ... 201-825-8080
Schroff Incorporated, Warwick, RI 02886 ... 401-732-3770
§ Schurter, Inc., Petaluma, CA 94952 ... 707-778-6311
Senior Inds., Inc., Wood Dale, IL 60191 ... 312-350-1600
§ Shelly Associates, Inc., Tustin, CA 92680 ... 714-669-9850
† Shogyo International Corp., Great Neck, NY 11021 ... 516-466-0911
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 ... 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 ... 201-321-3400
§ Silicon Sensors, Dodgeville, WI 53533 ... 608-935-2707
Silonex Inc., Plattsburgh, NY 12901 ... 518-561-3160
§ Solid State, Inc., Bloomfield, NJ 07003 ... 201-429-8700
Soltec Corp., San Fernando, CA 91340-1597 ... 818-365-0800;800-423-2344
§ Sorenson Lighted Controls, Hartford, CT 06114 ... 203-527-3092;1-800-243-0240
†# Spectrum Devices, Sugar Land, TX 77478-2420 ... 713-242-6417
§ Stetco, Inc., Franklin Pk., IL 60131 ... 708-671-4208
Stetron International, Inc., Buffalo, NY 14203 ... 716-854-3443
§ Teknational Inds., Inc., Rochester, NY 14620-1103 ... 716-232-1291
† Texas Optoelectronics, Inc., Garland, TX 75042 ... 214-487-0085
Visual Communications Co., Inc., San Diego, CA 92126 ... 619-549-6900
§ Wamco, Inc., Fountain Valley, CA 92708 ... 714-545-5560

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† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ... B•1073**
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 708-517-1144 ... B•1080
Kingbright USA Corp., Kingbright Elec. Co., Ltd., Alhambra, CA 91801, 818-281-9788;818-281-9807 ... B•1170-1171
§ **SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, La Mirada, CA 90638, 213-802-8425 ... B•1114-1115**
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ... B•1119-1121,1340
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ... B•1124
I I Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ... B•1200-1201
A.C. Interface Inc., Rancho Santa Margarita, CA 92688 ... 714-858-1866
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 ... 201-231-8300
Apollo Display Technologies, Inc., Holtsville, NY 11742 ... 516-654-1143
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 ... 416-828-2400
Densitron Corporation, Densitron International, Torrance, CA 90505 ... 213-530-3530
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475
Kyocera America, Inc., San Diego, CA 92123 ... 619-576-2766
§ Laube Technology, Woodland Hills, CA 91367 ... 818-703-1188
Ocular Inc., Richardson, TX 75081 ... 214-437-2561
§ Optrex/Satori, Torrance, CA 90503 ... 213-214-1791
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 ... 201-825-8080
Soltec Corp., San Fernando, CA 91340-1597 ... 818-365-0800;800-423-2344
Stetron International, Inc., Buffalo, NY 14203 ... 716-854-3443
† UCE, Inc., Norwalk, CT 06854 ... 203-838-7509
VL Electronics, Inc., Los Angeles, CA 90010-1603 ... 213-738-8700

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† **Centronic, Inc., The Morgan Crucible Company, Spec. Matls. & Tech Division, Newbury Park, CA 91320-1702, 805-499-5902 ... B•1322**
§ **EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ... B•1319**
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ... B•1325-1332
§† **Optek Technology Inc., Carrollton, TX 75006, 214-323-2200 ... B•1333**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ... B•1187
† **Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ... B•1342-1343**
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ... B•1345
§ A E G Corporation, Somerville, NJ 08876-1269 ... 908-231-8491
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 ... 201-231-8300
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 ... 416-335-5507
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 ... 818-882-0424
† EG & G Judson, Montgomeryville, PA 18936 ... 215-368-6900
§ Hewlett-Packard Co., Cupertino, CA 95014 ... 800-752-0900
§† Honeywell Microswitch Div., Richardson, TX 75081 ... 214-470-4271
Lite-On Inc., Milpitas, CA 95035 ... 408-946-4873
Marktech International Corp., Latham, NY 12110 ... 518-786-6591
† Melles Griot, Inc., Irvine, CA 92714 ... 714-261-5600
§ NTE Electronics, Inc., Bloomfield, NJ 07003 ... 201-748-5089
Opto Diode Corp., Newbury Park, CA 91320 ... 805-499-0335
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
† Silicon Sensors, Dodgeville, WI 53533 ... 608-935-2707
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 ... 201-575-5586
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 ... 708-364-7277

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† **MDF Products Inc., Danbury, CT 06811, 203-743-3579 ... D•1293**
† **Voltage Multipliers, Inc., Visalia, CA 93291, 209-651-1402 ... A•2127**
† EG & G Judson, Montgomeryville, PA 18936 ... 215-368-6900
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 ... 408-732-0880
† Koep Precision Standards, Inc., South Plainfield, NJ 07080 ... 201-757-2220/2277
§† Microsemi Corp., Santa Ana, CA 92704 ... 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 ... 602-941-6300
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ... 408-730-0300;800-PENSTOCK
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 ... 516-586-7600

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Direction Finding Sets & Systems (MIL)-2440

† Corvus Microwave Inc., Syracuse, NY 13211-2100 ... 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 ... 213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ... 214-470-2137
† E-Systems, Melpar Div., Falls Church, VA 22046 ... 703-560-5000
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 ... 516-933-3000
† Glatzer Industries Corp., New Rochelle, NY 10801 ... 914-576-2700
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 ... 203-753-5840
† Servo Corporation of America, Hicksville, NY 11802-9907 ... 516-938-9700

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American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1038-1039,1139
Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100 ..... B•1041
Canyon Elctrns., Phoenix, AZ 85021, 602-944-4421 ..... B•1043
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1044
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007, 708-952-8800 ..... B•1057
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... B•1046-1048
DCI Inc., Olathe, KS 66062, 913-782-5672 ..... B•1054
Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1055
Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 ..... B•1145
§ Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1805
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
EDI, Wood Dale, IL 60191, 708-860-5838 ..... B•1065
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747 .. B•1069-1072
† FOX METER INC., Elburn, IL 60119, 708-365-2422 ..... D•1345
F-P Electronics, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1075-1077
§ Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191 ..... B•1078-1079
§ Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 708-517-1144 ..... B•1083
§ Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086-1087,1164-1165
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1814
§ IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 .. B•1091
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1178
Nissei Electronics, Mountain View, CA 94043, 415-969-1100 ..... B•1103-1105
Ocular Inc., Richardson, TX 75081, 214-437-2561 ..... B•1106-1107
Optrex/Satori, Torrance, CA 90503, 213-214-1791 ..... B•1110-1111
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1112-1113
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... B•1183
§ SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, La Mirada, CA 90638, 213-802-8425 ..... B•1114-1115
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... B•1117, D•1108
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ... B•1949
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1119,1121
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122-1124
§ Standish Industries, Hamlin LCD Div., Lake Mills, WI 53551, 414-648-1000 ..... B•1125
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1127-1131
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 ..... B•1132
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1395-1398,1402
Applied Data Systems, Baltimore, MD 21202 ..... 800-541-2003;410-576-0335
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
C-Tek Inc., Wakefield, MA 01880 617-246-1720
† Data Check Corporation, San Diego, CA 92126 619-578-0101
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Endicott Research Group, Endicott, NY 13760 607-754-9187
§ Everlight - USA, Glendora, CA 91740 213-697-5067
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
§ Graphic Strategies, Inc., Sunnyvale, CA 94089 408-745-6500
† Infodex, Inc., Wolcott, CT 06716 203-879-4944
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
Kristel Corporation, West Chicago, IL 60185 708-293-0850
† K-Systems of Texas, Inc., El Paso, TX 79936 915-598-9769
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Lucas Deeco Corp., Hayward, CA 94544-7831 415-471-4700
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Polytronix, Inc., Richardson, TX 75081 214-238-7045
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 916-783-7878
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

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Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007, 708-952-8800 ..... B•1057
Data Ray Corp., Westminster, CO 80234, 1-800-926-5556; 303-451-1300 ..... B•1050-1053
Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1805
† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1016-1017,1090
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900;1-800-645-5104 ..... D•1288
§ AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Aspect Electronics Inc., Sunnyvale, CA 94086 408-737-2290
Aydin Corp., Horsham, PA 19044 215-657-7510
† CELCO, Mahwah, NJ 07430 201-327-1123
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498 319-395-1000
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
§ Computerware, Inc., Vienna, VA 22182-2266 703-821-8200
§ Conrac Display Products, Inc., Duarte, CA 91010 818-303-0095
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
† Data Check Corporation, San Diego, CA 92126 619-578-0101
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Digital Equip., Marlborough, MA 01752
§ Display Technologies, Elgin, IL 60123 708-931-2100
§ Dotronix, New Brighton, MN 55112 612-633-1742
§ Everlight - USA, Glendora, CA 91740 213-697-5067
Φ Genstar Rental Electronics, Inc., Woodland Hills, CA 91367 ..... 800-331-3440 (in CA); 800-227-8409
§ Graphic Strategies, Inc., Sunnyvale, CA 94089 408-745-6500
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
† Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
Kikusui International Corp., Torrance, CA 90503 ..... 213-371-4662;800-545-8784
KMS Advanced Products, Inc., Ann Arbor, MI 48106-1868 313-769-1780
§ Krenz Electronic, Inc., San Clemente, CA 92672 714-361-2433
Kristel Corporation, West Chicago, IL 60185 708-293-0850
§ Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Megadata Corp., Bohemia, NY 11716 516-589-6800
Mesa Technology Corp., Columbia, MD 21046 800-888-0567
§ Metra Instruments, Inc., San Jose, CA 95131 408-432-1110
MEXITRONIX (Woman Owned), Kingman, AZ 86401 602-757-9798
§† Mitsubishi Electronics, Torrance, CA 90502 213-515-3993
Omni Vision Inc., Glendale Heights, IL 60139 708-893-1720
SinoTECH, Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§† Teltron, Inc., Birdsboro, PA 19508 215-582-2711
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201
XKD Corporation, Los Gatos, CA 95030 408-395-3700

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Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034-1035
§ AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1038-1039,1137-1139
Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100 ..... B•1041
CBM America Corp., Santa Monica, CA 90404, 213-828-8245 ..... D•1082-1083
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1045
§ Chrono-log Corp., Havertown, PA 19083, 215-853-1130 ..... D•1084
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... B•1046-1048
§ Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1055
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
EDI, Wood Dale, IL 60191, 708-860-5838 ..... B•1065
† Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ..... B•1073
F-P Electronics, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1075-1077
§ Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191 ..... B•1078-1079

Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 708-517-1144 ..... B•1082-1083
§ Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086-1087
§ IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 .. B•1091
† Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1174
§ Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... B•1093
LXD, Inc., Cleveland, OH 44146, 216-786-8700 ..... B•1097-1099
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6900 .... B•1100-1102
Nissei Electronics, Mountain View, CA 94043, 415-969-1100 ..... B•1103-1104
Ocular Inc., Richardson, TX 75081, 214-437-2561 ..... B•1106
Optrex/Satori, Torrance, CA 90503, 213-214-1781 ..... B•1110-1111
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... B•1183
§ SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, La Mirada, CA 90638, 213-802-8425 ..... B•1114-1115
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... B•1117, D•1102
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1119-1121,1184
§ Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122-1123
Standish Industries, Hamlin LCD Div., Lake Mills, WI 53551, 414-648-2000 ..... B•1125
§ H Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1196,1198,1200-1201
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1127,1130-1131
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 ..... B•1132
§ A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1866
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
Canyon Elctrns., Phoenix, AZ 85021 602-944-4421
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
Computerwise, Olathe, KS 66062 913-829-0600
§ Craft Data, Inc., Mission Viejo, CA 92691 714-582-8281
Crystaloid Electronics, Hudson, OH 44236 216-655-2429
Digital Equip., Marlborough, MA 01752
Dotronix, New Brighton, MN 55112 612-633-1742
† EEV Inc., Elmsford, NY 10523 914-592-6050
§† Electronics Research Associates Inc., Wilton, CT 06897 203-762-9721
§ Everlight - USA, Glendora, CA 91740 213-857-5057
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502 908-874-4747
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
Inter-Market, Glenview, IL 60025 708-729-5330
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7870
Kingbright USA Corp., Kingbright Elec. Co., Ltd., Alhambra, CA 91801 ..... 818-281-9780; 818-281-9807
§† Lucas Deeco Corp., Hayward, CA 94544-7811 415-471-4700
MicroDimensions, Inc., Mentor, OH 44060 216-974-8075
§ Micro Lamps, Inc., Batavia, IL 60510-1420 708-879-8900
§ Noritake Co., Inc., Noritake Co., Limited (Japan), Torrance, CA 90505 213-373-8704
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630 714-527-0561
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Polytronix, Inc., Richardson, TX 75081 214-238-7045
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
SACO Controls Inc., Montreal,Qc, CANADA H4S 1V0 514-745-3010
§† Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-332-5050(Sls)
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-370-9831
Telegenix, Inc., Div. of Inductotherm Industries, Cherry Hill, NJ 08034 800-424-5220
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611
Texas Optoelectronics, Inc., Garland, TX 75042 214-437-0095
§ Three-Five Sys. Inc., Phoenix, AZ 85044 602-496-0035
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 916-783-7878
Vome Industries, Inc., Chicago, IL 60631 312-775-9440
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Edge Lighted & Back Lighted-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1036
American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... B•1038-1039
Apollo Display Technologies, Inc., Hollsville, NY 11742, 516-654-1143 ... B•1040
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
† Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ..... B•1073
§ Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191 ..... B•1078-1079
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 708-517-1144 ..... B•1082-1083
Ocular Inc., Richardson, TX 75081, 214-437-2561 ..... B•1106
§ Optrex/Satori, Torrance, CA 90503, 213-214-1781 ..... B•1110
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... B•1117
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1121
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122-1124
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 ..... B•1132
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
Crystaloid Electronics, Hudson, OH 44236 216-655-2429
§ Data Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502 908-874-4747
GM Nameplate, Inc., Seattle, WA 98118 206-284-2200
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
† Interface Products, Inc., Oceanside, CA 92056 619-945-9230
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Polytronix, Inc., Richardson, TX 75081 214-238-7045
† Spectra Lux Corp., Kirkland, WA 98034 206-747-0580
Tetra Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Three-Five Sys. Inc., Phoenix, AZ 85044 602-496-0035
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† UCE, Inc., Norwalk, CT 06854 203-838-7509
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

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§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-2200 ..... B•1045
Endicott Research Group, Endicott, NY 13751, 607-754-9187 ..... D•1743
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086-1087,1165
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1814
† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1016-1017,1090
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6900 .... B•1100-1102
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1120-1121
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122,1124
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 ..... B•1132
§ Allen-Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Apollo Display Technologies, Inc., Hollsville, NY 11742 516-654-1143
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6050
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
§ Craft Data, Inc., Mission Viejo, CA 92691 714-582-8281
Futaba Corp., Winchester, VA 22601 703-662-1500
Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
GM Nameplate, Inc., Seattle, WA 98118 206-284-2200
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173 708-517-1144
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
KMS Advanced Products, Inc., Ann Arbor, MI 48105-1856 313-769-1780
† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766 603-443-5444
§ Lucas Deeco Corp., Hayward, CA 94544-7811 415-471-4700
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630 714-527-0561
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Tecos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
† UCE, Inc., Norwalk, CT 06854 203-838-7509
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Electromagnetic-2450

EDI, Wood Dale, IL 60191, 708-860-7788 ..... B•1065
F P Electronics, Mississauga, Ont., CANADA L4W 2P3, 416-624-3029 .. B•1075
† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1016-1017
† Minarco Inc. - A Talley Ind., Thomaston, CT 06787-0458, 203-283-8291 .. B•1178
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1127-1128,1131
§ Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-332-5050(Sls)

Displays, Electromechanical-2450

Electrodynamics, Inc., 3 Talley Ind. Co., Rolling Meadows, IL 60008, 708-259-0760 ..... D•1124
† Minarco Inc. - A Talley Ind., Thomaston, CT 06787-0458, 203-283-8291 .. B•1178
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1128-1129,1131
† Bowman Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
† Chomerics, Inc.W.R. Grace & Co., Woburn, MA 01888 617-935-4850
§† Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
F P Electronics, Mississauga, Ont., CANADA L4W 2P3 416-624-3029
Hickok Electrical Instrument Company, Cleveland, OH 44108 216-541-8060
IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† Interface Products, Inc., Oceanside, CA 92056 619-945-9230
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Newatronics Inc., Stratford, Ontario, CANADA N5A 6V5 519-271-3850
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
Schrott Incorporated, Warwick, RI 02886 401-732-3770
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-332-5050(Sls)
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

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AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... B•1038-1039
Apollo Display Technologies, Inc., Hollsville, NY 11742, 516-654-1143 ... B•1040
Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
† Galileo Electro-Optics Corp., Sturbridge, MA 01566 506-347-9191
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400

Displays, Graphic-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034

§ AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1038-1039,1137-1139
Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100 ..... B•1041
CBM America Corp., Santa Monica, CA 90404, 213-828-8245 ..... D•1082-1083
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1044-1045
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... B•1046-1047
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§† Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747 .. B•1069-1072
† Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ..... B•1073
§ Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191 ..... B•1078-1079
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† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1016
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NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... B•1100-1102
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§ Optrex/Satori, Torrance, CA 90503, 213-214-1791 ..... B•1110-1111
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1112-1113
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, La Mirada, CA 90638, 213-802-8425 ..... B•1114-1115
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... B•1117, D•1108
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1119-1121
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122,1124
Standish Industries, Hamlin LCD Div., Lake Mills, WI 53551, 414-648-1000 ..... B•1125
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1129-1131
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 ..... B•1132
§ AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
† Alden Electronics, Inc., Westboro, MA 01581 508-366-8851
Applied Data Systems, Baltimore, MD 21202 ..... 800-541-2003;410-576-0335
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
Bergquist, Minneapolis, MN 55435 800-347-4572
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
§ Conrac Display Products, Inc., Duarte, CA 91010 818-303-0095
§ Covid, Inc., Tempe, AZ 85281 602-966-2221
Crystaloid Electronics, Hudson, OH 44236 216-655-2429
§† Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
Digital Equip., Marlborough, MA 01752
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
Dotronix, New Brighton, MN 55112 612-633-1742
Everlight - USA, Glendora, CA 91740 213-697-5067
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135 408-922-9000
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
Φ Genstar Rental Electronics, Inc., Woodland Hills, CA 91367 ..... 800-331-3440 (in CA); 800-227-8409
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§ Graphic Strategies, Inc., Sunnyvale, CA 94089 408-745-6500
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
§ Lucas Deeco Corp., Hayward, CA 94544-7831 415-471-4700
§ Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Mauell Corp., Dillsburg, PA 17019-0339 717-432-8686
§ Metra Instruments, Inc., San Jose, CA 95131 408-432-1110
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
§† Mitsubishi Electronics, Torrance, CA 90502 213-515-3993
§ Noritake Co., Inc., Noritake Co., Limited (Japan), Torrance, CA 90505 213-373-6704
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Polytronix, Inc., Richardson, TX 75081 214-238-7045
Raster Graphics, Inc., Bend, OR 97701 503-388-2584
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003 ..... 214-231-6663; 214-924-3289;1-800-331-6600
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-392-5050(Sls)
Supertek Electronics, Inc., Arlington Heights, IL 60005 312-981-5655
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
Taliq Corp., Sunnyvale, CA 94089 408-745-0750
† Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Tele-Denken Resources, Inc., Humble, TX 77346 713-852-5366
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Telegenix, Inc., Div. of Inductotherm Industries, Cherry Hill, NJ 08034 ... 609-424-5220
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 916-783-7878
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

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† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1016
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
† Galileo Electro-Optics Corp., Sturbridge, MA 01566 508-347-9191
† Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
† Oxley Inc., Branford, CT 06405 203-488-1033
Polytronix, Inc., Richardson, TX 75081 214-238-7045
† UCE, Inc., Norwalk, CT 06854 203-838-7509

Displays, Indicator Lights-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1139
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 .. B•1153
§† JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ..... B•1169
§ Kingbright USA Corp., Kingbright Elec. Co., Ltd., Alhambra, CA 91801, 818-281-9788;818-281-9807 ..... B•1170-1172
† Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1174
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1178
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... B•1183
SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, La Mirada, CA 90638, 213-802-8425 ..... B•1114-1115
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
Wilbrecht Electronics, St. Paul, MN 55107, 612-222-2791 ..... B•1211,1213
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
§† Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 612-222-2791
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Marktech International Corp., Latham, NY 12110 518-786-6591
§ Micro Lamps, Inc., Batavia, IL 60510-1420 708-879-0900
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Mouser Electronics, Mansfield, TX 76063 800-346-6873
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
§ Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240
Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
§† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560

Displays, Intelligent-2450

American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1045
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... B•1048
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
† Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ..... B•1073
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1089
† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1017
§ Optrex/Satori, Torrance, CA 90503, 213-214-1791 ..... B•1110-1111
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... D•1108
§ Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1123
§ Standish Industries, Hamlin LCD Div., Lake Mills, WI 53551, 414-648-1000 ..... B•1125
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
Applied Data Systems, Baltimore, MD 21202 ..... 800-541-2003;410-576-0335
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5100
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
§ Corman Technologies Inc., Waterloo, Ontario, CANADA N2V 1N2 519-884-4430
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444

§ Graphic Strategies, Inc., Sunnyvale, CA 94089 408-745-6500
§ Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086 408-736-3191
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
§ Isocom Inc., Campbell, CA 95008 408-370-2212
Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154 ... 617-894-8700
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
§ Krenz Electronic, Inc., San Clemente, CA 92672 714-361-2483
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Marktech International Corp., Latham, NY 12110 518-786-6591
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
Pacific Communications, Santa Ana, CA 92705 714-546-0147
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Polytronix, Inc., Richardson, TX 75081 214-238-7046
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§† Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-392-5050(Sls)
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-5904 708-364-1477
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 916-783-7878
VL Electronics, Inc., Los Angeles, CA 90010-1603 213-738-8700
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440

Displays, Laser-2450

Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086 408-736-3191
† Laser Concepts, Omega Organization Intl, Seattle, WA 98133 206-364-7881

Displays, Light-emitting Diode (LED)-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034,1035
§ **AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1038-1039,1137-1139**
Canyon Elctrns., Phoenix, AZ 85021, 602-944-4421 ..... B•1043
† **Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1056**
§ Chromo-Ing Corp., Havertown, PA 19083, 215-853-1930 ..... D•1034
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-6311 ..... B•1075
§ **Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 ..... B•1145,1150**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ..... B•1058-1064
EDI, Wood Dale, IL 60191, 708-860-5838 ..... B•1065
† **Ferna Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ..... B•1073**
† **FOX METER INC., Elburn, IL 60119, 708-365-2422 ..... D•1345-1347**
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5160 ... B•1153
§ **Globite Sales Ltd/Globlite Div., Pauls Valley, OK 73075, 405-238-5541;800-654-3662 ..... B•1154**
§ **Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086-1087,1164-1165**
§† **IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088,1814**
Industrial Devices, Inc., Hackensack, NJ 07601, 201-488-8080 ..... B•1166
§ **IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 ..... B•1091,1703**
§ **Kingbright USA Corp., Kingbright Elec. Co., Ltd., Alhambra, CA 91801, 818-281-9788;818-281-9807 ..... B•1170-1172**
† **Ledtronics, Inc., Torrance, CA 90505, 213-549-9295 ..... B•1092,1174**
§ **Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... B•1094-1095**
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 ... B•1178**
§ **NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... B•1100-1101**
§ **Rohm Corporation, Rohm Electronics Division, Addison, TX 75001, 214-241-2520 ..... B•1193**
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ... B•1969
§ **Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1119-1121,1184**
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1123**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ... B•1188-1191,1193-1195
§ **I I Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1196-1199,1201**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9699 ..... D•1375-1376,1378
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 ..... B•1132
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... B•1395-1396,1398-1400,1402-1405
Wilbrecht Electronics, St. Paul, MN 55107, 612-222-2791 ..... B•1211-1213
§ A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1866
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
Apollo Display Technologies, Inc., Holtsville, NY 11742 516-654-1143
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
Artisan Controls Corp., Parsippany, NJ 07054 201-428-1770
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
§ Corman Technologies Inc., Waterloo, Ontario, CANADA N2V 1N2 519-884-4430
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
† Digitec, Marion, OH 43302 614-387-3444
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 516-334-0870
§ Electrol Co., York, PA 17405 717-848-1722
§† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
§ Everlight - USA, Glendora, CA 91740 213-697-5067
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ Golden Pacific Electronics, Inc, Placentia, CA 92670 714-993-6970
Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086 408-736-3191
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ IDEC Corporation, Sunnyvale, CA 94086-5211 408-747-0550
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Inter-Market, Glenview, IL 60025 708-729-5330
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
ISL Products Int'l. Ltd., Syosset, NY 11791-6093 516-937-3475
§ Isocom Inc., Campbell, CA 95008 408-370-2212
Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154 ... 617-894-8700
Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 612-222-2791
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6905 708-359-2790
§ Marktech International Corp., Latham, NY 12110 518-786-6591
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
§ Micro Lamps, Inc., Batavia, IL 60510-1420 708-879-0900
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Newport Electronics, Santa Ana, CA 92704-4426 ..... 714-540-4914;800-NEWPORT
Opto Controls, Cheshire, CT 06410-1511 203-272-2794
§ Pacom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
† Pho-Tronics Div., E. H. Wagner Mfg. Co., Milwaukee, WI 53224 414-355-6704
§† Quality Technologies, Palo Alto, CA 94304 415-493-0400
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Schroff Incorporated, Warwick, RI 02886 401-732-3770
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 ... 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-392-5050(Sls)
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9401
Telegenix Inc., Div. of Inductotherm Industries, Cherry Hill, NJ 08034 ... 609-424-5220
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 ... 214-995-6611
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440
§ Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Lighted Segment-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034,1035
American Control Technology, Inc., West Dundee, IL 60118-2185, 708-426-6750 ..... B•1645
§ **AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1038-1039,1138-1139**
§ **Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5160 ..... B•1041**
Canyon Elctrns., Phoenix, AZ 85021, 602-944-4421 ..... B•1043
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1045**
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-6311 ..... B•1675
FCI Inc., Olathe, KS 66062, 913-782-0777 ..... B•1054
Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1055
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
EDI, Wood Dale, IL 60191, 708-860-5838 ..... B•1065
Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747 . B•1069-1072
† Ferna Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ..... B•1073
† FOX METER INC., Elburn, IL 60119, 708-365-2422 ..... D•1345-1347
F-P Electronics, Mississauga, Ont., CANADA L4W 2P1, 416-624-5020 ..... B•1075,1077
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 708-517-1144 ..... B•1082
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086-1087,1164-1165
† **IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1089**
IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 .. B•1091
§ **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ..... B•1169**
§ **Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... B•1094-1095**
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1178**
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... B•1100-1101
Ocutar Inc., Richardson, TX 75081, 214-437-2561 ..... B•1106-1107
§ **Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1119-1121**
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
Standish Industries, Hamlin LCD Div., Lake Mills, WI 53551, 414-648-1000 ..... B•1125
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1127-1129
Texmate, Inc., Vista, CA 92083-8397, 619-598-9699 ..... D•1376
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 ..... B•1132
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1396
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Dialight Corporation, Manasquan, NJ 08736 908-223-9400
† EEV Inc., Elmsford, NY 10523 914-592-6050

† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Everlight - USA, Glendora, CA 91740 213-697-5067
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086 408-736-3191
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Inter-Market, Glenview, IL 60025 708-729-5330
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
§† Lucas Deeco Corp., Hayward, CA 94544-7831 415-471-4700
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-392-5050(Sls)
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440
§† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Liquid Crystal (LCD)-2450

§ AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1038-1039,1137-1139
Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
CBM America Corp., Santa Monica, CA 90404, 213-828-8245 ..... D•1083
Data Ray Corp., Westminster, CO 80234, 1-800-926-5556; 303-451-1300 ..... B•1050-1053
DCI Inc., Olathe, KS 66062, 913-782-5672 ..... B•1054
§† Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1055
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747 .. B•1069-1072
† Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ..... B•1073
§ Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191 ..... B•1078-1079
§ Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 708-517-1144 ..... B•1080-1083
IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088-1089,1814
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1819
LXD, Inc., Cleveland, OH 44146, 216-786-8700 ..... B•1097-1099
Nissei Electronics, Mountain View, CA 94043, 415-969-1100 ..... B•1103-1105
† Ocular Inc., Richardson, TX 75081, 214-437-2561 ..... B•1106-1107
§ Optrex/Satori, Torrance, CA 90503, 213-214-1791 ..... B•1110-1111
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1113
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... B•1183
SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, La Mirada, CA 90638, 213-802-8425 ..... B•1114-1115
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... B•1117, D•1108
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ... B•1949
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1119-1121
§ Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122-1124
§ Standish Industries, Hamlin LCD Div., Lake Mills, WI 53551, 414-648-1000 ..... B•1125
§ † Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1196,1198,1200-1201
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1375-1376
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 ..... B•1132
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1395-1396
§ A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1866
§ Action Instruments, San Diego, CA 92123 619-279-5726
A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
Computerwise, Olathe, KS 66062 913-829-0600
§ Craft Data, Inc., Mission Viejo, CA 92691 714-582-8284
Crystaloid Electronics, Hudson, OH 44236 216-655-2429
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
DataLux Corp., Winchester, VA 22601 703-662-1500
† EEV Inc., Elmsford, NY 10523 914-592-6050
§† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Endicott Research Group, Endicott, NY 13760 607-754-9187
§ Epson America, Inc./OEM Div., Torrance, CA 90503 213-534-4500
§ Epson America Inc., Component Sales Dept., Torrance, CA 90503 213-787-6300
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Melfess Five, Inc., Los Angeles, CA 90025 ..... 213-826-8133;800-533-2297
MFI, Los Angeles, CA 90025 ..... 213-826-8133;800-533-2297
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Newport Electronics, Santa Ana, CA 92704-4426 ..... 714-540-4914;800-NEWPORT
§ PCI, Inc., San Jose, CA 95128 408-282-0200
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Polytronix, Inc., Richardson, TX 75081 214-238-7045
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Supertek Electronics, Inc., Arlington Heights, IL 60005 312-981-5655
Taliq Corp., Sunnyvale, CA 94089 408-745-0750
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 916-783-7878
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, LCD, Sheets-2450

AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... B•1038-1039
§ Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 708-517-1144 ..... B•1081,1083
Nissei Electronics, Mountain View, CA 94043, 415-969-1100 ..... B•1103-1105
Ocular Inc., Richardson, TX 75081, 214-437-2561 ..... B•1106
§ Optrex/Satori, Torrance, CA 90503, 213-214-1791 ..... B•1110
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1123-1124
Standish Industries, Hamlin LCD Div., Lake Mills, WI 53551, 414-648-1000 ..... B•1125
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502 908-874-4747
† Fema Elctrns. Corp., E. Brunswick, NJ 08816 908-238-1223
§ Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086 408-736-3191
Polytronix, Inc., Richardson, TX 75081 214-238-7045
Taliq Corp., Sunnyvale, CA 94089 408-745-0750
† UCE, Inc., Norwalk, CT 06854 203-838-7509
VL Electronics, Inc., Los Angeles, CA 90010-1603 213-738-8700

Displays, Message-2450

American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1038-1039,1139
Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1045
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... B•1046
DCI Inc., Olathe, KS 66062, 913-782-5672 ..... B•1054
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
EDI, Wood Dale, IL 60191, 708-860-5838 ..... B•1065
FOX METER INC., Elburn, IL 60119, 708-365-2422 ..... D•1345
F-P Electronics, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ... B•1075
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 708-517-1144 ..... B•1081-1083
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086-1087,1164-1165
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1819
Ocular Inc., Richardson, TX 75081, 214-437-2561 ..... B•1107
Optrex/Satori, Torrance, CA 90503, 213-214-1791 ..... B•1110
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1119-1121,1184
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122-1123
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1130
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1380
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1395
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Aydin Corp., Horsham, PA 19044 215-657-7510
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5100
Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-392-5050(Sls)
Telegenix, Inc., Div. of Inductotherm Industries, Cherry Hill, NJ 08034 ... 609-424-5220
† UCE, Inc., Norwalk, CT 06854 203-838-7509
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Multifunction-2450

American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1139
Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... B•1048
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
† FOX METER INC., Elburn, IL 60119, 708-365-2422 ..... D•1346-1347
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 708-517-1144 ..... B•1081-1083
† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1016
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1174

Optrex/Satori, Torrance, CA 90503, 213-214-1791 ..... B•1110-1111
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1123
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1375
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
Capitol Switch Inc., Bethel, CT 06801 203-744-3300
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
C-Tek Inc., Wakefield, MA 01880 617-246-1720
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 ... 619-931-3000
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
Ocular Inc., Richardson, TX 75081 214-437-2561
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-392-5050(Sls)
Taliq Corp., Sunnyvale, CA 94089 408-745-0750
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Planar Gas Discharge-2450

Canyon Elctrns., Phoenix, AZ 85021, 602-944-4421 ..... B•1043
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1044-1045
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1089
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5100
§ Craft Data, Inc., Mission Viejo, CA 92691 714-582-8284
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
† Displays, Inc., Lewistown, PA 17044 717-242-2541
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132

Displays, Plasma-2450

Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100 ..... B•1041
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1044-1045
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... B•1046-1048
§† Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1055
Endicott Research Group, Endicott, NY 13760, 607-754-9187 ..... B•1067
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1089,1814
AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
§ Craft Data, Inc., Mission Viejo, CA 92691 714-582-8284
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135 408-922-9000
Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
† Librascope Corp., Glendale, CA 91201 818-244-6541
§ Lucas Deeco Corp., Hayward, CA 94544-7831 415-471-4700
† Miltope Corp., Melville, NY 11747 516-420-0200
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630 714-527-0561
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
Telegenix, Inc., Div. of Inductotherm Industries, Cherry Hill, NJ 08034 ... 609-424-5220
† Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Programmable-2450

American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... B•1038-1039
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1045
§ Chrono-log Corp., Havertown, PA 19083, 215-853-1130 ..... D•1084
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... B•1048
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
† FOX METER INC., Elburn, IL 60119, 708-365-2422 ..... D•1345,1347
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... B•1117
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1119
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1123
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1375
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1396,1399
§ Action Instruments, San Diego, CA 92123 619-279-5726
AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
† Aydin Corp., Horsham, PA 19044 215-657-7510
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5100
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
§ Graphic Strategies, Inc., Sunnyvale, CA 94089 408-745-6500
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ ITT Gilfillan, ITT Defense Inc., Van Nuys, CA 91409 818-988-2600
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
§ Lucas Deeco Corp., Hayward, CA 94544-7831 415-471-4700
Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
Omega Engineering, Stamford, CT 06907 800-826-6342
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
§† Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Spectrum Corp., Houston, TX 77075 ..... 713-944-6200;1-800-392-5050(Sls)
Taliq Corp., Sunnyvale, CA 94089 408-745-0750
Telegenix, Inc., Div. of Inductotherm Industries, Cherry Hill, NJ 08034 ... 609-424-5220
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
† UCE, Inc., Norwalk, CT 06854 203-838-7509
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440

Displays, Projection Type (CRT; Electromechanical; Film; Light Valve)-2450

† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1089,1814
Aydin Corp., Horsham, PA 19044 215-657-7510
§ Conrac Display Products, Inc., Duarte, CA 91010 818-303-0095
§ Covid, Inc., Tempe, AZ 85281 602-966-2221
Dotronix, New Brighton, MN 55112 612-633-1742
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502 908-874-4747
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 ... 619-931-3000
† Librascope Corp., Glendale, CA 91201 818-244-6541
Mitsubishi Electronics, Torrance, CA 90502 213-515-3993
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630 714-527-0561
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
§† Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Terminal Data Corp., Rockville, MD 20855 301-921-8282
† UCE, Inc., Norwalk, CT 06854 203-838-7509

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Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
Canyon Elctrns., Phoenix, AZ 85021, 602-944-4421 ..... B•1043
§ Chrono-log Corp., Havertown, PA 19083, 215-853-1130 ..... D•1084
DCI Inc., Olathe, KS 66062, 913-782-5672 ..... B•1054, D•1342
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
EDI, Wood Dale, IL 60191, 708-860-5838 ..... B•1065
§ Electro-Numerics, Inc., Irvine, CA 92714, 714-250-1501 ..... D•1344
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747 .. B•1069-1072
† FOX METER INC., Elburn, IL 60119, 708-365-2422 ..... D•1345,1347
† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1016
§ IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 .. B•1091
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 .. D•1359-1360
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT ..... D•1365
Nissei Electronics, Mountain View, CA 94043, 415-969-1100 ..... B•1103-1105
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1395-1398
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
Applied Data Systems, Baltimore, MD 21202 ..... 800-541-2003;410-576-0335
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5100
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 708-662-9200
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
§ Craft Data, Inc., Mission Viejo, CA 92691 714-582-8284
C-Tek Inc., Wakefield, MA 01880 617-246-1720
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Datachron Inc., Anaheim, CA 92805 714-385-1705
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
FTS/AUSTRON, Austin, TX 78761-4766 512-251-2341
§ Graphic Strategies, Inc., Sunnyvale, CA 94089 408-745-6500
Inter-Market, Glenview, IL 60025 708-729-5330
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
KMC Systems, Inc., Midland Pk, NJ 07432 201-447-0007
§ LFE Instruments, Clinton, MA 01510-3099 508-835-1000
§ Lucas Deeco Corp., Hayward, CA 94544-7831 415-471-4700
M/A-COM Government Products, Inc., Hunt Valley, MD 21030 301-771-0077
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Systems Data, Inc., Akron, OH 44321 216-666-0085
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
Two Technologies,Inc., Horsham, PA 19044 215-441-5305
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ Vidco, Inc., Beaverton, OR 97005 503-641-1804
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440

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Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100 ..... B•1041

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 ..... D•1120,1165-1167
DCI Inc., Olathe, KS 66062, 913-782-5672 ..... B•1054
§ **Dialight Corporation, Manasquan, NJ 08736, 908-223-9400** ..... B•1145
† **Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455** .. B•1058-1064
Electro-Numerics, Inc., Irvine, CA 92714, 714-250-1501 ..... D•1344
† **FOX METER INC., Elburn, IL 60119, 708-365-2422** ..... D•1345
F-P Electronics, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1075,1077
† **IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311** ..... B•1089
§ **IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489** .. B•1091
§ **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019** ..... B•1169
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261** .. B•1178
SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, La Mirada, CA 90638, 213-802-8425 ..... B•1114-1115
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1119-1121,1184
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1128,1130-1131
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1380
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1395,1397-1398,1404
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
Canyon Elctrns., Phoenix, AZ 85021 602-944-4421
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
C-Tek Inc., Wakefield, MA 01880 617-246-1720
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
†# Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
§ Graphic Strategies, Inc., Sunnyvale, CA 94089 408-745-6500
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
Keltron Corp., Miniprinter/Security Systems Div., Waltham, MA 02154 ... 617-894-8700
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
Mitsubishi Electronics, Torrance, CA 90502 213-515-3993
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
§† Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§ Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ Vidco, Inc., Beaverton, OR 97005 503-641-1804
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440

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Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
F-P Electronics, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ... B•1075
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086-1087,1164-1165
Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... B•1093
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... B•1183
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1396,1403
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
† Data Check Corporation, San Diego, CA 92126 619-578-0101
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311

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§ **Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100** ..... B•1041
Endicott Research Group, Endicott, NY 13760, 607-754-9187 ..... B•1067
§† **IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311** ..... B•1089,1814
§ **NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000** .... B•1100-1102
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1120
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
Apollo Display Technologies, Inc., Holtsville, NY 11742 516-654-1143
Comark Corp., Medfield, MA 02052 508-359-8161
Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
§† Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
§† Lucas Deeco Corp., Hayward, CA 94544-7831 415-471-4700
§ Noritake Co., Inc., Noritake Co., Limited (Japan), Torrance, CA 90505 213-373-6704
Pacific Industrial Components Corp., See Altair Exchange Corp.
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440

Display Sets (MIL), Computer-2440

† **IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311** ..... B•1814
Ocular Inc., Richardson, TX 75081, 214-437-2561 ..... B•1106
Control Displays, Inc., Colmar, PA 18915 215-822-3383
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
Intronics, Inc., Canton, MA 02021 617-828-4992
† Librascope Corp., Glendale, CA 91201 818-244-6541
† Miltope Corp., Melville, NY 11747 516-420-0200
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
Two Technologies,Inc., Horsham, PA 19044 215-441-5305

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Intronics, Inc., Canton, MA 02021 617-828-4992

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Dividers, Frequency-3450 — ***See Vol. A***

Dividers, Power (LF, HF, VHF, UHF)-3450 — ***See Vol. A***

Dividers, Power, Microwave-3450 — ***See Vol. A***

Dividers, Voltage-Also See Networks, Resistance; Transformers, Voltage Dividing-2900 — ***See Vol. D***

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Doublers, Voltage-Also See Rectifiers, Bridges & Assemblies-4800 — ***See Vol. A***

Down Converters-3450 — ***See Vol. A***

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Drafting Symbols, Dry Transfer, Pressure Sensitive, etc. (Incl. Lettering)-4200 — ***See Vol. C***

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Drills & Accessories, Manual & Power-5400 — ***See Vol. C***

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Apollo Display Technologies, Inc., Holtsville, NY 11742, 516-654-1143 ... B•1040
§ **Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100** ..... B•1041
F-P Electronics, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1075,1077
† **Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561** ..... D•1143
§ **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691** ..... A•2118
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122-1123
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
Avasem Corporation, San Jose, CA 95126 408-297-1201
§ C-Tek Inc., Wakefield, MA 01880 617-246-1720
CTS Corporation, Microelectronics business unit., W. Lafayette, IN 47906 317-463-2565
§ Dialight Corporation, Manasquan, NJ 08736 908-223-9400
† Dionics, Westbury, NY 11590 516-997-7474
§† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
† Exar Corp., San Jose, CA 95161-9007 408-732-7970
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ Wilson, H. F., Engineering Co., Glen Ellyn, IL 60137 708-469-7473

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† **Linear Motions Co., Valinda, CA 91744, 818-918-7806** ..... B•1628
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621** ..... B•1568
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
† Dionics, Westbury, NY 11590 516-997-7474
† Marconi Circuit Technology Corp., Farmingdale, NY 11735 516-293-8636
§ MKC Electronics Corp., Overland Park, KS 66215 913-894-9711
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§† Silicon General, Garden Grove, CA 92641 714-898-8121
Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
Voltex, Amityville, NY 11701 516-842-2772

Drivers, Speaker-1300 — ***See Vol. D***

Drivers, Surface Mount-1100 — ***See Vol. D***

Drivers, Switch-3450 — *See Vol. A*

Drivers, Tube — See Drivers & Decoders for Readouts (Vol. B)

Drives & Drive Mechanisms (Dial)-2400 — *See Vol. C*

Drives/Subsystems, Core Disk Emulator-2000 — *See Vol. D*

Drives/Subsystems, Disk, 3½" Diskette-2000 — *See Vol. D*

Drives/Subsystems, Disk, 3¼" Winchester-2000 — *See Vol. D*

Drives/Subsystems, Disk, 5¼" Diskette-2000 — *See Vol. D*

Drives/Subsystems, Disk, 5¼" Winchester-2000 — *See Vol. D*

Drives, Subsystems, Disk, 8" Diskette-2000 — *See Vol. D*

Drives/Subsystems, Disk, 8" Winchester-2000 — *See Vol. D*

Drives/Subsystems, Disk, 14" Winchester-2000 — *See Vol. D*

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Drives/Subsystems, Disk, Fixed/Removable-2000 — *See Vol. D*

Drives/Subsystems, Disk Array-2000 — *See Vol. D*

Drives/Subsystems, Magnetic Tape, ¼" Cartridge-2000 — *See Vol. D*

Drives/Subsystems, Magnetic Tape, Cassette-2000 — *See Vol. D*

Drives/Subsystems, Magnetic Tape, Reel-to-Reel-2000 — *See Vol. D*

Drives/Subsystems, Semiconductor Emulator-2000 — *See Vol. D*

Dry Transfer Letters & Numbers — See Kits, Marking (Vol. C)

Ducts, Wiring-6000 — *See Vol. C*

Ducts, Fiber Optic-2475

† Cole-Flex Corporation, West Babylon, NY 11704 516-249-6150
§ Panduit Corp., Tinley Park, IL 60477-0981 800-777-3300

Dummy Loads, Electronic-2900 — *See Vol. D*

Dummy Loads, Microwave-2900 — *See Vol. D*

Dummy Loads, Power-2900 — *See Vol. D*

Dummy Loads, Programmable-2900 — *See Vol. D*

Dummy Loads, Resistive-2900 — *See Vol. D*

Dummy Loads (MIL), RF-2440

† Alan Industries Inc., Columbus, IN 47202 812-372-8869
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
† Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Compac, Holbrook, NY 11741 516-585-3400
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
† Electro Impulse, Neptune, NJ 07754-0278 908-776-5800
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
Pasternack Enterprises, Irvine, CA 92713 714-261-1920
† Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047 818-707-2020

Duplexers, Microwave-3450 — *See Vol. A*

Duplexers, Nonmicrowave-1900 — *See Vol. D*

Duplicators, Magnetic Tape-1300 — *See Vol. D*

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Earphones — See Headphones (Vol. D)

Earth Stations, TV, Receive Only-1900 — *See Vol. D*

Earth Stations; TV, Receive/Transmit-1900 — *See Vol. D*

Edge Clips, Surface Mount-2500 — *See Vol. C*

Edge Connectors, Surface Mount-2100 — *See Vol. C*

Editing Equipment, Tape-1300 — *See Vol. D*

Ejectors & Extractors, PC Boards — See Pullers, Circuit Board (Vol. C)

Elastomers, Conductive — See Conductive Elastomers (Vol. C)

Elastomers, Heat Shrinkable — See Caps, Forms & Tapes, Heat Shrinkable (Vol. C)

Electret — See Microphones, Condenser (Vol. D)

Electrical Measurement & Test Services — See Services, Electrical Measurement & Test (Vol. D)

Electrodes, Electroplating — See Electroplating Equipment & Supplies (Vol. D)

Electrodes, High Voltage-2900 — *See Vol. D*

Electromagnets-1850 — *See Vol. A*

Electronic Counter Countermeasures (ECCM) Fixes (MIL)-2440

AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
New Wave Instruments, Provo, UT 84604 801-373-4909
† Optical & Conductive Coatings, Meridian Inds., Inc., Pacheco, CA 94553 415-798-6066
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
ST Research Corporation, Newington, VA 22122 703-550-7000

Electronic Countermeasures (ECM) (MIL), Cruise Missiles-2440

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400

ECM Sets (MIL)-2440

Noise Com Inc., Paramus, NJ 07652, 201-261-8797 ..... D•1304
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
ST Research Corporation, Newington, VA 22122 703-550-7000
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333

ECM Systems (MIL)-2440

Noise Com Inc., Paramus, NJ 07652, 201-261-8797 ..... D•1305
† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† E-Systems, Greenville Div., Greenville, TX 75403-6056 903-455-3450
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

ECM Systems (MIL), Deceptive-2440

† Noise Com Inc., Paramus, NJ 07652, 201-261-8797 ..... A•1821
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† Aydin Corp., Horsham, PA 19044 215-657-7510
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000

Electronic Intelligence (Elint) (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
† E-Systems, Greenville Div., Greenville, TX 75403-6056 903-455-3450
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
M/A-COM Government Products, Inc., Hunt Valley, MD 21030 301-771-0077
New Wave Instruments, Provo, UT 84604 801-373-4909
† SCOPE Incorporated, Reston, VA 22090 703-471-5600
ST Research Corporation, Newington, VA 22122 703-550-7000
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Electronic Loads — See Dummy Loads (Vol. D)

Electronic Support Measures (ESM) Sets (MIL)-2440

AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
RTS Systems, Telex Communications, Inc., Burbank, CA 91506 818-566-6700
ST Research Corporation, Newington, VA 22122 703-550-7000
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Electronic Warfare (EW) Sets (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Republic Electronics Co., Hauppauge, NY 11788 516-273-9800
† SCOPE Incorporated, Reston, VA 22090 703-471-5600
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
ST Research Corporation, Newington, VA 22122 703-550-7000
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333

Electroplating Equipment & Supplies-4100 — *See Vol. D*

Electrostatic Discharge Guns - Also See Generators, ESD-2900 — *See Vol. D*

Electrostatic Discharge (MIL)-2440

§† NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072, 716-773-7634 ..... D•2238
Schaffner EMC, Inc. Instr. Div., Union, NJ 07083, 908-851-0644;800-367-5566 ..... D•1321
§† ACL Inc., Elk Grove, IL 60007 ..... 708-981-9212;1-800-782-8420
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-574-5400
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
# Electrostatic Consulting Assocs., Groton, MA 01450 508-448-5583
† Gordon Brush Mfg. Co., Inc., Los Angeles, CA 90021-1786 213-627-6889
† KeyTek Instrument Corp., Wilmington, MA 01887 508-658-0880
Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
§ Semtronics Corp., Peachtree City, GA 30269 404-487-6681
Simco Co., Hatfield, PA 19440 215-822-2171
§† Stackbin Corp., Lincoln, RI 02865 ..... 401-333-1600;800-333-1603
† Stag Microsystems Inc., Santa Clara, CA 95054 ..... 408-988-1118;1-800-227-8836

Elements, Sensing — See Transducers (Vol. B)

Eliminators, Battery — See Power Supplies, AC to DC Adapter (Vol. D)

Emitter Location & Identification System (MIL), Automatic Ground Transportable-2440

† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Emitters/Detectors, Infrared-3700

§ Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... B•1092
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1320-1321
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... B•1323
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1336-1338
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
† DBA Systems, Inc., Melbourne, FL 32902-0550 305-727-0660
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
§ Everlight - USA, Glendora, CA 91740 213-697-5067
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Idea, Inc., Brea, CA 92621 213-697-4332
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101 708-543-6200
† Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 612-222-2791
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Ortel Corp., Alhambra, CA 91803 818-281-3636
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Silonex Inc., Plattsburgh, NY 12901 518-561-3160
Soltec Corp., San Fernando, CA 91340-1597 ..... 818-365-0800;800-423-2344
Swan Associates, New Haven, CT 06534 203-387-3917
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Emitters, Fiber Optic-Also See Diodes, Laser-2475

§ ‖ Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1196,1198
§ A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1866
A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
† Math Assocs., Westbury, NY 11590 516-334-6800
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Ortel Corp., Alhambra, CA 91803 818-281-3636
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

Emulators, In-circuit-2900 — *See Vol. D*

Emulators, RTS-2900 — *See Vol. D*

Emulators, Terminal-2900 — *See Vol. D*

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Encapsulation Services — See Services, Encapsulation (Vol. D)

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Enclosures, CRT — See Mounts CRT (Vol. C)

Enclosures, Equipment & Panel Mounting-1400 — *See Vol. C*

Enclosures, Instrument, With Integral Connectors-1400 — *See Vol. C*

Enclosures, Keyboard-1400 — *See Vol. C*

Enclosures, Metal-1400 — *See Vol. C*

Enclosures, Nonmetallic-1400 — *See Vol. C*

Enclosures, Portable, Metallic & Nonmetallic-1400 — *See Vol. C*

Enclosures, Power Distribution-1400 — *See Vol. C*

Enclosures, Shielded-1400 — *See Vol. C*

Enclosures, Shipping, Metallic & Nonmetallic-1400 — *See Vol. C*

Enclosures, (MIL)-2440

Amco Engineering, Schiller Pk., IL 60176, 708-671-6670;800-833-3156 ..... C•1008,1010-1011
† Cabtron Systems, Inc., Northbrook, IL 60062, 708-498-6090 ..... C•1018
† Compac, Holbrook, NY 11741, 516-585-3400 ..... C•1021-1023
ECS Composites, Grants Pass, OR 97526, 503-476-8871 ..... C•1027
† EG & G Birtcher, EG & G, Inc., El Monte, CA 91734-1268, 818-442-2572 ..... C•1028-1029
† Electronic Enclosures, Div. Wyle Laboratories, El Segundo, CA 90245, 213-643-8181 ..... C•1030-1032
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... B•1806, C•1041
Emcor Products, Crenlo, Inc., Rochester, MN 55901, 507-289-3371 ..... C•1043
† Equipto Electronics Corp., Aurora, IL 60506, 708-897-4691 ..... C•1044-1045
Extrusion Technology, Inc., Randolph, MA 02368, 617-963-7200 ..... C•1051
† Gemini Inc., Cannon Falls, MN 55009, 507-263-3957;800-533-3631 ..... C•1055
† General Devices Co., Inc., Indianapolis, IN 46239-9632, 317-897-7000 ... C•1056
Graham Electronic Manufacturing Inc., Escondido, CA 92025, 619-747-9177;800-628-4095 ..... C•1057
§† Hardigg Inds., Inc., South Deerfield, MA 01373, 413-665-2163 ..... C•1059
† Optima Electronic Packaging Systems, Tucker, GA 30084-5088, 404-496-4000 ..... C•1064-1065,1069
Par Metal Products, Inc., Par Industrial Complex, Brooklyn, NY 11216, 718-774-5900 ..... C•1077
† S & S Associates, Inc., San Luis Obispo, CA 93401, 805-544-2500 .. C•1094-1096

† **Skydyne Div., AAR Mfg., Port Jervis, NY 12771, 914-856-6655;800-428-CASE** ..... C•1106-1107
§ **Star Case Manufacturing Co., Inc., Munster, IN 46321, 219-922-4440;800-822-STAR (outside IN);800-782-CASE (inside IN)** ..... C•1097
† **STRONGBOX, Culver City, CA 90231-2726, 213-305-8236** ..... C•1108
TDJ Co., Inc., San Diego, CA 92110, 619-276-3920 ..... C•1110
† **Underwater Kinetics, San Marcos, CA 92069, 619-744-7560** ..... C•1127-1129
Zero Enclosures, Zero Corp., Burbank, CA 91503, 818-846-4191;818-841-1325 ..... C•1136
ADE, Inc., Chicago, IL 60633 312-646-3400
† Ark Elctrns. Corp., Southampton, PA 18966 215-322-6510
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 ..... 603-742-1120;800-872-0042
† Compu-Craft Fabricators Inc., Warminster, PA 18974 215-443-7107
Dickinson USA Inc., Dickinson Manufacturing Co. Ltd., Lynnwood, WA 98037 ..... 206-742-3677;800-659-9768; In Canada 604-525-6444
† EDAK Inc., EDAK Ltd., Melbourne, FL 32934 ..... 407-242-2953;800-462-8479
Electrorack Products Co., Anaheim, CA 92806 714-776-5420
† Gordon, L., Packaging, Baltimore, MD 21230 301-539-6537
† Hoffman Engineering, Anoka, MN 55303 612-421-2240
† Instrument Enclosures, Sun Valley, CA 91352 818-768-4622
† Langley-Fleet Aerospace, Inc., San Diego, CA 92112 619-264-3181
Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762 508-695-2000
Quantum Scientific Inc., Toronto, ONT M4J4Y1 ..... 416-239-3363;800-268-6000
Rose Enclosures Sys., Inc., Frederick, MD 21701 301-696-9800
Schell Inc., St. Petersburg, FL 33733 ..... 813-822-2600; 800-237-2600
† SKB Coporation, Orange, CA 92667 714-637-1252
† Trilobyte Computer Corporation, San Leandro, CA 94577 415-895-1100

Encoders, Digital — See Encoders, Shaft Angle (Vol. B)

Encoders, Displacement, Linear-5500

Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042, 516-488-6700 ..... B•1925-1927
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120;800-872-0042 ..... B•1888
§ **Contaq Technologies Corp., Bristol, VT 05443, 802-453-3332** ..... B•1889
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... C•2243
† **Ocean Motions Co., Barrington, RI 02806, 401-245-1398** ..... B•1924
† **Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561** ..... D•1143
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1197-1199
U. S. Digital Corp., Vancouver, WA 98665, 206-576-0514;800-736-0194 (Sales) ..... B•1952-1955
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... B•1031
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Astrosystems, Lake Success, NY 11042 516-328-1600
Burleigh Instruments, Fishers, NY 14453 716-924-9355
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 707-584-7558
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§ Daedal, Harrison City, PA 15636 412-744-4451
Dynamics Research Corp., Encoder Division, Wilmington, MA 01887-2193 508-658-6100
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Enprotech Corp., Kalamazoo, MI 49007 616-381-0665
† Force, Inc., Christiansburg, VA 24073 703-382-0462
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
§ Heidenhain Corp., Schaumberg, IL 60173 708-490-1191
§ Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
§ JMR Electronics, Bronx, NY 10461 212-597-6050
MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3965
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11040 516-328-3300
† Teledyne Gurley, Troy, NY 12181 ..... 518-272-6300;800-759-1844
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
Trumeter Company, Inc., New York, NY 10001 ..... 212-564-0666;800-537-2261
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Encoders, Fiber Optic-2475

OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ..... B•1754
† **Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884** ..... B•1342-1343
Sumtak Electronics, Daido Corporation, Somerset, NJ 08875, 908-805-0008 ..... B•1950-1951
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311 818-341-6161
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
§ JMR Electronics, Bronx, NY 10461 212-597-6050
† Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
§† Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397

Encoders, Magnetic Strip-5500

American Magnetics Corporation, Group 4, Carson, CA 90745, 213-775-8651 ..... D•1079
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... D•2243
§ Xico, Inc., Chatsworth, CA 91311, 818-709-4400 ..... D•1116
Copal (USA), Inc., Torrance, CA 90501 213-618-0225
Creative Micro Systems, Los Alamitos, CA 90720 213-493-2481
Elcom Industries, Inc., St. Louis, MO 63132 314-429-3100
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Identatronics, Inc., Elk Grove, IL 60007 ..... 708-437-2654 1-800-323-5403
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
§ Mag-Tek, Carson, CA 90746 213-631-5602
Norton Electronics, Inc., Torrance, CA 90503 ..... 213-793-1300;1-800-FON-4-NEI
† Vertex Industries, Inc., Clifton, NJ 07014 201-472-1331

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Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230 ..... B•1243
§ Bourns, Inc., Electronic Components Div., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;800-750-7200 ..... A•2027
§ **Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120;800-872-0042** ..... B•1888
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600** ..... D•1176
IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 ..... B•1906
J. B. Merritt Controls, Inc., Norwalk, CT 06854, 203-855-9100;800-333-5762 ..... D•1139
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1916-1917
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1945-1946
Sumtak Electronics, Daido Corporation, Somerset, NJ 08875, 908-805-0008 ..... B•1950-1951
U. S. Digital Corp., Vancouver, WA 98665, 206-576-0514;800-736-0194 (Sales) ..... B•1952-1955
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... B•1031, 1956
§† Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
CUI Stack Inc., Beaverton, OR 97006 503-643-4899
Data Technology, Inc., Woburn, MA 01811 617-935-8820
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
† Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
Motor-Tronics Inc., Vista, CA 92083 619-727-7430
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-5028
Northern Precision Labs., Fairfield, NJ 07006 201-227-4900
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Trans-Tek, Ellington, CT 06029 203-872-8351
§ Veeder-Root, Simsbury, CT 06070-2003 203-651-2700

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† ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ..... D•1176
Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1915
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1930, D•2243
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1197-1199
† Aeroflex Laboratories Inc., ARX Inc., Plainview, NY 11803 516-694-6700
Astrosystems, Lake Success, NY 11042 516-328-1600
B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-810-7070; 908-572-0500
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
§ Encoder Products, Sandpoint, ID 83864 208-263-8541
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Ennovation of Wisconsin, Inc., Watertown, WI 53094 414-261-2996
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
IVO Industries, Inc., Eatontown, NJ 07724 ..... 908-542-5151;800-932-0489
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Performance Controls, Inc., Horsham, PA 19044 215-675-6500

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BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600 ..... B•1879
BEI Motion Systems Company, Digital Products Div., Little Rock, AR 72203, 501-851-4000 ..... B•1879
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 ..... B•1879
† **BEI Motion Systems Company, Rek Encoder Div., Needham Hgts., MA 02194, 617-455-1414** ..... B•1879-1881
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... B•1879
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042, 516-488-6700 ..... B•1886-1887

§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-872-0042 ..... B•1888
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1361,1363
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ..... B•1279
§ IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 ..... B•1723,1906
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1915
† Measurement Systems, Inc., Norwalk, CT 06854, 203-838-5561 ..... D•1138
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1298,1920, D•2243
OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ..... B•1754
§† Optek Technology Inc., Carrollton, TX 75006, 214-323-2200 ..... B•1333
Servo-Tek Products Co., Hawthorne, NJ 07506, 201-427-3100 ..... B•1310
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312
Sumtak Electronics, Daido Corporation, Somerset, NJ 08875, 908-805-0008 ..... B•1950-1951
U. S. Digital Corp., Vancouver, WA 98665, 206-576-0514;800-736-0194 (Sales) ..... B•1952-1955
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1031,1956
§† Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 .. 707-584-7558
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Copal (USA), Inc., Torrance, CA 90501 213-618-0225
§ C-Tek Inc., Wakefield, MA 01880 617-246-1720
§ Data Technology, Inc., Woburn, MA 01811 617-935-8820
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
Dynamics Research Corp., Encoder Division, Wilmington, MA 01887-2193 508-658-6100
§ Dynapar, Gurnee, IL 60031 312-662-2666
§ Electronic Counters & Controls, Inc., LFE Corp., Libertyville, IL 60048 ..... 708-362-8910; 800-422-3224
Elm Systems, Wauconda, IL 60084 708-526-5003
§ Encoder Products, Sandpoint, ID 83864 208-263-8541
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Ennovation of Wisconsin, Inc., Watertown, WI 53094 414-261-2996
Enprotech Corp., Kalamazoo, MI 49007 616-381-0665
Escap Products, Hauppauge, NY 11788 516-234-3900
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
§† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ..... 708-932-9380;800-468-6009
GME Systems, Inc., Pittsburgh, PA 15090 412-935-0440
Hansen Manufacturing Company, Inc., Subsidiary of IMC Magnetics Corp., Princeton, IN 47670-0023 812-385-3415
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
§ Heidenhain Corp., Schaumberg, IL 60173 708-490-1191
† HH Controls Co., Inc., Arlington, MA 02174 617-646-2626
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
† Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
Marktech International Corp., Latham, NY 12110 518-786-6591
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§† Renco Encoders Inc., Goleta, CA 93117-3094 805-968-1525
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
† Teledyne Gurley, Troy, NY 12181 ..... 518-272-6300;800-759-1844
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
§ Veeder-Root, Simsbury, CT 06070-2003 203-651-2700
§† Wide Range Elctrns. Corp., Chesterfield, MISSOURI 63005 314-532-5887

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BEI Motion Systems Company, Itek Encoder Div., Needham Hgts., MA 02194, 617-455-1414 ..... B•1879-1881
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... B•1879
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-872-0042 ..... B•1888
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
Emcor Products, Crenlo, Inc., Rochester, MN 55901 507-289-3371
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
† Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
# Sekai Electronics of America, Inc., La Mirada, CA 90638 714-670-1854
† Teledyne Gurley, Troy, NY 12181 ..... 518-272-6300;800-759-1844
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400

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§† Canoga-Perkins Corp., Chatsworth, CA 91311 818-718-6300
Dupont Electro-Optic Products, Dupont Electronics, Research Triangle Park, NC 27709 ..... 1-800-888-LAN1;919-481-5100
§ Longshine Technlg. Inc., San Jose, CA 95132 408-942-1746

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Data Translation, Inc., Marlboro, MA 01752 508-481-3700
† DEI, Escondido, CA 92029 619-743-8344

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Advanced Technology Company, Vista, CA 92083, 619-727-7430 ..... B•1235-1236, C•1605-1608
† Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1254
† Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017, 314-532-3505 ..... C•1623
§ Interfan, William J. Purdy Co., Burlingame, CA 94010, 415-347-1203 .... C•1626
McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550, 609-799-0100 ..... C•1632-1633
§ Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312
Lamb Electric Division, Ametek, Inc., Kent, OH 44240 216-673-3451
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Contact East, N. Andover, MA 01845 508-682-2000
Control Resources Inc., Smart Fan Div., Harvard, MA 01451 508-772-4043
† Hi-Tech, Inc., Zion, IL 60099 708-746-2447
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
† Kooltronic, Inc., Hopewell, NJ 08525 609-466-3400
† Kooltronic, Inc., Ventura, CA 93003 805-642-8521
† Merrill, Inc., Gwynedd Valley, PA 19437 215-361-1297
† MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779 516-467-5151

§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
§ Precision Fabrication Technologies, Inc., Monon, IN 47959 ..... 1-800-558-7297; 219-253-6666
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454

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AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
Daniels Manufacturing Corp., Orlando, FL 32824, 407-855-6161 ..... C•1703
† Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1217
§ MOLEX, Inc., Lisle, IL 60532, 708-969-4550 ..... C•1474
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
# Clifford of Vermont, Inc., Bethel, VT 05032 ..... 802-234-9921;800-451-4381
§ Electronic Components & Matls. Div., GTE Products Corp., Warren, PA 16365 814-723-2000
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
GTE Fiberoptic Products, Williamsport, PA 17701 .... 717-326-6591;1-800-FBR-OPTICS
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
† INTELCO, Acton, MA 01720 508-264-4485
§† Light Control Systems Inc., M/A COM Inc., Tyngsboro, MA 01879 508-649-9870
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 ..... 800-336-5917;703-953-4751
3M Private Network Products, 3M, Austin, TX 73769-2963 ..... 512-984-1800; 800-745-7459
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
† Power Technology, Inc., Little Rock, AR 72219-1117 501-568-1995
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
Teleterminal Corp., Greenland, NH 03840 603-431-1200
§ Thomas & Betts Corporation, Electronics Div., Greenville, SC 29616-2401 803-676-2900
† York Technology, Inc., Burbank, CA 91502 818-955-8927

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† AME Corporation, Towaco, NJ 07082-0195, 201-263-1700 ..... B•1644
AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... B•1137-1139
§ Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1686-1687
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1158,1160
† Homalite, Whitco, Inc., Wilmington, DE 19804, 302-652-3686 ..... B•1085
† JMJ Technical Prods., Newark, NJ 07105, 201-589-4257 ..... C•1591
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1174
§ RMF Products, Inc., Batavia, IL 60510, 708-879-0020 ..... C•1593
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1195
Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 .. B•1209
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
Everlight - USA, Glendora, CA 91740 213-697-5067
†# Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
Idea, Inc., Brea, CA 92621 213-697-4332
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
Lamb Industries, Inc., Portland, OR 97225 ..... 503-297-8878;800-824-9374
† Mark Polarized Corp., Hauppauge, NY 11788 516-273-1122
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Polaroid Corporation, Polarizer Div., Norwood, MA 02062 800-225-2770
RFI Corporation, Bay Shore, NY 11706 516-231-6400
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Schott Glass Technologies, Inc., Duryea, PA 18642 717-457-7485
Swan Associates, New Haven, CT 06534 203-387-3917
† Swedlow, Inc., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800
† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560

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Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... A•1677, B•1153
† Homalite, Whitco, Inc., Wilmington, DE 19804, 302-652-3686 ..... B•1085
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
Everlight - USA, Glendora, CA 91740 213-697-5067
Idea, Inc., Brea, CA 92621 213-697-4332
International Polarizer, Inc., Marlborough, MA 01752 508-481-7495
Metuchen Capacitors, Inc., Old Bridge, NJ 08857 908-679-3366
Polaroid Corporation, Polarizer Div., Norwood, MA 02062 800-225-2770
† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560

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† Homalite, Whitco, Inc., Wilmington, DE 19804, 302-652-3686 ..... B•1085
† JMJ Technical Prods., Newark, NJ 07105, 201-589-4257 ..... C•1591
† Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1025
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5100
† Barr Associates, Inc., Westford, MA 01886 508-692-7513
BT & D Technologies, Wilmington, DE 19803 302-479-0300
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., Willow Grove, PA 19090 215-659-3080
†# Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
International Polarizer, Inc., Marlborough, MA 01752 508-481-7495

† Mark Polarized Corp., Hauppauge, NY 11788 516-273-1122
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
† Optical & Conductive Coatings, Meridian Inds., Inc., Pacheco, CA 94553 415-798-6066
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
† Optima Precision, Inc., West Linn, OR 97068 ..... 800-544-4118;503-638-2525
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
† Plumer Precision Optics, Pennsburg, PA 18073 215-679-6272
† Pomfret Research Optics, Orange, VA 22960 703-854-4350
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Schneider Corp. of America, Woodbury, NY 11797 516-496-8500
Schott Glass Technologies, Inc., Duryea, PA 18642 717-457-7485
Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Swedlow, Inc., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800

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Filters (MIL), Electrical & Networks-2440

† **Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655** ..... **A•1661**
† **Eagle Wichita, Wichita, KS 67277, 316-942-5100** ..... **A•1666-1668**
† **Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333** ..... **A•1670**
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705, 714-979-4440 ..... **A•1065,1619**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1671**
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 ..... **A•1620-1622**
† **Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144** ..... **A•1673**
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 .. **A•1624**
Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... **A•2234**
† **Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600** ... **A•1678-1679**
Interpoint Corporation, Redmond, WA 98073-9705, 206-882-3100 ..... **D•1815**
§† **JMK, Inc., Amherst, NH 03031, 603-886-4100** ..... **A•1626**
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ..... **A•1682-1683**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ... **A•1685-1687**
Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... **A•1688**
Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. **B•1921**
§† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1415,1696-1698**
† **Oxley Inc., Branford, CT 06405, 203-488-1033** ..... **A•1705, B•1025**
§† **Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929** ..... **A•1740**
RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... **A•1633**
† **TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224** ..... **A•1708**
Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Ark Elctrns. Corp., Southampton, PA 18966 215-322-6510
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hertz Filter, Syosset, NY 11791 516-822-4770
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
Intepro Systems Inc., Billerica, MA 01821 508-663-7555
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
† Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† SFE Technologies, San Fernando, CA 91340 818-365-9411
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
Spectrum Control, Inc., Erie, PA 16505 814-455-0966
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200

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Flanges (MIL), Waveguide-2440

† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
§ Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700

Flashers-2200 — ***See Vol. D***

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† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200** ..... **B•1540**
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
† Modular Devices, Shirley, NY 11967 516-345-3100
† Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717

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Fuse Elements-4300

§† **FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594** ..... **B•1365**
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ... **B•1382-1383**
§ **Schurter, Inc., Petaluma, CA 94952, 707-778-6311** ..... **A•1638-1639, B•1389, C•1518**
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
Avasem Corporation, San Jose, CA 95126 408-297-1201
§ Bussmann:Cooper Industries, St. Louis, MO 63178 314-394-2877
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Ercona, Patchogue, NY 11772 516-758-0700
Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308

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Fuses-4300

§ **Bel Fuse, Jersey City, NJ 07302, 201-432-0463** ..... **B•1352-1353,1355**
Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... **A•1747**
§† **FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594** ..... **B•1365**
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... **B•1367**

§† Littelfuse, Inc., Des Plaines, IL 60016, 708-824-1188;708-824-0400 .. B•1372-1373
Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491 ..... A•1095
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ... B•1382-1383
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1389, C•1518
§ Wickmann USA, Inc., Wickmann-Werke GmbH, Atlanta, GA 30331, 404-699-7820 ..... B•1392-1394
§† Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§† Bussmann:Cooper Industries, St. Louis, MO 63178 314-394-2877
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§ Fuse Electric Mfg. Co. Inc., Long Island City, NY 11101 718-937-3000
U.S. Elco Inc., Santa Clara, CA 95054 ..... 1-800-888-ELCO
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Ercona, Patchogue, NY 11772 516-758-0700
§† Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
† Fuses Unlimited, D.E.I., Van Nuys, CA 91406 818-786-8111
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Gould Shawmut, Newburyport, MA 01950 ..... 508-462-6662/3131
§ International Components Corp., Melville, NY 11747 516-293-1500
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
† KRL/Bantry Components, Inc., Manchester NH 03103 603-668-3210
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Mepcopal Company, San Diego, CA 92121 619-453-0332
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487

Fuses, Failure Indicating-4300

Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... B•1352-1353
§ FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1365
§ Littelfuse, Inc., Des Plaines, IL 60016, 708-824-1188;708-824-0400 .. B•1372-1373
Oxley Inc., Stamford, CT 06905, 203-468-1830 ..... B•1025
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ... B•1382-1383
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1389
§ Wickmann USA, Inc., Wickmann-Werke GmbH, Atlanta, GA 30331, 404-699-7820 ..... B•1392-1394
§† Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§† Bussmann:Cooper Industries, St. Louis, MO 63178 314-394-2877
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
† Fuses Unlimited, D.E.I., Van Nuys, CA 91406 818-786-8111
§ Gould Shawmut, Newburyport, MA 01950 ..... 508-462-6662/3131
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556

Fuses, Fuseholders, Boxes & Panels (MIL)-2440

Connector Corp., Chicago, IL 60646, 312-539-3168 ..... C•1327
Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 ..... B•1543
§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1365
§† Littelfuse, Inc., Des Plaines, IL 60016, 708-824-1188;708-824-0400 .. B•1372-1373
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2212
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1389
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§† Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Bussmann:Cooper Industries, St. Louis, MO 63178 314-394-2877
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Doran Manufacturing Co., Cincinnati, OH 45225 513-681-5424
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
§ Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
§ International Components Corp., Melville, NY 11747 516-293-1500
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§† Keystone Electronics Corp., Astoria, NY 11105-2017 718-956-8900
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487

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§ Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... B•1352-1353
§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1365
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ..... B•1382-1383, C•1486
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1389, C•1518-1519
§ Wickmann USA, Inc., Wickmann-Werke GmbH, Atlanta, GA 30331, 404-699-7820 ..... B•1392-1394
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§† Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§† Bussmann:Cooper Industries, St. Louis, MO 63178 314-394-2877
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Ercona, Patchogue, NY 11772 516-758-0700
§ Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
Fuses Unlimited, D.E.I., Van Nuys, CA 91406 818-786-8111
Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500

Fuses, Thermal-4300

Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1840
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... B•1352-1353
§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1365
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1850-1851
Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491 ..... A•1095
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 ..... B•1391
§ Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§† Bussmann:Cooper Industries, St. Louis, MO 63178 314-394-2877
§ Chatham Controls, Chatham, NJ 07928 201-635-8892
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
† Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
Keloma/Rodan Division, Anaheim, CA 92806 714-630-0081
KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Optrox/Saton, Torrance, CA 90503 213-214-1791
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Thermik Corp., Thermik Sensor Technics, GmbH, New Bern, NC 28562 919-636-5720
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538 419-525-8450
Western Electn. Comps. Corp., Camarillo, CA 93010 805-482-8002

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§ Data Instruments, Inc., Acton, MA 01720, 508-264-9550 ..... B•1891
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 ... B•1892-1893
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1854-1855,1945-1946, C•1799, D•1307,1368-1369
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
BLH Electronics, Inc., Canton, MA 02021-9111 617-821-2000
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
HBM, Inc., Marlboro, MA 01752 508-624-4500
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
§† Kistler-Morse, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
Measurements Group, Inc., Raleigh, NC 27611 919-365-3800
§ Newport Electronics, Santa Ana, CA 92704-4426 ..... 714-540-4914;800-NEWPORT
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
Sensor Developments Inc., Lake Orion, MI 48361 313-391-3000
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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Gearheads & Speed Reducers - Also see gears and gear mechanisms-3500

† Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1254
† Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017, 314-532-3505 ..... C•1623
§ Jan Hardware Mfg. Co., Melville, NY 11747, 718-361-0800 ..... C•1587
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1300-1301,1920, D•2243
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312
§† Berg, W. M., Inc., East Rockaway, NY 11518 516-599-5010
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089 708-215-9600
Canon U.S.A., Electrn. Comps. Div., Lake Success, NY 11042 516-488-6700
§ Electrol Co., York, PA 17405 717-848-1722
§ Empire Magnetics, Rohnert Park, CA 94928 707-584-2801
Escap Products, Hauppauge, NY 11788 516-234-3900
§† Globe Motors, Dayton, OH 45404 513-228-3171
† H D Systems, Inc., Hauppauge, NY 11788 516-231-6630
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
Infranor, Naugatuck, CT 06770 ..... 203-729-8258;800-BE-SERVO
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614

† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB 0264-324155
§† PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
§† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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Generator Groups (MIL), Signal-2440

† Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800

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Generators, Function-2900 — *See Vol. D*

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† American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100 ..... B•1876-1877
† Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ..... B•1882, D•1130
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cryomagnetics, Inc., Oak Ridge, TN 37830 615-482-9551
Dowty RFL Inds. Inc./Instrumentation Div., The Dowty Grp. PLC, Boonton, NJ 07005-0239 201-334-3100
Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
LDJ Incorporated, Troy, MI 48099-0219 313-528-2202
Magnetic Instrumentation, Indianapolis, IN 46226 317-545-2102
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Walker Scientific, Worcester, MA 01606 ... 508-852-3674;508-853-3232;800-962-4638

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§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
† Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571 ..... C•1404-1405
U.S. Terminals Inc., Cincinnati, OH 45243, 513-561-8145 ..... C•1563
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
Autosplice, Inc., San Diego, CA 92121 619-535-0077
Autoswage Products, Shelton, CT 06484 203-929-1401
§† Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000

§† ITT Cannon, Santa Ana, CA 92705-5684 714-557-4700
§ Lyn-Tron, Inc., Burbank, CA 91505 ..... 213-849-6211;800-423-2734

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† RDI Elctrns., Inc., New Rochelle, NY 10801, 914-632-7274 ..... D•1057
Accusonic Systems Corp., A DSG Company, New Hyde Park, NY 11040 516-328-3300
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
† Roanwell, New York, NY 10014 212-989-1090
† Shogyo International Corp., Great Neck NY 11021 516-466-0911

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Heaters, Display-5300

Minco Products, Minneapolis, MN 55432 612-571-3121

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§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 .. B•1851
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1346, D•1369
Ajax Magnethermic Corp., Warren, OH 44482 216-372-8511
† Blue M, A Unit of General Signal, Blue Island, IL 60406 708-385-9000
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
§† Casso-Solar, Pomona, NY 10970 914-354-2500
Cogebi, Inc., Dover, NH 03820 603-749-6896
† DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
§† Despatch Industries, Minneapolis, MN 55418 612-781-5363
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-574-5400
† Electrofilm, Valencia, CA 91355 805-257-2240
† Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
Eraser Co., Syracuse, NY 13221 315-454-3237
§ GTE Sylvania, Emissive Products/Process Heat, Exeter, NH 03833 603-772-4331
§ Hoffman Engineering, Anoka, MN 55303 612-421-2240
Kelema/Rodan Division, Anaheim, CA 92806 714-630-0081
† Minco Products, Minneapolis, MN 55432 612-571-3121
† Molecu-Wire, Farmingdale, NJ 07727 201-938-9473
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
† OAL Associates, Inc., Escondido, CA 92033 619-743-7143
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640
Ogden Manufacturing Co., Arlington Heights, IL 60005 708-593-8050
§ Pamran Inc., Racine, WI 53404 414-637-7999
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Thermolab, Van Nuys, CA 91405 818-787-4084
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
† Trent, Inc., Philadelphia, PA 19127 215-482-5000

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§† Casso-Solar, Pomona, NY 10970 914-354-2500
† Glenro, Inc., Paterson, NJ 07501-1715 ..... 201-279-5900;800-922-0106
§ GTE Sylvania, Emissive Products/Process Heat, Exeter, NH 03833 603-772-4331
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640
Ogden Manufacturing Co., Arlington Heights, IL 60005 708-593-8050
Omega Engineering, Stamford, CT 06907 800-826-6342
§† Remtek Corporation, Fremont, CA 94538 415-490-3999
§ S. F. Products Corporation, Chester, NJ 07930 201-271-4009

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§† AAVID Engineering, Inc., Laconia, NH 03247-0400, 603-528-3400 ..... C•1604
Bergquist, Minneapolis, MN 55435, 800-347-4572 ..... C•1670,1672-1673
§† EG & G Wakefield Engineering, Wakefield, MA 01880, 617-245-5900 ..... C•1614
Extrusion Technology, Inc., Randolph, MA 02368, 617-963-7200 ..... C•1051
† Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1127
† Thermacore Inc., Lancaster, PA 17601, 717-569-6551 ..... C•1666
§† Thermalloy, Inc., Dallas, TX 75381-0839, 214-243-4321 ..... C•1667
§† Calmark Corp., San Gabriel, CA 91776 818-287-0451
Delbert Blinn Co., Pomona, CA 91769 714-629-3900
Dow Corning Corp., Midland, MI 48686-0994 517-496-4000
§† IERC, Burbank, CA 91502 213-849-2481
§ Mann, Henry, Inc., Huntingdon Valley, PA 19006 215-355-7200
† M P C, Santa Ana, CA 92704 714-775-0211
† Noren Products Inc., Menlo Pk., CA 94025 415-322-9500
Precision Extrusions, Inc., Bensenville, IL 60106 708-766-0340
† Products Engrg. Corp., Azusa, CA 91702 818-969-5879
† Star-Tron Corporation, Providence, RI 02909 401-274-5090
Unitrack Industries, Inc., West Chester, PA 19380 215-692-0800

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† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Republic Electronics Co., Hauppauge, NY 11788 516-273-9800
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500

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Imagers, Charge-Coupled Devices-3700

Dalsa Inc., Waterloo, Ont., CANADA N2V 2E9 519-886-6000
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Hamamatsu Photonic Systems Corp., Industrial Video, Wakefield, MA 01880 617-245-6100
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611
Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000

Imagers, Charge-Injection Devices-3700

CIDTEC (CID Technologies Inc.), Liverpool, NY 13088 315-451-9410

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Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564 ..... **B•1272-1273**
Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635, 602-459-1150 ..... **B•1280-1282**
§ **Superior Electric, Bristol, CT 06010, 203-582-9561** ..... **B•1315**
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 .. 707-584-7558
§ Daedal, Harrison City, PA 15636 412-744-4451
Design Components, Inc., Franklin, MA 02038 ..... 508-528-7300;800-341-4811
§ Electronic Counters & Controls, Inc., LFE Corp., Libertyville, IL 60048 ..... 708-362-8910; 800-422-3224
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
§ Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
§ ServoByte Inc., Millbury, MA 01527 508-865-0225

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† **BEI Motion Systems Company, Digital Products Div., Little Rock, AR 72203, 501-851-4000** ..... **B•1879**
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 ..... **B•1879**
BEI Motion Systems Company, Itek Encoder Div., Needham Hgts., MA 02194, 617-455-1414 ..... **B•1879-1881**
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... **B•1879**
† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300** ..... **D•1151**
† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510** ..... **D•1152,1155, 1157**
† **Interface Engineering Inc., Holbrook, MA 02343, 617-986-2600** ..... **D•1182-1183**
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... **B•1947**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100** ..... **D•1196,1199**
U. S. Digital Corp., Vancouver, WA 98665, 206-576-0514;800-736-0194 (Sales) ..... **B•1952-1955**
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... **B•1031**
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Astrosystems, Lake Success, NY 11042 516-328-1600
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
C-Tek Inc., Wakefield, MA 01880 617-246-1720
§ Daedal, Harrison City, PA 15636 412-744-4451
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
† Electric Tachometer, Philadelphia, PA 19142 215-726-7723
§ Electronic Counters & Controls, Inc., LFE Corp., Libertyville, IL 60048 ..... 708-362-8910; 800-422-3224
† HH Controls Co., Inc., Arlington, MA 02174 617-646-2626
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† Magtech Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581
§† Meco Industries, Mechanical Engraving Co., Inc., Bronx, NY 10470 212-324-4455
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB 0264-324155
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
† North Atlantic Industries, Hauppauge, NY 11788 516-582-6500
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Teledyne Gurley, Troy, NY 12181 ..... 518-272-6300;800-759-1844
Trans-Tek, Ellington, CT 06029 203-872-8351
§† Veeder-Root, Simsbury, CT 06070-2003 203-651-2700
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116 215-464-9300
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

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† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300** ..... **D•1151**
Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ..... **D•1152**
† **Interface Engineering Inc., Holbrook, MA 02343, 617-986-2600** ..... **D•1182-1183**
Astrosystems, Lake Success, NY 11042 516-328-1600
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
C-Tek Inc., Wakefield, MA 01880 617-246-1720
† GAP Instrument Corp., Hauppauge, NY 11788 516-273-0909
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
Jewell Electrical Instruments, Manchester, NH 03103 603-669-6400
† Magtech Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581
§† Meco Industries, Mechanical Engraving Co., Inc., Bronx, NY 10470 212-324-4455
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
North Atlantic Industries, Hauppauge, NY 11788 516-582-6500
Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
§† Veeder-Root, Simsbury, CT 06070-2003 203-651-2700
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116 215-464-9300

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§ **CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518** ..... **A•2194**
§† **Data Display Products, El Segundo, CA 90245-4630, 213-640-0442;800-421-6815** ..... **B•1142-1144**
Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 ..... **B•1145-1150**
§† **Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180** ..... **B•1686**
§† **FiC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594** ..... **B•1365**
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§ **Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989** ..... **B•1166-1167**
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† **Mineico Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261** .. **B•1178**
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§† C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
Computer Doctors, College Park, MD 20740 ..... 1-800-RAM-STAR;301-474-3095
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
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† Magtech Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581
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† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
§ Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 03-3471-8548
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
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† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
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§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700
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§ Chessell Corp., Newtown, PA 18940 215-968-0660
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
† Dixson, Inc., Grand Junction, CO 81503 303-244-1241
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§† Hickok Electrical Instrument Company, Cleveland, OH 44108 216-541-8060
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
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§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722 516-234-3800
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
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† Atec, Inc., Houston, TX 77055 713-468-7971
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§ Biddle Instruments, Blue Bell, PA 19422 215-646-9200
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Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
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† Dixson, Inc., Grand Junction, CO 81503 303-244-1241
§ Dynapar, Gurnee, IL 60031 312-662-2666
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§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
§ LFE Instruments, Clinton, MA 01510-3099 508-835-1000
Mag-Con, St. Paul, MN 55113 612-633-8820
Metrix Instrument Co., Houston, TX 77043 713-461-2131
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390; 800-999-3390
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† Stemco Instruments, Colt Industries, Longview, TX 75607 214-643-3236
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† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440
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† **Rustrak Instruments, Mark IV Company, E. Greenwich, RI 02818, 401-884-6800;800-332-3202 ..... D•1423**
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§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Acurex Corp./Autodata Div., Mountain View, CA 94039 415-967-9100
† Atec, Inc., Houston, TX 77055 713-468-7971
§ Athena Controls, Inc., Plymouth Meeting, PA 19462 215-828-2490
§† Bailey Controls Co., Wickliffe, OH 44092 216-585-8500
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§ Chessell Corp., Newtown, PA 18940 215-968-0660
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§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ EDL, Inc., Danville, VA 24540 ..... 804-799-0807;1-800-DIAL EDL
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-574-5400
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 800-422-4342
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
§† Fenwal Electronics, Inc./APD, Milford, MA 01757 508-478-6000
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Fuji Electric Corp. of America, Los Angeles, CA 90071 213-622-4490
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† Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
† Howell Instruments, Ft. Worth, TX 76107 817-336-7411
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† Transicoil Inc., Penn Airborne Products, Southampton, PA 18966 215-355-3400
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§ CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026 314-343-8518
Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000

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† Astro International Corp., League City, TX 77573 713-332-2484
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§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
§† Casso-Solar, Pomona, NY 10970 914-354-2500
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
† Diversified Optical Products, Inc., Salem, NH 03079 603-898-1880
§ EDL, Inc., Danville, VA 24540 ..... 804-799-0807;1-800-DIAL EDL
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
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§ Everest Interscience, Inc., Fullerton, CA 92634-3640 800-422-4342
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† Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717
† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
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§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
Dubbeldee Harris Diamond Corp.:D. Drukker & Zn. N.V., Mt. Arlington, NJ 07856 201-770-1420
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
† INTELCO, Acton, MA 01720 508-264-4485
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
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† Galileo Electro-Optics Corp., Sturbridge, MA 01566 508-347-9191
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Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† INTELCO, Acton, MA 01720 508-264-4485
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MetriCor, Inc., Woodinville, WA 98072 206-483-5577
Olympus Corporation, Industrial Fiberoptics Division, Lake Success, NY 11042-1179 516-488-3880
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
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Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
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† EEV Inc., Elmsford, NY 10523 914-592-6050
ElectroPhysics Corp., Nutley, NJ 07110 201-667-0170
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141

Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
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Engineered Assemblies & Components Corp., Teterboro, NJ 07606 ..... 201-288-4477; 800-447-5639
§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
† Square D Co., Palatine, IL 60067 708-397-2600

Interrupters, Optoelectronic-3700

NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1327
§† **Optek Technology Inc., Carrollton, TX 75006, 214-323-2200** ..... B•1333
§ **Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500** ..... B•1339,1581
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611

Interrupters, Photo-3700

NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1325-1326,1330-1332
§ **Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500** ..... B•1581
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707

Interrupters, Power-4300

E-T-A Circuit Breakers, Chicago, IL 60648, 708-647-6303 ..... B•1361-1364
Mechanical Products Inc., Jackson, MI 49204, 517-782-0391 ..... B•1378-1381
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1326
Bermar Corp., Research Triangle Park, NC 27709 919-489-4316
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4076
† Jennings, San Jose, CA 95122-2636 408-292-4025
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
§ Schaffner EMC, Inc. Instr. Div., Union, NJ 07083 ..... 908-851-0644;800-367-5566
Schurter, Inc., Petaluma, CA 94952 707-778-6311

Interrupters, Vacuum-4300

† Jennings, San Jose, CA 95122-2696 408-292-4025
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621

Intervalometers — See Timers (Vol. D)

Inverters, DC to AC — See Power Supplies, AC Output (Vol. D)

Inverters (MIL), DC to AC-2440

† **Avionic Instruments, Avenel, NJ 07001, 908-382-7100** ..... D•2160,2162-2165
Endicott Research Group, Endicott, NY 13760, 607-754-9187 ..... D•1741
Interelectronics Corp., Congers, NY 10920, 914-EL8-8000 ..... D•1797
KGS Electronics, Inc., Pasadena, CA 91103, 818-798-0766 ..... D•2219
American Monarch, Minneapolis, MN 55421 612-788-9161
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
† Fisher-Baker Corp., Fort Pierce, FLA 34957 407-466-0750
† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766 603-448-3444
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
† MagneTek Defense Systems, MagneTek, Inc., Anaheim, CA 92805 714-956-9200
Tripp-Lite, Chicago, IL 60610-4188 312-329-1777

Ion, Implanter, medium current-4100 — *See Vol. D*

Isolators, Antenna-1200 — *See Vol. D*

Isolators, Ferrite-3450 — *See Vol. A*

Isolators, High Voltage-4050 — *See Vol. D*

Isolators, Line-4050 — *See Vol. D*

Isolators, Microwave (All Types)-3450 — *See Vol. A*

Isolators, Multi-channel-1900 — *See Vol. D*

Isolators, Optoelectronic-3700

§ **EG & G Vactec, St. Louis, MO 63132, 314-423-4900** ..... B•1319
Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... B•1095
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2212
§ **NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000** ..... B•1100,1325-1329
§ **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691** ..... A•2118
§ **Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500** ..... B•1339
Sitenex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1345
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8491
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
BT & D Technologies, Wilmington, DE 19803 302-479-0300
† Dionics, Westbury, NY 11590 516-997-7474
Dymec Inc., Winchester, MA 01890 617-729-7870
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
Grayhill Inc., La Grange, IL 60525 708-354-1040
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
§ Marktech International Corp., Latham, NY 12110 518-786-6591
Micropac Inds., Inc., Garland, TX 75040 214-272-3571
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Namiki, Precision of America, Inc., Rochelle Park, NJ 07662 201-368-0123
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
Opto 22, Huntington Bch., CA 92649 714-891-5861
† Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
§† Quality Technologies, Palo Alto, CA 94304 415-493-0400
§† Raytheon Co., Quincy, MA 02169 617-479-5300
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611
§ Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397

Isolators, Signal (I, V,)-1900 — *See Vol. D*

Isolators, Source — See Isolators, Line (Vol. D)

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Jack Panel Assemblies & Access. — See Panels, Jack (Vol. C)

Jacks (All Types)-2100 — *See Vol. C*

Jacks, Modular Telephones-2100 — *See Vol. C*

Jacks (MIL)-2440

† **ADC Telecommunications, Inc., Minneapolis, MN 55435, 612-835-6800** ..... C•1157-1159
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
§ **Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571** ..... C•1325
Jolo Industries, Inc., Garden Grove, CA 92643, 714-554-6840 ..... C•1409
§ **Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700** ..... C•1539,1541
U.S. Terminals Inc., Cincinnati, OH 45243, 513-561-8145 ..... C•1563
Accessories For Electronics, Inc., Baldwin, NY 11510-3593 516-546-1751
† Accurate Electronics Corp., Elyria, OH 44036 ..... 216-366-6330;1-800-325-8979
† Andon Elctrns. Corp., Lincoln, RI 02865 401-333-0388
Autoswage Products, Shelton, CT 06484 203-929-1401
† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 708-455-8830
† Direct Sound Corporation, New York, NY 10011 212-691-9050
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Keystone Electronics Corp., Astoria, NY 11105-2017 718-956-8900
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101 617-890-4750
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047 818-707-2020

Jammers (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Jamming Systems (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† E-Systems, Greenville Div., Greenville, TX 75403-6056 903-455-3450
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751 ..... B•1218-1220,1222
Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060 703-552-2111

Joints, Rotary, Microwave-3450 — *See Vol. A*

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Joysticks, Inductive-2200 — *See Vol. D*

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Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000 ..... B•1795
† Cortron Inc., Methuen, MA 01844, 508-975-5445 ..... B•1803
§ DataLux Corp., Winchester, VA 22601, 703-662-1500 ..... B•1804
Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1805
Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... B•1807
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... B•1809
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1815
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1818-1819
Lucas Duralith Corporation, Millville, NJ 08332, 609-825-6900 ..... B•1822
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ..... B•1826
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000 ..... B•1828-1829
Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1787
Veetronix,.Inc., Lexington, NE 68850, 308-324-4600 ..... B•1790
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§# Arkay Engravers, Inc., Ronkonkoma, NY 11779 516-467-7795
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
Control Displays, Inc., Colmar, PA 18915 215-822-3383
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403 ..... 612-375-9639;800-677-8719
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
§ Mantex Corp., Oxford, MI 48371 313-628-8210
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
MOLEX, Inc., Lisle, IL 60532 708-969-4550
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332
Plasticorp, Harbor City, CA 90710 213-539-9530

Keyboards, Address Encoded-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000 ..... B•1795
† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1796-1797
† Cortron Inc., Methuen, MA 01844, 508-975-5445 ..... B•1803
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... B•1807
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... B•1809
IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ..... B•1826
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000 ..... B•1828-1829
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 708-662-9200
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ Mantex Corp., Oxford, MI 48371 313-628-8210
MGR Industries Inc., Ft. Collins, CO 80524 303-221-2201
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
† SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Vetra Systems Corp., Plainview, NY 11803 516-454-6469

Keyboards, Capacitive-5150

† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1797
Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1805
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800

Keyboards, Conductive Rubber-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000 ..... B•1795
† Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ..... B•1073
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... B•1807
Glolite Sales Ltd/Glowlite Div., Pauls Valley, OK 73075, 405-238-5541;800-654-3662 ..... B•1811
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088,1814
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1815
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1818-1819
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ..... B•1825
Shin-Etsu Polymer America, Inc., Union City, CA 94587, 415-475-9000 .. C•1521
Advanced Connector Technology, Ventura, CA 93001 805-653-5753
† AME Corporation, Towaco, NJ 07082-0195 201-263-1700
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
Conductive Rubber Technology, Inc., Bothell, WA 98021 206-486-8559
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
MGR Industries Inc., Ft. Collins, CO 80524 303-221-2201
Paneltec, Santa Clara, CA 95054 408-496-1175
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
West Electronic Sales Team, Westminster, CA 92683 .... 714-898-0120;213-495-5569

Keyboards, Ferrite Core-5150

† Cortron Inc., Methuen, MA 01844, 508-975-5445 ..... B•1803
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
KMS Advanced Products, Inc., Ann Arbor, MI 48106-1868 313-769-1780

Keyboards, Full Travel-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000 ..... B•1795
† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1797
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1802
CTI Electronics, Stratford, CT 06497, 203-386-9779 ..... D•1085
§ DataLux Corp., Winchester, VA 22601, 703-662-1500 ..... B•1804
§† Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1805
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... B•1807
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135, 408-922-9000 ..... B•1808
George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... B•1809
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1812-1813
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088,1814
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ..... B•1825
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000 ..... B•1827-1829
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Enterprise Systems Corp., Dover, NH 03820 603-742-7363
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Spectra Lux Corp., Kirkland, WA 98034 206-747-0560

Keyboards, Hard Contact-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000 ..... B•1795
† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1797
† Cortron Inc., Methuen, MA 01844, 508-975-5445 ..... B•1803
§ DataLux Corp., Winchester, VA 22601, 703-662-1500 ..... B•1804
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... B•1807
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... B•1809
Glolite Sales Ltd/Glowlite Div., Pauls Valley, OK 73075, 405-238-5541;800-654-3662 ..... B•1811
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1812-1813
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088,1814
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1818-1819

§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000 ..... B•1827-1829
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 708-662-9200
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450

Keyboards, Lighted-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-6000 ..... B•1795
† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1796-1797
† Cortron Inc., Methuen, MA 01844, 508-975-5445 ..... B•1803
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... B•1807
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... B•1809
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1812-1813
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1815
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1818-1819
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ..... B•1820-1821
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1824
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ..... B•1825
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ..... B•1826
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
Conductive Rubber Technology, Inc., Bothell, WA 98021 206-486-8559
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ MGR Industries Inc., Ft. Collins, CO 80524 303-221-2201
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3692;1-800-243-0240
† Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
† Stacoswitch, Costa Mesa, CA 92626 714-549-3041
§ Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400

Keyboards, Low Profile-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-6000 ..... B•1795
† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1796-1797
† Cortron Inc., Methuen, MA 01844, 508-975-5445 ..... B•1803
§† Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ..... B•1805
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... B•1807
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135, 408-922-9000 ..... B•1808
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... B•1809
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1812-1813
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088, 1814
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1815
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0446 ..... B•1820-1821
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1824
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ..... B•1825
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ..... B•1826
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2579, 708-438-4000 ..... B•1827-1828
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 708-662-9200
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
† GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ MGR Industries Inc., Ft. Collins, CO 80524 303-221-2201
§ NMB Technologies, Chatsworth, CA 91311 818-341-3355
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
† Stacoswitch, Costa Mesa, CA 92626 714-549-3041
§ Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
§ Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400

Keyboards, Membrane-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-6000 ..... B•1795
Bergquist, Minneapolis, MN 55435, 800-347-4572 ..... B•1800-1801
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1802
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... B•1807
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135, 408-922-9000 ..... B•1808
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088, 1814
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1815
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1818
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ..... B•1820-1821
Lucas Duralith Corporation, Millville, NJ 08332, 609-825-6900 ..... B•1822
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1824
PacTec, LaFrance Corp., Philadelphia, PA 19153, 215-365-8400 ..... C•1075
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000 ..... B•1827-1828
Shin-Etsu Polymer America, Inc., Union City, CA 94587, 415-475-9000 .. C•1521
A E G Corporation, Somerville, NJ 08876-1269 908-231-9491
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
† C.A.M. Graphics Co., Inc., Amityville, NY 11701 516-842-3400
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6600
Conductive Rubber Technology, Inc., Bothell, WA 98021 206-486-8559
DOW SWITCH, Wilmington, MA 01887 617-935-6395
Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Endicott Research Group, Endicott, NY 13760 607-754-9187
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
† GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
GTI/Circuits Div., Leesburg, IN 46538 219-453-3261
The Hall Company, Urbana, OH 43078 513-652-1376
† Hallmark Technologies, Mt. Dora, FL 32757 300-874-9063
HMW Enterprises, Inc., Etters, PA 17319 717-938-4691
Industrial Computer Source, San Diego, CA 92111 619-279-0084
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Mantex Corp., Oxford, MI 48371 313-628-8210
Methode Electronics, Inc., Chicago, IL 60656 708-867-9600
§ MGR Industries Inc., Ft. Collins, CO 80524 303-221-2201
§† Miller Dial Corp., El Monte, CA 91731 818-444-4555
§ MOLEX, Inc., Lisle, IL 60532 708-969-4550
Moxness Products, Inc., Verse Technologies, Racine, WI 53405 ..... 414-554-5050; 800-558-5706
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332
NMB Technologies, Chatsworth, CA 91311 818-341-3355
OMNI Switch USA Inc., Phoenix, AZ 85027 602-582-0629
Paneltec, Santa Clara, CA 95054 408-496-1175
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
† Sheldahl, Inc., Northfield, MN 55057 507-663-8000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
† Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003 ..... 214-231-6663; 214-924-3289;1-800-331-6600
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
§ Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386
West Electronic Sales Team, Westminster, CA 92683 .. 714-898-0120;213-495-5569

Keyboards, Modular-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000 ..... B•1795
† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1796-1797
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1802
† Cortron Inc., Methuen, MA 01844, 508-975-5445 ..... B•1803
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1690
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... B•1806
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... B•1807
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... B•1809
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1812-1813
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088, 1814
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 .. B•1823, C•1455
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000 ..... B•1827-1829
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366

MOLEX, Inc., Lisle, IL 60532 708-969-4550
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Vetra Systems Corp., Plainview, NY 11803 516-454-6469

Keyboards, Pad-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000 ..... **B•1795**
† Amkey, Methuen, MA 01844, 508-975-5445 ..... **B•1797**
† Cortron Inc., Methuen, MA 01844, 508-975-5445 ..... **B•1803**
§ DataLux Corp., Winchester, VA 22601, 703-662-1500 ..... **B•1804**
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... **B•1692**
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... **B•1806**
† Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ..... **B•1073**
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... **B•1807**
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... **B•1809**
Glolite Sales Ltd/Glowlite Div., Pauls Valley, OK 73075, 405-238-5541;800-654-3662 ..... **B•1811**
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... **B•1812-1813**
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... **B•1088,1814**
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... **B•1824**
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ..... **B•1825**
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ..... **B•1826**
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000 ..... **B•1827-1828**
§ AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 708-662-9200
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
§ Digitran Division, Xcel Corporation, Ontario, CA 91761 714-391-4321
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ Mantex Corp., Oxford, MI 48371 313-628-8210
§ MGR Industries Inc., Ft. Collins, CO 80524 303-221-2201
MOLEX, Inc., Lisle, IL 60532 708-969-4550
NMB Technologies, Chatsworth, CA 91311 818-341-3355
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000

Keyboards, Photo-optical-5150

§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525

Keyboards, Programmable-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000 ..... **B•1795**
† Amkey, Methuen, MA 01844, 508-975-5445 ..... **B•1797**
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... **B•1802**
† Cortron Inc., Methuen, MA 01844, 508-975-5445 ..... **B•1803**
§ AFE Displays Inc., Charlottesville, VA 22901 804-974-7801
† Aydin Corp., Horsham, PA 19044 215-657-7510
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
† Da-Tech Corp., Ivyland, PA 18974 215-322-9410
HMW Enterprises, Inc., Etters, PA 17319 717-938-4691
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Mors Technologies Inc., Mors Group-France, Delson, Quebec, CANADA J0L 1G0 514-638-4150
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
Vetra Systems Corp., Plainview, NY 11803 516-454-6469
VG Controls, Inc., Hewitt, NJ 07421 201-853-4600

Keyboards, Reed-5150

† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... **B•1656**
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... **B•1809**
† Da-Tech Corp., Ivyland, PA 18974 215-322-9410

Keyboards, Solid State-5150

† Amkey, Methuen, MA 01844, 508-975-5445 ..... **B•1797**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... **B•1802**
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491

Keyboards, Wireless-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000 ..... **B•1795**
Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ..... **B•1805**
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332

Keyboards & Keypads (MIL)-2440

† Amkey, Methuen, MA 01844, 508-975-5445 ..... **B•1797**
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... **B•1656**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... **B•1802**
§† Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ..... **B•1805**
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... **B•1807**
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135, 408-922-9000 ..... **B•1808**
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... **B•1809**
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... **B•1088,1814**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... **B•1815**
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... **B•1818-1819**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 ..... **B•1823**
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ..... **B•1825**
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ..... **B•1826**
Advanced Connector Technology, Ventura, CA 93001 805-653-5753
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
Conductive Rubber Technology, Inc., Bothell, WA 98021 206-486-8559
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
† GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
Industrial Computer Source, San Diego, CA 92111 619-279-0084
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
Mesa Technology Corp., Columbia, MD 21046 800-888-0567
§ MGR Industries Inc., Ft. Collins, CO 80524 303-221-2201
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
† Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400

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Keypads-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000 ..... **B•1795**
American Magnetics Corporation, Group 4, Carson, CA 90745, 213-775-8651 ..... **D•1079**
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... **B•1654**
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... **B•1802**
§ Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ..... **B•1805**
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... **B•1689-1690,1692**
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ..... **B•1807**
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... **B•1809**
Glolite Sales Ltd/Glowlite Div., Pauls Valley, OK 73075, 405-238-5541;800-654-3662 ..... **B•1811**
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... **B•1812-1813**
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... **B•1088,1814**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... **B•1815**
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 ..... **B•1817**
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... **B•1818-1819**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 ..... **B•1823**
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ..... **B•1825**
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000 ..... **B•1827-1828**
Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... **B•1787**
 # Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... **B•1791**
Advanced Connector Technology, Ventura, CA 93001 805-653-5753
† AME Corporation, Towaco, NJ 07082-0195 201-263-1700
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
Conductive Rubber Technology, Inc., Bothell, WA 98021 206-486-8559
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
§ DataLux Corp., Winchester, VA 22601 703-662-1500
EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Endicott Research Group, Endicott, NY 13760 607-754-9187
Industrial Computer Source, San Diego, CA 92111 619-279-0084
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Mantex Corp., Oxford, MI 48371 313-628-8210
Memtron Technologies, Inc., Frankenmuth, MI 48734 ..... 517-652-2656;800-234-7525
MOLEX, Inc., Lisle, IL 60532 708-969-4550
Moxness Products, Inc., Versa Technologies, Racine, WI 53405 ..... 414-554-5050; 800-558-5706
OMNI Switch USA, Inc., Phoenix, AZ 85027 602-582-0629
Plasticorp, Harbor City, CA 90710 213-539-9530
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
§ Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450

§ Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
Vetra Systems Corp., Plainview, NY 11803 516-454-6469
VG Controls, Inc., Hewitt, NJ 07421 201-853-4600

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Kits, Connector-2100 — *See Vol. C*

Kits, Enclosure Prototyping-1400 — *See Vol. C*

Kits, Fiber Optic-2475

§ AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
† Daniels Manufacturing Corp., Orlando, FL 32824, 407-855-6161 ..... C•1703
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
# Clifford of Vermont, Inc., Bethel, VT 05032 ..... 802-234-9921;800-451-4381
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§ Contact East, N. Andover, MA 01845 508-682-2000
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
Engineered Assemblies & Components Corp., Telerboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4637
† INTELCO, Acton, MA 01720 508-264-4485
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
§ Thomas & Betts Corporation, Electronics Div., Greenville, SC 29616-2401 803-676-2900

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Kits, Printed Circuit-1700 — *See Vol. C*

Kits, Programming Board-4200 — *See Vol. C*

Kits, Shielding-4525 — *See Vol. C*

Kits, Terminal-2100 — *See Vol. C*

Kits, Training Aid-4200 — *See Vol. C*

Knobs - Also see Dials, Instrument-2400 — *See Vol. C*

Knobs, Collet-2400 — *See Vol. C*

Knobs, Limit Stop-2400 — *See Vol. C*

Knobs, Locking, Control Shaft-2400 — *See Vol. C*

Knobs, Slip Clutch-2400 — *See Vol. C*

Knobs, Torque, Incremental, Ratio Drive-2400 — *See Vol. C*

Labels, Coatings, Crayons, Pellets, etc., Temperature Indicating-5300

§ EDL, Inc., Danville, VA 24540 ..... 804-799-0807;1-800-DIAL EDL
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-574-5400
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 800-422-4342
Omega Engineering, Stamford, CT 06907 800-826-6342
§† Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
§ Tempil Div., Big Three Inds., S. Plainfield, NJ 07080 908-757-8300

Labels, Pressure Sensitive, Adhesive-2400 — *See Vol. C*

Laboratories, Testing — See Services, Electrical Measurement & Test (Vol. D)

Lacing, Cable — See Cords & Tapes, Lacing (Vol. C)

Laminates, Clad Metal, Continuous Strip-2500 — *See Vol. C*

Laminates, Metal Clad (Including Copper)-2500 — *See Vol. C*

Laminates, Plastic Impregnated (Unclad)-2500 — *See Vol. C*

Laminates, Plastic (With Integral Heating Elements)-5300

Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-574-5400
Flexible Technologies, Arlon, E. Providence, RI 02914 401-434-2340

Lamp Adapters-2460

§† Data Display Products, El Segundo, CA 90245-4630, 213-640-0442;800-421-6815 ..... B•1142-1144
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1158,1161
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1174
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 ..... B•1182
Autoswage Products, Shelton, CT 06484 203-929-1401
Display Devices, Inc., Encinitas, CA 92023 619-753-0113
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700

Lamp Assembly Color Filters, Lens Mountable-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1141
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1166
† Lamptronix Co., Ltd., Crystal Lake, IL 60014-4443, 815-455-0400 ..... B•1173
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1174
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 ..... B•1182
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... B•1766
§ Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 .. B•1209
† AME Corporation, Towaco, NJ 07082-0195 201-263-1700
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
Engineered Assemblies & Components Corp., Telerboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Ercona, Patchogue, NY 11772 516-758-0760
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
†# Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
Lamb Industries, Inc., Portland, OR 97225 ..... 503-297-8878;800-824-9374
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
Marktech International Corp., Latham, NY 12110 518-786-6591
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Pacific Industrial Components Corp., Northridge, CA 91324 818-775-1007
Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911

Lamp Drivers-2460

† Data Display Products, El Segundo, CA 90245-4630, 213-640-0442;800-421-6815 ..... B•1142-1144
Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1166
Automation Displays Inc., Eau Claire, WI 54703 715-834-8595
IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
† Marconi Circuit Technology Corp., Farmingdale, NY 11735 516-293-3626
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§† Silicon General, Garden Grove, CA 92641 714-898-8121
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670

Lamp Holders — See Sockets, Lamp & Lamp Assemblies (Vol. B)

Lamps, Arc-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Christie Electric Corp., Gardena, CA 90248 213-715-1402
§ Control Laser Corp., Orlando, FL 32809 407-438-2500
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
§† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
UVP, Inc., San Gabriel, CA 91778 818-285-3123
Voltarc Technologies, Inc., Fairfield, CT 06430 203-255-2633
Xenon Corp., Woburn, MA 01801 617-935-3594

Lamps, Deuterium-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
Oriel Corp., Stratford, CT 06497-0872 203-377-8282

Lamps, Edge Lighting, Panel-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
§† JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ..... B•1169
Lamptronix Co., Ltd., Crystal Lake, IL 60014-4443, 815-455-0400 ..... B•1173
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
† Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-3933
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-4000
§ Micro Lamps, Inc., Batavia, IL 60510-1420 708-879-0900
§ Pacific Industrial Components Corp., Northridge, CA 91324 818-775-1007
Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240

† Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
Wamco, Inc., Fountain Valley, CA 92708 714-545-5560

Lamps, Electroluminescent-2460

Endicott Research Group, Endicott, NY 13760, 607-754-9187 ..... D•1741
Lucas Duralith Corporation, Millville, NJ 08332, 609-825-6900 ..... B•1822
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... B•1768
AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
BKL, King of Prussia, PA 19406 215-277-2910
DOW SWITCH, Wilmington, MA 01887 617-935-6395
† Durel Corporation, Affiliate of 3M & Rogers Corp., Tempe, AZ 85282 602-731-6200
E-L Products Corp., Sub.of Astronics Co., E. Aurora, NY 14052 716-655-0800
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
F-P Electronics, Mississauga, Ont., CANADA L4W 2P1 416-624-3020
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
Lamptronix Co., Ltd., Crystal Lake, IL 60014-4443 815-455-0400
† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766 603-448-3444
Optrex/Satori, Torrance, CA 90503 213-214-1791
THHC/ Lamp Division, The Home & House Center, Inc., City of Ind., CA 91748 818-965-6088
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Lamps, Exciter, Photographic-2460

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
† Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ North American Philips Lighting, Somerset, NJ 08875 201-563-3000
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Flashtube-2460

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
Lite-On Inc., Milpitas, CA 95035 408-946-4873
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Voltarc Technologies, Inc., Fairfield, CT 06430 203-255-2633
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Fluorescent-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034,1036
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1159
§ JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ..... B•1169
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1186
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Contact East, N. Andover, MA 01845 508-682-2000
Copal (USA), Inc., Torrance, CA 90501 213-618-0225
Electra-Tec, Impert Industries, Inc., Otsego, MI 49078 .... 800-225-3532;616-694-2058
† Fisher-Baker Corp., Fort Pierce, FLA 34957 407-466-0750
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§† Luxo Lamp Corp., Port Chester, NY 10573 914-937-4433
§ Mann, Henry, Inc., Huntingdon Valley, PA 19006 215-355-7200
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§ Micro Lamps, Inc., Batavia, IL 60510-1420 708-879-0900
Pacific Industrial Components Corp., See Altair Exchange Corp.
§ Pacific Industrial Components Corp., Northridge, CA 91324 818-775-1007
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Voltarc Technologies, Inc., Fairfield, CT 06430 203-255-2633
Waldmann Lighting Co., Wheeling, IL 60090 708-520-1060

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Lamps, High Intensity Discharge (HID)-2460

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Hollow Cathode-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
† Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372

Lamps, Incandescent-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1141
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1160-1162
§ Glolite Sales Ltd/Glowlite Div., Pauls Valley, OK 73075, 405-238-5541;800-654-3662 ..... B•1154
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1166-1167
§† JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ..... B•1169
Lamptronix Co., Ltd., Crystal Lake, IL 60014-4443, 815-455-0400 ..... B•1173
† Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1174
§† Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN, 03-3471-8548 ..... B•1180-1181
Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1025,1179
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 ..... B•1182
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... B•1768
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1186
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188,1190-1195
§† Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244, 603-464-5533 ..... B•1202-1207
Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 ..... B•1208-1209
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Dialight Corporation, Manasquan, NJ 08736 908-223-9400
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ Inter-Market, Glenview, IL 60025 708-729-5330
§ Jensen Tools, Inc., Axia, Inc., Phoenix, AZ 85044 602-968-6241
Lamb Industries, Inc., Portland, OR 97225 ..... 503-297-8878;800-824-9374
§ Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 612-222-2791
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
§† Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
† Lumitron, Summit, NJ 07902-0267 201-273-8998
§† Luxo Lamp Corp., Port Chester, NY 10573 914-937-4433
§ Mann, Henry, Inc., Huntingdon Valley, PA 19006 215-355-7200
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
Micro Lamps, Inc., Batavia, IL 60510-1420 708-879-0900
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Pacific Industrial Components Corp., Northridge, CA 91324 818-775-1007
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
† RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§† Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240
†# Spectrum Devices, Sugar Land, TX 77478-2420 713-242-6417
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
THHC/ Lamp Division, The Home & House Center, Inc., City of Ind., CA 91748 818-965-6088
§† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187 315-685-8945
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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Lamps, Infrared-2460

§ Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... B•1092
† Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1025,1179
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§† Casso-Solar, Pomona, NY 10970 914-354-2500
§ Contact East, N. Andover, MA 01845 508-682-2000
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
ElectroPhysics Corp., Nutley, NJ 07110 201-667-0170
E-L Products Corp., Sub.of Astronics Co., E. Aurora, NY 14052 716-655-0800
Eraser Co., Syracuse, NY 13221 315-454-3237
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ North American Philips Lighting, Somerset, NJ 08875 201-563-3000

§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
† OAL Associates, Inc., Escondido, CA 92033 619-743-7143
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
Silicon Sensors, Dodgeville, WI 53533 608-935-2707
†# Spectrum Devices, Sugar Land, TX 77478-2420 713-242-6417
Swan Associates, New Haven, CT 06534 203-387-3917
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035

Lamps, Krypton-2460

JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ..... B•1169
Lamptronix Co., Ltd., Crystal Lake, IL 60014-4443, 815-455-0400 ..... B•1173
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
THHC/ Lamp Division, The Home & House Center, Inc., City of Ind., CA 91748 818-965-6088
§ Xenon Corp., Woburn, MA 01801 617-938-3594

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Lamps, Magnifying, Inspection-4100 — See Vol. D

Lamps, Mercury Vapor-2460

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ American Ultraviolet, Murray Hill, NJ 07974 908-665-2211
Aristo Grid Lamp Prods., Roslyn, NY 11576 516-484-6141
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Carlon, A Div. of Lamson & Sessions, Cleveland, OH 44122 216-831-4000
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ North American Philips Lighting, Somerset, NJ 08875 201-563-3000
Pacific Industrial Components Corp., See Altair Exchange Corp.
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§† Spectronics Corp., Westbury, NY 11590 ..... 516-333-4840/1-800-274-8888
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
UVP, Inc., San Gabriel, CA 91778 818-285-3123
Voltarc Technologies, Inc., Fairfield, CT 06430 203-255-2633
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Nanopulse-2460

Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Neon-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
§ Arcoelectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1141
† Data Display Products, El Segundo, CA 90245-4630, 213-640-0442;800-421-6815 ..... B•1142-1144
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1159
Globite Sales Ltd/Globite Div., Pauls Valley, OK 73075, 405-238-5541;800-654-3662 ..... B•1154
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1166-1167
§† JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ..... B•1169
† Lamptronix Co., Ltd., Crystal Lake, IL 60014-4443, 815-455-0400 ..... B•1173
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1186
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ... B•1188,1192-1193,1195
§ Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244, 603-464-5533 ..... B•1203
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
§ Dialight Corporation, Manasquan, NJ 08736 908-223-9400
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
† GBC, Inc., Lamp Division, Ocean, NJ 07712 908-774-8502
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
§† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
§ Inter-Market, Glenview, IL 60025 708-729-5330
International Microelectronics, Arlington, TX 76003 817-561-2244
§† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 612-222-2791
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
Micro Lamps, Inc., Batavia, IL 60510-1420 708-879-0900
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 03-3471-8548
Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
† RDI Elctrns., Inc. New Rochelle, NY 10801 914-632-7274
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§† Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§ Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240
†# Spectrum Devices, Sugar Land, TX 77478-2420 713-242-6417
UVP, Inc., San Gabriel, CA 91778 818-285-3123
Voltarc Technologies, Inc., Fairfield, CT 06430 203-255-2633
Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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§† Data Display Products, El Segundo, CA 90245-4630, 213-640-0442;800-421-6815 ..... B•1142-1144
§ Dialight Corporation, Manasquan, NJ 08736 908-223-9400
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-6811
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
†# Spectrum Devices, Sugar Land, TX 77478-2420 713-242-6417
§ Square D Co., Palatine, IL 60067 708-397-2600

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§† Data Display Products, El Segundo, CA 90245-4630, 213-640-0442;800-421-6815 ..... B•1142-1144
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Square D Co., Palatine, IL 60067 708-397-2600

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† Lamptronix Co., Ltd., Crystal Lake, IL 60014-4443, 815-455-0400 ..... B•1173
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Christie Electric Corp., Gardena, CA 90248 213-715-1402
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
§ Ercona, Patchogue, NY 11772 516-758-0700
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
§ Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
§† ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
Lamb Industries, Inc., Portland, OR 97225 ..... 503-297-8878;800-824-9374
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ North American Philips Lighting, Somerset, NJ 08875 201-563-3000
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828

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Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 ..... B•1182
Alpha-M Corp., Dallas, TX 75229 214-406-0424
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
§ Stoelting Co., Wood Dale, IL 60191 708-860-9700
Xenon Corp., Woburn, MA 01801 617-938-3594

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† NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072, 716-773-7634 ..... D•2238

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Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1162-1163
§ JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ..... B•1169
Lamptronix Co., Ltd., Crystal Lake, IL 60014-4443, 815-455-0400 ..... B•1173
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§† Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244, 603-464-5533 ..... B•1202
American Ultraviolet, Murray Hill, NJ 07974 908-665-2211
AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Micro Lamps, Inc., Batavia, IL 60510-1420 708-879-0900
§ North American Philips Lighting, Somerset, NJ 08875 201-563-3000
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Pacific Industrial Components Corp., Northridge, CA 91324 818-775-1007
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828

Waldmann Lighting Co., Wheeling, IL 60090 708-520-1060
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187 315-685-8945

Lamps, Ultraviolet-2460

† **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019** ..... **B•1169**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **B•1187**
§ American Ultraviolet, Murray Hill, NJ 07974 908-665-2211
Aristo Grid Lamp Prods., Roslyn, NY 11576 516-484-6141
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
† Clean Room Prods., Ronkonkoma, NY 11779-6528 516-588-7000
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Divelbiss Corp., Fredericktown, OH 43019 614-694-9015
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
Hamamatsu Corporation, Bridgewater, NJ 08807 201-231-0960
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ Luxo Lamp Corp., Port Chester, NY 10573 914-937-4433
§† Spectronics Corp., Westbury, NY 11590 ..... 516-333-4840/1-800-274-8888
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§ UVP, Inc., San Gabriel, CA 91778 818-285-3123
Voltarc Technologies, Inc., Fairfield, CT 06430 203-255-2633
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Xenon-2460

§† **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019** ..... **B•1169**
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... **B•1186**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **B•1187**
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Christie Electric Corp., Gardena, CA 90248 213-715-1402
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
§ North American Philips Lighting, Somerset, NJ 08875 201-563-3000
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Pacific Industrial Components Corp., Northridge, CA 91324 818-775-1007
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
THHC/ Lamp Division, The Home & House Center, Inc., City of Ind., CA 91748 818-965-6088
UVP, Inc., San Gabriel, CA 91778 818-285-3123
Xenon Corp., Woburn, MA 01801 617-938-3594

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† **Oxley Inc., Branford, CT 06405, 203-488-1033** ..... **B•1335**
ACL Inc., Elk Grove, IL 60007 ..... 708-981-9212;1-800-782-8420
§ Aerotech, Inc., Pittsburgh, PA 15238 412-963-7470
† Analog Modules, Inc., Longwood, FL 32750 407-339-4355
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
BT & D Technologies, Wilmington, DE 19803 302-479-0300
Burleigh Instruments, Fishers, NY 14453 716-924-9355
Chicago Laser Systems, Inc., Chicago, IL 60634 312-282-2710
† Cleveland Crystals, Euclid, OH 44117 216-486-6100
† Coherent General, Inc., Sturbridge, MA 01566 508-347-2681
† Coherent, Inc., Palo Alto, CA 94303 415-493-2111
Computer Peripherals Inc., Newbury Pk, CA 91320 ..... 805-499-5751;800-854-7600
† Control Laser Corp., Orlando, FL 32809 407-438-2500
† Diversified Optical Products, Inc., Salem, NH 03079 603-898-1880
† D. O. Industries, Rochester, NY 14623 716-359-4000
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
† EG&G, Inc., Electronics Components Div., Salem, MA 01970 508-745-3200
ElectroPhysics Corp., Nutley, NJ 07110 201-667-0170
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 619-931-3000
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
† Kontes, Kimble Div. of Owens/IL, Vineland, NJ 08360 800-223-7150
§† Laser Concepts, Omega Organization Intl., Seattle, WA 98133 206-364-7881
Lincoln Laser Co., Phoenix, AZ 85004 602-257-0407
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
3M Photodyne Products, Dynatel Systerms Division, Camarillo, CA 93010 ..... 805-388-8378;800-426-8688
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Noll, J. A. Co., Monroeville, PA 15146 412-856-7566
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Photon, Inc., Santa Clara, CA 95054-3432 408-492-9449
† Power Technology, Inc., Little Rock, AR 72219-1117 501-568-1995
Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
Quantronix, Smithtown, NY 11788 516-273-6900
Raytheon Co., Laser Products, Quincy, MA 02169 617-479-5300
§ RMF Products, Inc., Batavia, IL 60510 708-879-0020
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
Spectra-Physics Lasers Inc., Mountain View, CA 94039-7013 ..... 415-961-2550; 800-227-8054
Spiricon, Inc., Logan, UT 84321 801-753-3729
Staffall Inc., Cranston, RI 02910 401-461-5554
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Union Carbide Chemicals & Plastics Company Inc., Industrial Chemicals Div., Crystal, San Diego, CA 92123 619-279-4500
U. S. Laser Corp., Wyckoff, NJ 07481 201-848-9200
Xenon Corp., Woburn, MA 01801 617-938-3594

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Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... **B•1156-1157**
§ **Idea, Inc., Brea, CA 92621, 213-697-4332** ..... **B•1086-1087,1164**
§ **Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989** ..... **B•1166-1167**
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§ **Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020** ..... **B•1183**
§ **Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500** ..... **B•1184**
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§ **Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900** ..... **B•1208-1209**
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
§ EPD Electronics, Inc., Gardena, CA 90247 213-515-4996
§ Everlight - USA, Glendora, CA 91740 213-697-5067
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
International Microelectronics, Arlington, TX 76003 817-561-2244
§† Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
Mouser Electronics, Mansfield, TX 76063 800-346-6873
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
Soltec Corp., San Fernando, CA 91340-1597 ..... 818-365-0800;800-423-2344
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Three-Five Sys., Inc., Phoenix. AZ 85044 602-496-0035
Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386

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† **JMJ Technical Prods., Newark, NJ 07105, 201-589-4257** ..... **C•1591**
† **Oxley Inc., Branford, CT 06405, 203-488-1033** ..... **B•1025,1179**
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 ..... **B•1182**
Burleigh Instruments, Fishers, NY 14453 716-924-9355
Ceramaseal, New Lebanon, NY 12125 518-794-7800
† Cleveland Crystals, Euclid, OH 44117 216-486-6100
† Coherent, Inc., Palo Alto, CA 94303 415-493-2111
† Diversified Optical Products, Inc., Salem, NH 03079 603-898-1880
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
Dubbeldee Harris Diamond Corp.:D. Drukker & Zn. N.V., Mt. Arlington, NJ 07856 201-770-1420
† Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912

§† Ercona, Patchogue, NY 11772 516-758-0700
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ IR Scientific, Carlisle, MA 01741 508-667-7110
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
† Mark Polarized Corp., Hauppauge, NY 11788 516-273-1122
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
† Optima Precision, Inc., West Linn, OR 97068 ..... 800-544-4118;503-638-2525
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
† Plumer Precision Optics, Pennsburg, PA 18073 215-679-6272
§ RMF Products, Inc., Batavia, IL 60510 708-879-0020
† Saphikon, Inc., Milford, NH 03055 603-673-5831
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Schneider Corp. of America, Woodbury, NY 11797 516-496-8500
Schott Electronics, Seymour, CT 06483 203-881-0102
Schott Glass Technologies, Inc., Duryea, PA 18642 717-457-7485
Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003 ..... 214-231-6663; 214-924-3289;1-800-331-6600
§ Visual Communications Co., Inc., San Diego, CA 92126 619-549-6900
§ Carl Zeiss, Inc., Thornwood, NY 10594 914-747-1800

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Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1335
† Coherent, Inc., Palo Alto, CA 94303 415-493-2111
† Diversified Optical Products, Inc., Salem, NH 03079 603-898-1880
† D. O. Industries, Rochester, NY 14623 716-359-4000
† Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
§† Ercona, Patchogue, NY 11772 516-758-0700
§ General Hardware Mfg., New York, NY 10013 212-431-6100
Gordon Instruments, Inc., Orchard Park, NY 14127 ..... 716-662-5353;1-800-333-2672
Heitz, Karl, Inc., Woodside, NY 11377 718-565-0004
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
Mini-Circuits Lab., Brooklyn, NY 11235-0003 718-934-4500
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
† Plumer Precision Optics, Pennsburg, PA 18073 215-679-6272
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Schneider Corp. of America, Woodbury, NY 11797 516-496-8500
Schott Glass Technologies, Inc., Duryea, PA 18642 717-457-7485
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Stenning Instruments, Inc., Pacific Palisades, CA 90272 213-459-2930
§ Carl Zeiss, Inc., Thornwood, NY 10594 914-747-1800

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† Cut Craft, Inc., Ft. Worth, TX 76102, 817-332-6151 ..... C•1675,1688
§ Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1686-1687
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-9569 ..... B•1166
† JMJ Technical Prods., Newark, NJ 07105, 201-589-4257 ..... C•1591
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1174
† Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1179
§ RMF Products, Inc., Batavia, IL 60510, 708-879-0020 ..... C•1593
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 ..... B•1182
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188,1191-1195
§ Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 .. B•1209
§† Atlantic Optical Moulding, Webster, MA 01570 508-943-1746
† Doniech, Inc., Doylestown, PA 18901 215-348-5010
§† Ercona, Patchogue, NY 11772 516-758-0700
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
Lucas Duralith Corporation, Millville, NJ 08332 609-825-6900
† Mark Polarized Corp., Hauppauge, NY 11788 516-273-1122
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
Noll, J. A. Co., Monroeville, PA 15146 412-856-7566
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Polaroid Corporation, Polarizer Div., Norwood, MA 02062 800-225-2770
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Schneider Corp. of America, Woodbury, NY 11797 516-496-8500
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003 ..... 214-231-6663; 214-924-3289;1-800-331-6600

Lids, Hybrid Package-3130 — *See Vol. A*

Light Choppers-3700

§ BEA electro-optics, Inc., Des Plaines, IL 60016 708-298-1420
Displaytech, Inc., Boulder, CO 80301 303-449-8933
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
† Electro Optical Industries Inc., Santa Barbara, CA 93111 ..... 805-964-6701 (ext. 280)
† Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
† Millivac Instruments, Inc., Schenectady, NY 12301 518-355-8300
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040

Light Pens-2000 — *See Vol. D*

Light Sources, Fiber Optic - Also see Generators, Light Pulse-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
Anritsu, Oakland, NJ 07436, 201-337-1111;800-255-7234 ..... D•1218
Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100 ..... D•1229
§† Lamptronix Co., Ltd., Crystal Lake, IL 60014-4443, 815-455-0400 ..... B•1173
Advantest America, Inc., Lincolnshire, IL 60069 708-634-2552
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Chiu Technical Corp., Kings Park, NY 11754 516-544-0606
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
Fiberoptics Technology, Inc., Pomfret, CT 06258 ..... 203-928-0443, 800-403-5248
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
† Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§† ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
† INTELCO, Acton, MA 01720 508-264-4485
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
§ Laser Precision Corp., Utica, NY 13502 315-797-4449
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
3M Photodyne Products, Dynatel Systems Division, Camarillo, CA 93010 ..... 805-388-8378;800-426-8688
† 3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Olympus Corporation, Industrial Fiberoptics Division, Lake Success, NY 11042-1179 516-488-3880
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Ortel Corp., Alhambra, CA 91803 818-281-3636
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
Soltec Corp., San Fernando, CA 91340-1597 ..... 818-365-0800;800-423-2344
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
Volpi-MFG-USA, Auburn, NY 13021-1289 315-255-1737
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187 315-685-8945
† Xenon Corp., Woburn, MA 01801 617-938-0594
† York Technology, Inc., Burbank, CA 91502 818-955-8927

Light Sources, Infrared - Also see Generators, Light Pulse-3700

Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100 ..... D•1229
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
High Technology Sensors, Inc., Longwood, FL 32779 407-884-7722
§ IR Scientific, Carlisle, MA 01741 508-667-7110
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Ortel Corp., Alhambra, CA 91803 818-281-3636
Swan Associates, New Haven, CT 06534 203-387-3917
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

Light Sources, Photoelectric-3700

§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1319
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1320-1321
§ Altech Corp., Somerville, NJ 08876 908-707-8484
† Ametek, Inc., Mansfield & Green Div., Largo, FL 34643 813-536-7831
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
§ FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ..... 708-932-9380;800-468-6009
§ Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390; 800-999-3390
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 818-341-5151
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodann Electronics Mfg. Co., Brea, CA 92621 ..... 714-529-1301;800-366-7010
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717

Light Sources, Stroboscopic-3700

Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 ..... B•1182
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000

Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
Hughey & Phillips, Inc., Simi Valley, CA 93065 805-581-5591
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390; 800-999-3390
§ Sunshine Instruments, Philadelphia, PA 19115 ..... 215-673-5600;800-343-1199
Xenon Corp., Woburn, MA 01801 617-938-3594

Light Sources, Ultraviolet-3700

Injectorall Electronics (Woman Owned), Bohemia, NY 11716, 516-563-3388 ..... **C•1147**
† American Ultraviolet, Murray Hill, NJ 07974 908-665-2211
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ Chiu Technical Corp., Kings Park, NY 11754 516-544-0606
§ Contact East, N. Andover, MA 01845 508-682-2000
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
§ Efos Inc., Mississauga, Ont., CAN L4Z 2E8 416-568-4268
EG&G Gamma Scientific, Div. of EG&G Inc, San Diego, CA 92123 619-279-8034
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-574-5400
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§† Powertron Corp., Sparta, NJ 07871 201-579-5599
§† Spectronics Corp., Westbury, NY 11590 ..... 516-333-4840/1-800-274-8888
† Stenning Instrments, Inc., Pacific Palisades, CA 90272 213-459-2930
Swan Associates, New Haven, CT 06534 203-387-3917
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828
§ UVP, Inc., San Gabriel, CA 91778 818-285-3123
Xenon Corp., Woburn, MA 01801 617-938-3594

Lights, Indicator-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... **B•1034**
§ AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... B•1137-1138
† Data Display Products, El Segundo, CA 90245-4630, 213-640-0442;800-421-6815 ..... B•1142-1144
§† Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 ..... B•1145-1150
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1058-1064
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1686
§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1365
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1156-1163
Globite Sales Ltd/Glowlite Div., Pauls Valley, OK 73075, 405-238-5541;800-654-3662 ..... B•1154
§ Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086-1087,1164-1165
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1088
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1166-1167
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1715
§† JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ..... B•1169
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374 ..... B•1728-1729
Lamptronix Co., Ltd., Crystal Lake, IL 60014-4443, 815-455-0400 ..... B•1173
† Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1022,1174
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1178
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1747-1751
† Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1025,1179
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 ..... B•1182
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... B•1768
SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, La Mirada, CA 90638, 213-802-8425 ..... B•1114-1115
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1186
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188-1190
§ Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1787
§† Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244, 603-464-5533 ..... B•1202,1204-1207
§ Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 ..... B•1208-1209
§ Wilbrecht Electronics, St. Paul, MN 55107, 612-222-2791 ..... B•1211-1213
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
§ Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§† Audiosone, Inc., Stratford, CT 06497 203-377-4475
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ Daitron, Inc., Tigard, OR 97223 503-620-2879
Display Devices, Inc., Encinitas, CA 92023 619-753-0113
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
† Eltech, Horsham, PA 19044 215-441-0404
Entrelec Div/GEC Alsthom International, Inc., Irving, TX 75038 214-550-9025
Everlight - USA, Glendora, CA 91740 213-697-5067
Furnas Elec., Batavia, IL 60510 708-879-6000
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
§† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086 408-736-3191
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
§ Inter-Market, Glenview, IL 60025 708-729-5330
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§† Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 612-222-2791
§† Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§† Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766 603-448-3444
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
§ Merix Chemical Co., Chicago, IL 60649 312-221-8242
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Micro Lamps, Inc., Batavia, IL 60510-1420 708-879-0900
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§† OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
§ Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 03-3471-8548
§† Oslo Controls, Cheshire, CT 06410-1511 203-272-2794
Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
† Pyle-National, Inc. LPL Co., Chicago, IL 60651 ..... 312-342-6300 x210
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
§† Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
†# Spectrum Devices, Sugar Land, TX 77478-2420 713-242-6417
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700
§ Sylvania Lighting Division-U.S., Sylvania Lighting Center, Danvers, MA 01923 1-800-544-4828

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§ FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1365
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1849,1851
§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170 ..... B•1385
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 ..... B•1391
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1868
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•1153
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Burndy Corporation, An FCI Company, Norwalk, CT 06852 203-838-4444
§† Bussmann:Cooper Industries, St. Louis, MO 63178 314-394-2877
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
Mechanical Products Inc., Jackson, MI 49204 517-782-0391
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
Schurter, Inc., Petaluma, CA 94952 707-778-6311
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§ Square D Co., Palatine, IL 60067 708-397-2600
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002
Wilmington Research & Development, Topsfield, MA 01983 508-887-2501

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Magnets (MIL), Permanent-2440

† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
† Johnmaster Corp., Randallstown, MD 21133-0207 410-655-1400
† Magnet Sales & Mfg. Co. Inc., Culver City, CA 90230-6127 ..... 213-391-7213; 800-421-6692
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 308-284-4093
RJF International Corp., Fairlawn, OH 44333 216-668-7689
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100

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Meters, Coercivity-2900 — *See Vol. D*
Meters, Conductance-2900 — *See Vol. D*
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Meters, Decibel Indicating-2900 — *See Vol. D*
Meters, Deviation-2900 — *See Vol. D*
Meters, Digital ESR-2900 — *See Vol. D*
Meters, Digital RPM-2900 — *See Vol. D*
Meters, Digital, 2-wire, 4-20 mA Current Loop-2950 — *See Vol. D*
Meters, Dissolved Oxygen-2900 — *See Vol. D*
Meters, Distortion & Noise-2900 — *See Vol. D*
Meters, Edgewise-2950 — *See Vol. D*
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Meters, VAR-2900 — *See Vol. D*
Meters, Vibration-2900 — *See Vol. D*
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Meters (MIL)-2440

† Gralex Industries, Norwood, NJ 07648, 800-486-4499 ..... D•1348
International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... D•1350-1351
† International Microtronics, Tucson, AZ 85714, 602-748-7900 ..... D•1352-1357

Jobmaster Corp., Randallstown, MD 21133-0207, 410-655-1400 ..... A•1285
§† Qualitec Technologies, Inc., Fremont, CA 94538, 415-498-1046 ..... D•1313
§ Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1403
‡ RFC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Bowmar Telecommunications Div., Acton, MA 01720 508-263-8565
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
§† M.C., (International Microtronics Corp.), Tucson, AZ 85711 602-748-7920
Mercer Electronics, Simpson Electric Co., Elgin, IL 60120 708-697-2260
‡ Millivac Instruments, Inc., Schenectady, NY 12301 518-355-8900
† Photo Research/Kollmorgen, Chatsworth, CA 91312-3 818-341-5151
Simpson Electric Co., Elgin, IL 60120 708-697-2260
Telephonics Corporation/PTI Instruments, Huntington, NY 11743 ..... 516-549-6000/6420
§ Triplett Corporation, Bluffton, OH 45817-1900 419-358-5015

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† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1720-1721
Interpoint Corporation, Redmond, WA 98073-9706, 206-882-3100 ..... A•1732-1733, D•1810,1815
† Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762, 508-695-2000 ..... A•1735
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965-1967
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
† Allied-Signal Aerospace Co., Fenidx Communications Div., Towson, MD 21204 410-583-4000
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
CTS Corporation, Microelectronics business unit, W. Lafayette, IN 47906 317-463-2046
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
† Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
Intepro Systems Inc., Billerica, MA 01821 508-663-7555
Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500

Microcircuits (MIL), Linear-2440

† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4608 408-720-9737
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
† Aydin Corp., Horsham, PA 19044 215-657-7510
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
§† Silicon General, Garden Grove, CA 92641 714-896-8121
§† Teledyne Components, Mountain View, CA 94039-7237 415-968-9241
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500
† Third Domain, Inc., Tucson, AZ 85701-7562 602-290-1890

Microcircuits (MIL), Low Power Schottky-2440

Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500

Microcircuits (MIL), Memories, CMOS, Hybrids-2440

Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1720-1721
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ..... A•1730-1731
† Q-Tech Corp., Culver City, CA 90232-2510, 213-636-7900 ..... A•1445
Sunrise Electronics, Inc., Glendora, CA 91740, 818-914-1926 ..... D•1329
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
Memory X, Inc., San Diego, CA 92123 619-292-1151
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
M-Tron Industries, Yankton, SD 57078 605-665-9321
† Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† VLSI Technology, Inc., San Jose, CA 95131 408-434-7673
† White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040 602-437-1520

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Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1720-1721
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ..... A•1730-1731
Sunrise Electronics, Inc., Glendora, CA 91740, 818-914-1926 ..... D•1329
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500
† Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000

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Accusonic Systems Corp., A DSG Company, New Hyde Park, NY 11040 516-328-3300
§† Audiosonic, Inc., Stratford, CT 06497 203-377-4475
Japan Electronic Manufacturers Agency Inc., Wilmette, IL 60091 708-251-3600
§† Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200

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Microscopes-3700

§ Cambridge Instruments, Inc., Optical Systems Division, Buffalo, NY 14240 716-691-3000
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
ElectroPhysics Corp., Nutley, NJ 07110 201-667-0170
§† Excel Technology Intl. Corp., Bohemia, NJ 08502 908-874-4747
† Melles Griot, Inc., Irvine, CA 92714 714-261-5500
† Melton Optics Inc., Solana Beach, CA 92075-0690 619-755-4477
§ Pacific Transducer Corp., Los Angeles, CA 90064-1432 213-478-1134
Research Devices, Inc., Piscataway, NJ 08854 908-572-4800
§ Solder Absorbing (SAT), A Spirig Co., Springfield, MA 01108 800-628-8362
Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§† Vision Engineering, Inc., New Milford, CT 06776 203-355-3776
§ Carl Zeiss, Inc., Thornwood, NY 10594 914-747-1800

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Mirrors, Front Surface-3700

Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1335
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., Willow Grove, PA 19090 215-659-3080
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
Metron Optics Inc., Solana Beach, CA 92075-0690 619-755-4477
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
† Optima Precision, Inc., West Linn, OR 97068 ..... 800-544-4118;503-638-2525
† Plumer Precision Optics, Pennsburg, PA 18073 215-679-6272
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Swedlow, Inc., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800

Mirrors, Rear Surface-3700

Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1335

Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., Willow Grove, PA 19090 215-659-3080
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
† Optima Precision, Inc., West Linn, OR 97068 ..... 800-544-4118;503-638-2525
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Swedlow, Inc., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800

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Universal Voltronics Corp, Thermedics Inc./ThermoElctron Corp., Mt. Kisco, NY 10549, 914-241-1300 ..... D•2132-2133
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† CATEL Telecommunications, Fremont, CA 94537 415-659-8988
† Coherent, Inc., Palo Alto, CA 94303 415-493-2111
§ Data-Design Labs., Cucamonga, CA 91730 714-987-2511
RE Instruments Corp., Westlake, OH 44145 216-871-7617

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Modulators, Light-3700

NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1326
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
BT & D Technologies, Wilmington, DE 19803 302-479-0300
† Cleveland Crystals, Euclid, OH 44117 216-486-6100
§ Data-Design Labs., Cucamonga, CA 91730 714-987-2511
Displaytech, Inc., Boulder, CO 80301 303-449-8933
† Electro Optical Industries Inc., Santa Barbara, CA 93111 ..... 805-964-6701 (ext. 280)
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
† INTELCO, Acton, MA 01720 508-264-4485
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
RE Instruments Corp., Westlake, OH 44145 216-871-7617
Tektronix, Inc., Beaverton, OR 97077 800-835-9433

Modulators, Magnetic-2200 — *See Vol. D*

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Modules, Switching-5100

Advanced Systems Concepts, Inc., Altadena, CA 91001, 818-791-0983 .. D•1144
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ... B•1673
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1675
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1240
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1691
§ Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000 ..... B•1488, D•1171,1173
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1490-1491
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1529-1531,1534-1535
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1731,1915
§ Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 .. B•1608
Weidmuller Inc., Richmond, VA 23236, 804-794-2877 ..... C•1579
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089 708-215-9600
Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ duTec, Inc., Jackson, MI 49204-0964 800-248-1632
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ International Technologies, Inc., Warwick, RI 02888 401-781-5595
MarLee Switch Co., Upland, CA 91786 714-982-8988
Maxus Electronic Corp., Boulder, CO 80301 303-447-1226
Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
T-Bar Data Switch Corp., Shelton, CT 06484 203-926-1801
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136

Modules (MIL), Electronic-2440

† ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ..... D•1177
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1196
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
† Diversified Systems, Inc., Indianapolis, IN 46268 317-299-9547
KineticSystems, Lockport, IL 60441 815-838-0005
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Modular Devices, Shirley, NY 11967 516-345-3100
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
† NAVAN Corporation, Media, PA 19063 215-543-8066
§ RTS Systems, Telex Communications, Inc., Burbank, CA 91506 818-566-6700
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000
Techrand Corp. of America, Muskegon, MI 49444 616-798-2930
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831

Modules (MIL), Standard Electronic-2440

† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600** ..... **D•1177**
† **MDF Products Inc., Danbury, CT 06811, 203-743-3579** ..... **D•1293**
† Diversified Systems, Inc., Indianapolis, IN 46268 317-299-9547
† Electronic Components & Matls. Div., GTE Products Corp., Warren, PA 16365 814-723-2000
KineticSystems, Lockport, IL 60441 815-838-0005
† Koep Precision Standards, Inc., South Plainfield, NJ 07080 ..... 201-757-2220/2277
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000
Techrand Corp. of America, Muskegon, MI 49444 616-798-2900
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831

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Monitors, Humidity-2200 -- *See Vol. D*

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Monitors, Power Failure-2200 -- *See Vol. D*

Monitors, Power, Microwave-2900 -- *See Vol. D*

Monitors, Power, RF-2900 -- *See Vol. D*

Monitors, Response Time-2900 -- *See Vol. D*

Monitors, Television, Fiberoptic-2475

§ Advanced Video Products, Littleton, MA 01460 508-486-0024
§ Conrac Display Products, Inc., Duarte, CA 91010 818-303-0095
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757 ..... 516-957-8700; 800-645-5516
§† Teltron, Inc., Birdsboro, PA 19508 215-582-2711

Monitors, Temperature-Also See Controls, Temperature-5300

† Chromalox Instrs. & Controls, La Vergne, TN 37086-3536, 615-793-3600 ..... D•1121
Cossen/Texmate, Vista, CA 92083-8397, 619-598-9899 ..... D•1382
International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... D•1351
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 .. B•1851
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-8846 .. D•1358-1351
Omega Engineering, Stamford, CT 06907, 800-826-6342 ... B•1854, D•1368-1369
PPM, Inc., Cleveland, OH 44139, 216-349-3300 ..... D•1371
† Rustrak Instruments, Mark IV Company, E. Greenwich, RI 02818, 401-884-6600;800-333-3202 ..... D•1423
Sensor Scientific, Inc., Fairfield, NJ 07006, 201-227-7790;800-524-1610 ..... B•1862-1863
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1382
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1866-1869
WARREN G-V, GENERAL SIGNAL CORP., WHIPPANY, NJ 07981, 201-386-1200 ..... B•1870
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1395
ABB Kent-Taylor Inc., ASea Brown Boveri, Rochester, NY 14692 716-235-5000
Action Instruments, San Diego, CA 92123 619-279-5726
Active Control Instrumentation, Key Largo, FL 33037 305-451-1000
§ Acurex Corp./Autodata Div., Mountain View, CA 94039 415-967-9100
§ Amprobe Instrument, Core Industries, Inc., Lynbrook, NY 11563 516-593-5600
Analogic Corp., Peabody, MA 01960 508-977-3000
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
§ Beckman Industrial Corp. An Affiliate of Emerson Elec. Co., San Diego, CA 92123-1898 619-495-3200
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Burling Instruments, Inc., Chatham, NJ 07928-0298 201-635-9481
Calex Mfg. Co., Inc., Pleasant Hill, CA 94523 510-932-3911
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
† Climatronics, Bohemia, NY 11716 516-567-7300
† CML MACARR, A Marine Electric Systems Co., Clifton, NJ 07014-1135 201-471-6600
Controlex, Inc., New Boston, NH 03070 603-487-5612
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Crompton Modutec, Manchester, NH 03103 ..... [illegible] 5121;800 METERS-1
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Digital Dynamics, Inc., Scotts Valley, CA 95066 408-438-4444
† Digitec, Marion, OH 43302 614-387-3444
† Dranetz Technologies, Inc., Edison, NJ 08818-4019 908-287-3680
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
Electric Tachometer, Philadelphia, PA 19142 215-728-7722
§ Electromatic Controls Corp., Hoffman Estates, IL 60196-2016 708-882-5757
§ E-Squared Technology Corp., Ventura, CA 93005 805-644-9644
Extraline Angus Instrument Corp., Indianapolis, IN 46224 317-244-7611
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 800-422-4342
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
§ John Fluke Mfg. Co. Inc., Everett, Wa 98206 Wa 98203 206-347-6100
† FOX METER INC, Elburn, IL 60119 708-365-2422
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-6220
§† Gordon Co.,Widlow, Richmond, IL 60071 815-678-2211
Gordon Products, Brookfield, CT 06804 203-775-4501
† Hancock Electronics Corp., Hingham, MA 02043 617-740-4190
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
† Howell Instruments, Ft. Worth, TX 76107 817-336-7411
Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
§ Intra-computer, Jamaica, NY 11416 718-297-5500
§ Jewell Electrical Instruments, Manchester, NH 03103 603-669-6400
§ Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
Kotema/Rudan Division, Anaheim, CA 92806 714-630-0081
KineticSystems, Lockport, IL 60441 815-838-0005
Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
Lambert Engineering Inc., Bend, OR 97701 503-388-2625
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007 ..... 215-781-6700; 800-523-5909
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
§ Love Controls Corp., Wheeling, IL 60090 708-541-9700
Magnetic Co, Paul, MN 55113 612-333-3939
[illegible] Instruments, Inc., San Jose, CA 95131 ..... 408-[illegible]
Metrix Instrument Co., Houston, TX 77043 713-461-2131
Metrosonics, Inc., Rochester, NY 14692-3075 716-334-7300
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
Minco Products, Minneapolis, MN 55432 612-571-3121
§ Newport Electronics, Santa Ana, CA 92704-4426 ..... [illegible]
§ Non-Linear Systems/Div. of Kaypro Corp., San Diego, CA 92121 ..... [illegible]
§ Pacific Transducer Corp., Los Angeles, CA 90064-1483 ..... [illegible]
Prince Instruments, Inc., Southampton, PA 18966 ..... [illegible]
† Reico Products, Denver, CO 80237 303-756-1143
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
Serial Lab Prods., Inc., Marlboro, MA 01752 617-481-1684
§ S. F. Products Corporation, Chester, NJ 07930 201-271-4009
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400
§ Sorrel, Inc., Eden Prairie, MN 55344 ..... 612-937-8835;1-800-8-SOFREL
Solder Absorbing Technology (SAT), A Sprig Co., Springfield, MA 01105 800-628-8687
Stanford Resch. Sys., Inc., Sunnyvale, CA 94086 408-744-9040
Strawberry Tree, Inc., Sunnyvale, CA 94086 408-736-8600
§ Sunshine Instruments, Philadelphia, PA 19115 ..... 215-677-[illegible];800-345-1709
§ Superior Electric, Bristol, CT 06010 203-582-9561
† Syscon Intl., Inc. So. Bend, IN 46601-0796 219-235-3900
Technical Services Laboratory, Inc., Ft. Walton Beach, FL 32548 904-243-3732
Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
§ Tempil Div., Big Three Inds., S. Plainfield, NJ 07080 908-757-0300
§ Temptronic Corporation, Newton, MA 02158 617-965-3501
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
§ VA-Tran Systems Inc., Chula Vista, CA 91911 619-423-4555
† VirTis Co., Gardiner, NY 12525 ..... 914-255-5000; 800-431-8232
Western Electm. Comps. Corp., Camarillo, CA 93010 805-482-8002
§ Yellow Springs Instrument Co., Yellow Springs, OH 45387 ..... [illegible]
MRV LM

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Monitors (MIL), Data-2440

Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007, 708-952-8800 ..... B•1857
† **Infodex, Inc., Wolcott, CT 06716, 203-879-4944** ..... B•1016-1017,1090
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Computer Doctors, College Park, MD 20740 ..... 1-800-RAM-STAR;301-474-3095
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
Intronics, Inc., Canton, MA 02021 617-828-4992
§ Science/Electronics, Dayton, OH 45401-0986 513-859-5555
§ Sofrel, Inc., Eden Prairie, MN 55344 ..... 612-937-8835;1-800-8-SOFREL

Motor & Generator Armatures, Rotors, Stators-3500

† **Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017, 314-532-3505** ..... C•1623
† **Georator Corp., Manassas, VA 22110-0070, 800-523-9938** .... D•2195-2196,2198
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... B•1031,1318
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 805-527-0900
† Danmar Inds., Moorpark, CA 93021 1-805-529-3788,1-800-666-6268
† Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
† EEMCO, Datron, Inc., Los Angeles, CA 90039 818-247-7060
† Fabricast, S. El Monte, CA 91733 818-443-3247
§† Fibertek Inc., Franklin, TN 37065 615-794-1400
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 908-241-0710
† Globe Motors, Dayton, OH 45404 513-228-3171
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
§ Howard Industries, Inc., Milford, IL 60953 815-889-4105
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§ Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
National Lamination Co., National Material Ltd., Des Plaines, IL 60018 ... 708-298-7676
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 516-864-1000
§ Powertron, Contraves Goerz Corp., Charlotte, NC 28210 704-525-8962
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
† Sko-Die, Inc., Morton Grove, IL 60053 708-965-1130
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400

Motor Assemblies with Integral Tachometer/Encoder-3500

† **Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000** ..... B•1251
† **Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017, 314-532-3505** ..... C•1623
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ..... B•1279
§† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529** ..... B•1298,1920, D•2243
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1303-1305
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1309
§ Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266 ... B•1311
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312
† Astromec, Inc., Carson City, NV 89706 702-883-9226
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040 815-397-7400
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Data Technology, Inc., Woburn, MA 01811 617-935-8820
Escap Products, Hauppauge, NY 11788 516-234-3900
† GME Systems, Inc., Pittsburgh, PA 15090 412-935-0440
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§† Industrial Drives, A Kollmorgen Div., Radford, VA 24141 703-639-2495
§ Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
Parvex Servo Systems, GEC Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
§ Westamp, Santa Monica, CA 90404 213-393-0401

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Motors, Brush, DC-3500

Advanced Technology Company, Vista, CA 92083, 619-727-7430 ... B•1235-1237
§ **Bodine Electric Company, Chicago, IL 60618, 312-478-3515** ..... B•1248
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1252-1253
Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1254
† **Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131** ..... B•1255
Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017, 314-532-3505 ..... C•1623
§† **Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495** ..... B•1277
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ..... B•1279
Mabuchi Motor America Corp., New York, NY 10016, 212-686-3622 ..... B•1293
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529** ..... B•1298-1299, D•2243
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041** ..... B•1303-1305
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1308
§ **TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676** ..... D•2245
† American Electronics, Fullerton, CA 92631 714-871-3020
Lamb Electric Division, Ametek, Inc., Kent, OH 44240 216-673-3451
† Astromec, Inc., Carson City, NV 89706 702-883-9226
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040 815-397-7400
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5200
Buehler Products, Inc., Raleigh, NC 27636 919-469-8522
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Copal (USA), Inc., Torrance, CA 90501 213-618-0225
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
§ Electric Motor Engineering, Mission Viejo, CA 92691 714-583-9802
Electrol Co., York, PA 17405 717-848-1722
Escap Products, Hauppauge, NY 11788 516-234-3900
§ General Industries, Elyria, OH 44035 216-323-3136
General Numeric Corporation, Elk Grove Village, IL 60007 708-640-1595
† GME Systems, Inc., Pittsburgh, PA 15090 412-935-0440
Hansen Manufacturing Company, Inc., Subsidiary of IMC Magnetics Corp., Princeton, IN 47670-0023 812-385-3415
§ Harowe Servo Controls, Inc:A Fasco Co., West Chester, PA 19380 215-692-2700
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
§ Howard Industries, Inc., Milford, IL 60953 815-889-4105
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§ Pacific Scientific Co., Rockford, IL 61109 815-226-3100
Parvex Servo Systems, GEC Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
Performance Controls, Inc., Horsham, PA 19044 215-675-6500
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605 818-764-4266
Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
Vasak Inds., Inc., El Segundo, CA 90245 ..... 1-800-67-VASAK
§ Westamp, Santa Monica, CA 90404 213-393-0401

Motors, Brushless, DC-3500

Advanced Technology Company, Vista, CA 92083, 619-727-7430 ..... B•1237
Automotion, Inc., Ann Arbor, MI 48108, 313-662-7771 ..... B•1245
† **BEI Motion Systems Company, Kimco Magnetics Div., San Marcos, CA 92069, 619-744-5671** ..... B•1879
† **Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000** ..... B•1251
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330** ..... B•1254
§ **ebm Industries, Inc., Farmington, CT 06034, 203-674-1515** ..... C•1613
† **Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131** ..... B•1255
ETRI, Inc., Monroe, NC 28110, 704-289-5423 ..... C•1615-1617
Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017, 314-532-3505 ..... C•1623
Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564 ..... B•1274
Indek Corporation, San Jose, CA 95131, 408-432-1199 ..... C•1624-1625
§† **Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495** ..... B•1276-1277
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ..... B•1279
Mabuchi Motor America Corp., New York, NY 10016, 212-686-3622 ..... B•1293
† **Magtech Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581** ..... B•1294
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1297
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529** ..... B•1298-1299, D•2243
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041** ..... B•1303-1305
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ..... C•1650,1652
Papst Mechatronic Corp., Newport, RI 02840, 401-849-8810 ..... C•1654-1655
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1309
† **Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266** ... B•1311
† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300** ..... B•1312
§ **Superior Electric, Bristol, CT 06010, 203-582-9561** ..... B•1314
Synektron Corporation, Portland, OR 97223, 503-684-3090 ..... B•1316-1317
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Airpax-International Division, A North American Philips Co., Cheshire, CT 06410 203-271-6000
Lamb Electric Division, Ametek, Inc., Kent, OH 44240 216-673-3451

Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Dynamics, Inc., Woburn, MA 01801 617-935-4944
† Astromec, Inc., Carson City, NV 89706 702-883-9226
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 805-527-0900
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040 815-397-7400
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5200
† Brailsford & Co., Rye, NY 10580 914-967-1820
Buehler Products, Inc., Raleigh, NC 27636 919-469-8522
Canon U.S.A., Ecltrn. Comps. Div., Lake Success, NY 11042 516-488-6700
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 707-584-7558
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Copal (USA), Inc., Torrance, CA 90501 213-618-0225
Digital Motor, Inc., Portland, OR 97229-5501 503-629-9692
† EG & G Rotron, Custom Div., Woodstock, NY 12498 914-679-5201
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
General Numeric Corporation, Elk Grove Village, IL 60007 708-640-1595
† Globe Motors, Dayton, OH 45404 513-228-3171
† GMF Systems, Inc., Pittsburgh, PA 15090 412-935-0440
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
H D Systems, Inc., Hauppauge, NY 11788 516-231-6630
Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§ Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB 0264-324155
Motor-Tronics, Inc., Vista, CA 92083 619-727-7430
† MPSC Corporation, Torrington, CT 06790 203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91403 818-997-8675
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V5 519-271-3080
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
§ Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§† Pacific Scientific Co., Rockford, IL 61109 815-226-3100
Parvex Servo Systems, GEC Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
§ Powertron, Contraves Goerz Corp., Charlotte, NC 28210 704-525-8962
§† Rapidsyn, Division, Oceanside, CA 92054 619-439-7500
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11040 516-328-3970
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
Vasak Inds., Inc., El Segundo, CA 90245 ..... 1-800-67-VASAK
§ Westamp, Santa Monica, CA 90404 213-393-0401

Motors, Clock & Timing-3500

§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1248
§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1447-1448
§† Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564 ..... B•1272-1274
Mabuchi Motor America Corp., New York, NY 10016, 212-685-6022 ..... B•1293
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... D•2243
Airpax-International Division, A North American Philips Co., Cheshire, CT 06410 203-271-6000
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089 708-215-9600
§† Cramer Co., Old Saybrook, CT 06475 800-247-6784
† Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
Hansen Manufacturing Company, Inc., Subsidiary of IMC Magnetics Corp., Princeton, IN 47670-0023 812-385-3415
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
Mallory Controls, Emerson Electric, Indianapolis, IN 46214 317-328-4010
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008 708-253-6000
§ Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400

Motors, Control-3500

Advanced Technology Company, Vista, CA 92083, 619-727-7430 ..... B•1235-1237
Automotion, Inc., Ann Arbor, MI 48108, 313-662-7771 ..... B•1245
§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1248
Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017, 314-532-3505 ..... C•1623
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ..... B•1279
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925 ... D•1121
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... D•2243
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1303-1305
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1308
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1314
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Airpax-International Division, A North American Philips Co., Cheshire, CT 06410 203-271-6000
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
§ Anaheim Automation, Anaheim, CA 92801 714-992-6990
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
† Astro Instrument Corp., Deerfield, FL 33442-3019 305-698-6000
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 805-527-0900
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040 815-397-7400
§ Berkeley Process Control, Inc., Richmond, CA 94804 415-526-3333
Bertsch U.S., Vista, CA 92083 619-727-7420
Buehler Products, Inc., Raleigh, NC 27636 919-469-8522
§ Carter Motor, Warren, IL 61087-0647 815-745-2100
§ Centent Co., Santa Ana, CA 92707 714-979-6491
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§† Cramer Co., Old Saybrook, CT 06475 800-247-6784
Cross Electronics, Warrendale, PA 15086 412-776-1591
§ Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
† Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
† EEMCO, Darron, Inc. Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
§† Electrol Co., York, PA 17405 717-848-1722
Electronic Innovations Corp., Englewood, CO 80110 303-789-0424
Escap Products, Hauppauge, NY 11788 516-234-3900
General Numeric Corporation, Elk Grove Village, IL 60007 708-640-1595
† Globe Motors, Dayton, OH 45404 513-228-3171
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† Honeywell Inc., Commercial Bldgs. Grp., MN 27-4231 Minneapolis, MN 55408 612-870-2294
Howard Industries, Inc., Milford, IL 60953 815-889-4105
§ Hurst Manufacturing Div., Princeton, IN 47670 812-385-2564
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§ Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
§ Inertial Motors, Doylestown, PA 18901 215-345-1010
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
§ Klockner Moeller, Franklin, MA 02038 508-520-7080
Lincoln Laser Co., Phoenix, AZ 85004 602-257-0407
Magtech Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581
Mallory Controls, Emerson Electric, Indianapolis, IN 46214 317-328-4010
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB 0264-324155
Motor-Tronics, Inc., Vista, CA 92083 619-727-7430
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
§ Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§ Pacific Scientific Co., Rockford, IL 61109 815-226-3100
Parvex Servo Systems, GEC Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
Rapidsyn Division, Oceanside, CA 92054 619-439-7500
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
Servo-Tek Products Co., Hawthorne, NJ 07506 201-427-3100
† Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605 818-764-4266
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11040 516-328-3970
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
§ Westinghouse Electric Corp., Control Division, Oldsmar, FL 34667 813-855-4621

Motors, DC Timing-3500

§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1447-1448
† Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1254
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... D•2243
† Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266 ... B•1311
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312
Airpax-International Division, A North American Philips Co., Cheshire, CT 06410 203-271-6000
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
Bertsch U.S., Vista, CA 92083 619-727-7420
Buehler Products, Inc., Raleigh, NC 27636 919-469-8522
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042 516-488-6700
§ Cramer Co., Old Saybrook, CT 06475 800-247-6784
Hansen Manufacturing Company, Inc., Subsidiary of IMC Magnetics Corp., Princeton, IN 47670-0023 812-385-3415
Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400

Motors, Drag Cup-3500

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† American Electronics, Fullerton, CA 92631 714-871-3020

† Astro Instrument Corp., Deerfield, FL 33442-3019 305-698-6000
† EEMCO, Datron, Inc., Los Angeles, CA 90039 818-247-7060
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB 0264-324155
Parvex Servo Systems, GEC Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

Motors, Fractional Horsepower-3500

Advanced Technology Company, Vista, CA 92083, 619-727-7430 ..... B•1235-1237, C•1605
† **BEI Motion Systems Company, Kimco Magnetics Div., San Marcos, CA 92069, 619-744-5671 ..... B•1879**
Bertsch U.S., Vista, CA 92083, 619-727-7420 ..... B•1246-1247
§ **Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1248**
† **Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000 ..... B•1251**
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1252-1253
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1254**
§ **ebm Industries, Inc., Farmington, CT 06034, 203-674-1515 ..... C•1613**
Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017, 314-532-3505 ..... C•1623
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ..... B•1279
§ **Mabuchi Motor America Corp., New York, NY 10016, 212-686-3622 ..... B•1293**
Magtech Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581 ..... B•1294
† **McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550, 609-799-0100 ..... C•1633**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1297
§† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1298-1299, D•2243**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1303-1305**
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ..... C•1650,1652
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1308-1309
† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312**
Synektron Corporation, Portland, OR 97223, 503-684-3090 ..... B•1316-1317
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Airpax-International Division, A North American Philips Co., Cheshire, CT 06410 203-271-6000
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
† American Electronics, Fullerton, CA 92631 714-871-3020
Lamb Electric Division, Ametek, Inc., Kent, OH 44240 216-673-3451
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Instrument Corp., Deerfield, FL 33442-3019 305-698-6000
† Astromec, Inc., Carson City, NV 89706 702-883-9226
† Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 805-527-0900
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040 815-397-7400
Buehler Products, Inc., Raleigh, NC 27636 919-469-8522
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089 708-215-9600
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042 516-488-6700
§ Carter Motor, Warren, IL 61087-0647 815-745-2100
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§† Cramer Co., Old Saybrook, CT 06475 800-247-6784
Digital Motor, Inc., Portland, OR 97229-5501 503-629-9692
§ Eaton Corporation, Electric Drives Division, Kenosha, WI 53141 414-656-4011
† EG & G Rotron, Custom Div., Woodstock, NY 12498 914-679-5201
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
§ Electric Motor Engineering, Mission Viejo, CA 92691 714-583-9802
§ Electrol Co., York, PA 17405 717-848-1722
Escap Products, Hauppauge, NY 11788 516-234-3900
§ General Industries, Elyria, OH 44035 216-323-3136
General Numeric Corporation, Elk Grove Village, IL 60007 708-640-1595
§† Globe Motors, Dayton, OH 45404 513-228-3171
† GME Systems, Inc., Pittsburgh, PA 15090 412-935-0440
Hankscraft Motors, Div. of Gerber Prods. Co., Reedsburg, WI 53959 608-524-4341
Hansen Manufacturing Company, Inc., Subsidiary of IMC Magnetics Corp., Princeton, IN 47670-0023 812-385-3415
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† Hertner Div.:Exide Corp., Cleveland, OH 44111 216-252-4242
§ Howard Industries, Inc., Milford, IL 60953 815-889-4105
§ Hurst Manufacturing Div., Princeton, IN 47670 812-385-2564
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
† Merrill, Inc., Gwynedd Valley, PA 19437 215-361-1297
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008 708-253-6000
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB 0264-324155
Motor-Tronics, Inc., Vista, CA 92083 619-727-7430
Namiki, Precision of America, Inc., Rochelle Park, NJ 07662 201-368-0123
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
§ Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
§† Pacific Scientific Co., Rockford, IL 61109 815-226-3100
Papst Mechatronic Corp., Newport, RI 02840 401-849-8810
Parvex Servo Systems, GEC Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ Powertron, Contraves Goerz Corp., Charlotte, NC 28210 704-525-8962
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
§ Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605 818-764-4266
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
§ Superior Electric, Bristol, CT 06010 203-582-9561
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11040 516-328-3970
Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400
Vasak Inds., Inc., El Segundo, CA 90245 ..... 1-800-67-VASAK
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

Motors, Gearhead-3500

Advanced Technology Company, Vista, CA 92083, 619-727-7430 ..... B•1235-1237
Bertsch U.S., Vista, CA 92083, 619-727-7420 ..... B•1246-1247
§ **Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1248**
§ **Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1252-1253**
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1254**
Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017, 314-532-3505 ..... C•1623
§† **Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564 ..... B•1272-1273**
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ..... B•1279
§† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1298-1299, D•2243**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1303-1305**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1308-1309
† **Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266 ..... B•1311**
† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312**
§ **Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1314**
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1318**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Airpax-International Division, A North American Philips Co., Cheshire, CT 06410 203-271-6000
† American Electronics, Fullerton, CA 92631 714-871-3020
Lamb Electric Division, Ametek, Inc., Kent, OH 44240 216-673-3451
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Instrument Corp., Deerfield, FL 33442-3019 305-698-6000
† Astromec, Inc., Carson City, NV 89706 702-883-9226
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
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† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
§ Electric Motor Engineering, Mission Viejo, CA 92691 714-583-9802
§ Electrol Co., York, PA 17405 717-848-1722
§ Empire Magnetics, Rohnert Park, CA 94928 707-584-2801
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§ General Industries, Elyria, OH 44035 216-323-3136
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Molon Motor & Coil Corporation, Rolling Meadows, IL 60008 708-253-6000
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† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
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§ Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
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† Rapidsyn Division, Oceanside, CA 92054 619-439-7500

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Servo-Tek Products Co., Hawthorne, NJ 07506 201-427-3100
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400

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† **Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000** ..... B•1251
† **Magtech Controls, Vernitron Corporation, San Diego, CA 92073, 619-429-5581** ..... B•1294
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... B•1318
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 805-527-0900
† EEMCO, Datron, Inc., Los Angeles, CA 90039 818-247-7066
§† Harowe Servo Controls, Inc:A Fasco Co., West Chester, PA 19380 215-692-2700
Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400

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§ **Bodine Electric Company, Chicago, IL 60618, 312-478-3515** ..... B•1248
§† **Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564** ..... B•1272-1274
† **McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550, 609-799-0100** ..... C•1633
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... B•1318
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† American Electronics, Fullerton, CA 92631 714-871-3020
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Instrument Corp., Deerfield, FL 33442-3019 305-698-6000
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
§ Cramer Co., Old Saybrook, CT 06475 800-247-6784
Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
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† EEMCO, Datron, Inc., Los Angeles, CA 90039 818-247-7066
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§† Globe Motors, Dayton, OH 45404 513-228-3171
Hansen Manufacturing Company, Inc., Subsidiary of IMC Magnetics Corp., Princeton, IN 47670-0025 ..... B•1272-1274
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
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Lincoln Laser Co., Phoenix, AZ 85004 602-257-0407
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 10SAB 0264-324155
† NIDEC Corporation, Torrington, CT 06790 203-482-4422
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
§ Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
Papst Mechatronic Corp., Newport, RI 02840 401-849-8810
Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
† Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605 818-764-4266
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400

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§ **Bodine Electric Company, Chicago, IL 60618, 312-478-3515** ..... B•1248
§ **Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311** ..... B•1253
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330** ..... B•1254
Fasco Industries, Inc., Hawker Siddeley No. 200, Chesterfield, MO 63017, 314-532-3505 ..... C•1623
§† **Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564** ..... B•1272-1274
† **McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550, 609-799-0100** ..... C•1633
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... D•2243
† **Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266** ..... B•1311
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† American Electronics, Fullerton, CA 92631 714-871-3020
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† Astro Instrument Corp., Deerfield, FL 33442-3019 305-698-6000
† Astromec, Inc., Carson City, NV 89706 702-883-9226
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 805-527-0900
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
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† EG & G Rotron, Custom Div., Woodstock, NY 12498 914-679-5201
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† Hertner Div.:Exide Corp., Cleveland, OH 44111 216-252-4242
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† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 10SAB 0264-324155
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Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
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§ Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
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† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300** ..... B•1312
Airpax-International Division, A North American Philips Co., Cheshire, CT 06410 203-271-6000
† Anorad Corp., Hauppauge, NY 11788 516-231-1995
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 707-584-7558
Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
§ Empire Magnetics, Rohnert Park, CA 94928 707-584-2801
General Controls, Inc., Elk Grove Village, IL 60007 312-595-2152
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
Motion Science Inc., San Jose, CA 95112 408-993-0300
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
† Optima Precision, Inc., West Linn, OR 97068 ..... 800-544-4118;503-638-2525
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
Sierracin/Magnedyne, Carlsbad, CA 92009 619-438-3321
Unico, Franksville, WI 53126-0505 414-886-5678

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† **BEI Motion Systems Company, Kimco Magnetics Div., San Marcos, CA 92069, 619-744-5671** ..... B•1279
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§ **Bodine Electric Company, Chicago, IL 60618, 312-478-3515** ..... B•1248
† **Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000** ..... B•1251
§ **Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311** ..... B•1252-1253
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330** ..... B•1254
† **Eitrol Corporation, Canoga Park, CA 91304, 818-709-0131** ..... B•1255
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§† **Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564** ..... B•1272-1274
§† **Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495** ..... B•1277
Inranor, Naugatuck, CT 06770, 203-729-9258;800-BE-SERVO ..... B•1279
† **Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635, 602-459-1150** ..... B•1280-1282
§ Matsushi Motor America Corp., New York, NY 10016, 212-686-3622 ..... B•1293
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1297
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1298-1299, D•2243
† **Motor Technology, Inc., Dayton, OH 45429, 513-254-1041** ..... B•1303-1305
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ..... B•1306-1307
Papst Mechatronic Corp., Newport, RI 02840, 401-849-8810 ..... C•1655
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1308-1309
† **Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266** ..... B•1311
† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300** ..... B•1312
§† **Superior Electric, Bristol, CT 06010, 203-582-9561** ..... B•1314
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† Astro Instrument Corp., Deerfield, FL 33442-3019 305-698-6000
† Astromec, Inc., Carson City, NV 89706 702-883-9226
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§ Electrol Co., York, PA 17405 717-848-1722
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† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400
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§ Westamp, Santa Monica, CA 90404 213-393-0401

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Electro-Pacific, Goleta, CA 93117 805-964-0751
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† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

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BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ..... B•1249
§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1252-1253
† Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1254
§† Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564 ..... B•1272-1273, 1275
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Magtech Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581 ..... B•1294
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 .. B•1306-1307, C•1650
† Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266 ... B•1311
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1314
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1031,1318
† Abrams Instrument Corp., Okemos, MI 48864 517-332-6405
† ADVANCED MICRO SYSTEMS, INC., Hudson, NH 03051-4920 603-882-1447
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
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Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
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§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
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Molon Motor & Coil Corporation, Rolling Meadows, IL 60008 708-253-6000
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
† Optima Precision, Inc., West Linn, OR 97068 ..... 800-544-4118;503-638-2525
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
§ Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
§† Pacific Scientific Co., Rockford, IL 61109 815-226-3100
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
† Rapidsyn Division, Oceanside, CA 92054 619-439-7500
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11040 .. 516-328-3970
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400

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§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1248
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§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1252-1253
† Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1254
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§† Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564 ..... B•1272-1274
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† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1314
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1318
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Airpax-International Division, A North American Philips Co., Cheshire, CT 06410 203-271-6000
† American Electronics, Fullerton, CA 92631 714-871-3020
Anaheim Automation, Anaheim, CA 92801 714-992-6990
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Instrument Corp., Deerfield, FL 33442-3019 305-698-6000
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042 516-488-6700
§† Cramer Co., Old Saybrook, CT 06475 800-247-6784
EEMCO, Datron, Inc., Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
§ General Industries, Elyria, OH 44035 216-323-3136
General Numeric Corporation, Elk Grove Village, IL 60007 708-640-1595
§† Globe Motors, Dayton, OH 45404 513-228-3171
Hansen Manufacturing Company, Inc., Subsidiary of IMC Magnetics Corp., Princeton, IN 47670-0023 812-385-3415
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§† Industrial Drives, A Kollmorgen Div., Radford, VA 24141 703-639-2495

§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
Lincoln Laser Co., Phoenix, AZ 85004 602-257-0407
Mallory Controls, Emerson Electric, Indianapolis, IN 46214 317-328-4010
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008 708-253-6000
† NIDEC Corporation, Torrington, CT 06790 203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
§ Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
§† Pacific Scientific Co., Rockford, IL 61109 815-226-3100
Papst Mechatronic Corp., Newport, RI 02840 401-849-8810
§ Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
‡ Rapidsyn Division, Oceanside, CA 92054 619-439-7500
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400

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† **Magtech Controls, Vernitron Corporation, San Diego, CA 92073, 619-498-5581** ..... B•1294
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† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529** ..... B•1298, D•2243
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Airpax-International Division, A North American Philips Co., Cheshire, CT 06410 203-271-6000
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 805-527-0900
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
Buehler Products, Inc., Raleigh, NC 27636 919-469-8522
Canon U.S.A., Elctn. Comps. Div., Lake Success, NY 11042 516-488-6700
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Cramer Co., Old Saybrook, CT 06475 800-247-6784
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
† Globe Motors, Dayton, OH 45404 513-228-3171
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
Howard Industries, Inc., Milford, IL 60953 815-889-4105
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§† Industrial Drives, A Kollmorgen Div., Radford, VA 24141 703-639-2495
Infranor, Naugatuck, CT 06770 ..... 203-729-8258;800-BE-SERVO
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
Micronel U.S., Vista, CA 92083 619-727-7400
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008 708-253-6000
† NIDEC Corporation, Torrington, CT 06790 203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
§ Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
§ Pacific Scientific Co., Rockford, IL 61109 815-226-3100
Parvex Servo Systems, GEC Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703 516-864-1000
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400

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† Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040 815-397-7400
§ Carter Motor, Warren, IL 61087-0647 815-745-2100
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
§† Globe Motors, Dayton, OH 45404 513-228-3171
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008 708-253-6000
Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
Parvex Servo Systems, GEC Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121 414-723-6400

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† **Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000** ..... B•1251
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§† **Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495** ..... B•1277
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† Astromec, Inc., Carson City, NV 89706 702-883-9226
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
† Hertner Div.:Exide Corp., Cleveland, OH 44111 216-252-4242
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400

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Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-3728, 915-592-3253 ..... B•1839
§† **Fenwal Electronics, Inc./APD, Milford, MA 01757, 508-478-6000** ..... B•1845
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Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... B•1858
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Milross Controls, Inc., Southampton, PA 18966 215-355-0200
Omega Engineering, Stamford, CT 06907 800-826-6342
§† Telephonics Corporation/PBD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002

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AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
† **Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727** ..... B•1217
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751** ..... B•1218-1220,1222-1223
§† **Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998, 213-828-7496** ..... B•1225
† **Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121** ..... B•1227-1228
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Atlantic Scientific Corporation, Melbourne, FL 32901 1-800-544-4737
Aydin Corp., Horsham, PA 19044 215-657-7510
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§† Canoga-Perkins Corp., Chatsworth, CA 91311 818-718-6300
† CATEL Telecommunications, Fremont, CA 94537 415-659-8988
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411

§† Dataproducts New England, Inc., Wallingford, CT 06492 203-265-7151
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-921-2726
Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-8600
§# Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
ICS Electronics Corp., Milpitas, CA 95035-5545 408-263-5500
† Lightwave Communications, Inc., Ridgefield, CT 06877 203-438-3591
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
Racal-Milgo, Sunrise, FL 33323-2899 ..... 305-846-1601;800-327-4440
RE Instruments Corp., Westlake, OH 44145 216-871-7617
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
§† Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397

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† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910-1911
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965-1966
† Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1027
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1975
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
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Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2008
§† Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Resistive Company, Boone, NC 28607 704-264-8861
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
† Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
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General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Joslyn Electronic Systems, Goleta, CA 93116 ..... 800-752-8068; 805-968-3551

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§ Aerotech, Inc., Pittsburgh, PA 15238 412-963-7470
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Diversified Optical Products, Inc., Salem, NH 03079 603-898-1880
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
§† Ercona, Patchogue, NY 11772 516-758-0700
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080 201-769-3200
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
† Math Assocs., Westbury, NY 11590 516-334-6800
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
Noll, J. A. Co., Monroeville, PA 15146 412-856-7566
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
† Pomfret Research Optics, Orange, VA 22960 703-854-4350
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
† Carl Zeiss, Inc., Thornwood, NY 10594 914-747-1800

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§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† Isocom Inc., Campbell, CA 95008 408-370-2212
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Lutze, Inc., West Caldwell, NJ 07006 ..... 201-227-2371;800-447-2371
§ Marktech International Corp., Latham, NY 12110 518-786-6591
Micropac Inds., Inc., Garland, TX 75040 214-272-3571
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
† Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
§† Quality Technologies, Palo Alto, CA 93404 415-493-0400
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Silonex Inc., Plattsburgh, NY 12901 518-561-3160
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035

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§† Optek Technology Inc., Carrollton, TX 75006, 214-323-2200 ..... B•1333
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†‡ Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1196,1199
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A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
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§ Marktech International Corp., Latham, NY 12110 518-786-6591
Micropac Inds., Inc., Garland, TX 75040 214-272-3571
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
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§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035

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† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1325-1327
† CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1330,1339-1341,1344-1345
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† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1368-1369
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1371
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1385
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1395,1398
§† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1402-1403
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901, 804-977-8050 ..... A•1432
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ..... A•1445
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1449
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Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
CTS Corporation, Elkhart, IN 46514 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-8220
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ..... 708-932-9380;800-468-6009
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Hy-Q International (USA) Inc., Erlanger, KY 41018 606-283-5000
Litton Electron Devices, San Carlos, CA 94070 415-591-8411
§ Lucas Zeta, Inc., Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
MF Elctrns. Corp., New Rochelle, NY 10801 914-576-6570
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Raltron Electronics, Miami, FL 33172 305-593-6033
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
† Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
† Wenzel Associates, Inc., Austin, TX 78728 512-244-7741

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§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271

BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
Epsilon-Lambda Elctrns. Corp., Geneva, IL 60134 708-232-9611
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† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
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† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
Sivers IMA AB, Culver City, CA 90230 213-306-4248
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500
§† Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
TOYOCOM USA INC., Arlington Heights, IL 60005 ... 708-593-8780/1-800-TOYOCOM
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† Wenzel Associates, Inc., Austin, TX 78728 512-244-7741
† Z Communications, Inc., Ft. Lauderdale, FL 33309 305-735-1000

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Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
Bergquist, Minneapolis, MN 55435 800-347-4572
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§ C & K/Unimax, Inc., C & K Components, inc., Wallingford, CT 06492 203-269-8701
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
† DOW SWITCH, Wilmington, MA 01887 617-935-6395
† E-L Products Corp., Sub.of Astronics Co., E. Aurora, NY 14052 716-655-0800
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Hallmark Technologies, Mt. Dora, FL 32757 800-874-9063
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
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§† Miller Dial Corp., El Monte, CA 91731 818-444-4555
OMNI Switch USA, Inc., Phoenix, AZ 85027 602-582-0629
Pacific Industrial Components Corp., See Altair Exchange Corp.
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
† Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
Technical Panels, Inc., Temple City, CA 91780 ..... 800-343-1170;818-285-3105
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Wontronics, Los Angeles, CA 90039 213-660-6230

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Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 708-517-1144 ..... B•1082-1083
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† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766 603-448-3444
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
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† Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
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Doran Manufacturing Co., Cincinnati, OH 45225 513-681-5424
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Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
† GRIM Corporation, Medford, NJ 08055-0968 609-267-7950
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§† Meco Industries, Mechanical Engraving Co., Inc., Bronx, NY 10470 212-324-4455
† Ratelco, Power Systems, Seattle, WA 98109-5589 206-624-7770
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
§ Trimm Inc., Newton Instr. Co., Libertyville, IL 60048 708-362-3700
§ USD Products , Div. of Bussmann, Chicago, IL 60656 708-867-4600

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† **Centronic, Inc., The Morgan Crucible Company, Spec. Matls. & Tech Division, Newbury Park, CA 91320-1702, 805-499-5902** ..... B•1322
§ **Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500** ..... B•1341
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A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400

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† **Centronic, Inc., The Morgan Crucible Company, Spec. Matls. & Tech Division, Newbury Park, CA 91320-1702, 805-499-5902** ..... B•1322
§† **Optek Technology Inc., Carrollton, TX 75006, 214-323-2200** ..... B•1333
§ **Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500** ..... B•1341
† **Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884** ..... B•1342-1344
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Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
§ BEA electro-optics, inc., Des Plaines, IL 60016 708-298-1420
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ Ercona, Patchogue, NY 11772 516-758-0700
Hamamatsu Corporation, Bridgewater, NJ 08807 201-231-0960
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† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
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§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035

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§† **Datak Corp., Sparks, NV 89431, 702-359-7474** ..... C•1685
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† **ADC Telecommunications, Inc., Minneapolis, MN 55435, 612-835-6800** ..... C•1157-1159
§ **Circuit Assembly Corp., Irvine, CA 92718-2703, 714-855-7887** ..... C•1317
U.S. Terminals Inc., Cincinnati, OH 45243, 513-561-8145 ..... C•1563
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647 201-768-5400
† Direct Sound Corporation, New York, NY 10011 212-691-9050
† Lynn Electronics, Feasterville, PA 19047 ..... 215-677-6700;800-523-6075
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101 617-890-4750
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584 309-693-3300
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047 818-707-2020

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International Polarizer, Inc., Marlborough, MA 01752 508-481-7495
† Mark Polarized Corp., Hauppauge, NY 11788 516-273-1122
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
Oriel Corp., Stratford, CT 06497-0872 203-377-8282

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§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•2016

§† Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•2018,2020-2022

§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-872-0042 ..... A•2030

ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... B•1256,1258

IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258,1261-1262

JDK Controls, Inc., Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2043

§ Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•2064-2065

Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... A•2045-2046

§† Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... A•2055-2057

Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•2059

† Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2062

§† Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139, 818-781-1642 ..... A•2037

Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... A•2071

Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1031

§† Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2073

§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2076

† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2079

† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501

Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506

Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639

† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733

Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600

† Penny & Giles, Santa Monica, CA 90401 213-393-1497

Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810

§† Vamistor Corp., Sevierville, TN 37862 615-453-0001

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† Abbott Electronics, Los Angeles, CA 90034, 213-202-8820 ..... D•1523
§ Abbott Technologies, Inc. Power Supplies Division, Sun Valley, CA 91352, 818-504-0644,1-800-367-8200,818-841-3630 ..... D•1511
† Acopian Technical Company, Easton, PA 18044, 215-258-5441 ..... D•1549
† Aditech Power Inc., Anaheim, CA 92806, 714-634-9211 ..... D•1580
† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900 ..... D•2156
† Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-2702 ..... D•1548
† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500 ..... D•1588-1593
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221 ..... D•1599-1603
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 416-660-9819 ..... D•1605
† Avionic Instruments, Avenel, NJ 07001, 908-382-7100 ... D•2160-2162,2164,2166
Behlman Electronics, Inc., Ventura, CA 93003, 805-642-0660 ..... D•2169
† CEC Electronics Corp., Hauppauge, NY 11788, 516-582-4422 ..... D•1650-1651
† Computer Products inc., Power Conversion America, Fremont, CA 94537-5102, 510-657-6700 ..... D•1663
Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565; ..... D•1683,1688
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† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328 ... D•1697
† D & B Power, Inc., Bayshore, NY 11706, 516-586-5955 ..... D•1699
† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... D•1700-1701,1705
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462/3487 ..... D•1709
† EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521 .... D•1714-1715
Electronic Measurements, Neptune, NJ 07753, 908-922-9300 ..... D•1727
Eigar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•1728,2192
† EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626 ... D•1732-1733
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735, 516-293-4100 ..... D•1752-1753
HC Power Inc., Irvine, CA 92714-5716, 714-261-2200 ..... D•1785
International Power DC Power Supplies, inc., Camarillo, CA 93010, 805-987-7900 ..... D•1779-1781
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Kepco, Inc., Flushing, NY 11352, 718-461-7000 ..... D•1837-1839
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 ..... B•1538-1540, D•1877
Melcher, Inc., Ashland, MA 01721, 800-828-9712 ..... D•1892-1894
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† Modular Devices, Shirley, NY 11967, 516-345-3100 ..... D•1901-1902,1904,1906
Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07652, 201-385-0500 ..... D•2214
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... D•1915
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521 ..... D•1918
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... D•1919
Power-One, Inc., Camarillo, CA 93012, 805-987-8741 ..... D•1988
† Power Supply Concepts Inc., Florida, NY 10921, 914-651-5000 .... D•2004-2005
Power Switch Corporation, Lodi, NJ 07644, 201-478-5788 ..... D•2008
† Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959 ..... D•2013
† Rantec Microwave & Elctrns., Inc., Los Osos, CA 93402, 805-528-5858 ..... D•2020-2022
Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616 ..... D•2027
† RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450 ..... D•2028-2030,2032-2033
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 ..... D•2049
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... D•2058
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§ U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 213-316-9984 ..... D•2027
Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352 ... 818-504-0644; 1-800-367-8200;818-841-3630
§† ACME-URDC, Inc., West Jordan, UT 84084 801-561-9385
† Advanced Conversion Tech., Middletown, PA 17057 717-939-2300
Analog Modules, Inc., Longwood, FL 32750 407-339-4355
Astrosystems, Lake Success, NY 11042 516-328-1600
† ATC Power Systems, Inc., Nashua, NH 03063 603-882-1366
Autronics Corp., Arcadia, CA 91006 818-445-5470
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† B C Systems, Inc., Setauket, NY 11790 516-751-9370
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Brandt Electronics, Inc., Mountain View, CA 94043 415-967-4944
† Christie Electric Corp., Gardena, CA 90248 213-715-1402
† CML MACARR, A Marine Electric Systems Co., Clifton, NJ 07014-1135 201-471-6800
§† CPS, Inc., Fremont, CA 94538-6517 415-657-6363
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
† Electronic Development Associates, Inc., Dix Hills, NEW YORK 11746 .. 516-673-3881
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499 206-657-7474
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221 213-635-9555
† ETM Electromatic Inc, Newark, CA 94560 415-797-1100
§ HBS Equipment Corporation, Los Angeles, CA 90040 213-726-3033
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
Intepro Systems Inc., Billerica, MA 01821 508-663-7555
Interelectronics Corp., Congers, NY 10920 ..... 914-ELB-8000
JMK, Inc., Amherst, NH 03031 603-886-4100
Keltec Florida, Inc., Microwave Pro, Ft. Walton Bch., FL 32549-2917 904-244-0043
† Lambda Electronics Inc., Melville, NY 11747-3700 516-694-4200
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
† Mep Controls, Bordentown, NJ 08505 609-298-7300
MIL Electronics, Inc., Nashua, NH 03036 603-882-3200
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-475-7831
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† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
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† Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630 714-527-0561
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
Pacific Power Source Corp., Huntington Bch., CA 92649 .. 714-898-2691;800-854-2433
Performance Controls, Inc., Horsham, PA 19044 215-675-6500
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† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821 617-667-9500
† Power Functions Engineering, Garland, TX 75042 214-278-0996
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Power Star, Inc., Irvine, CA 92713 ..... 714-261-5377;800-854-9420
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
Powertech, Inc., Fairlawn, NJ 07410 201-791-5050
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† Rantec Microwave & Electronics, Esco Electronics, Chatsworth, CA 91311 818-885-8223
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 708-439-2800
† Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
† Technology Dynamics Inc., Bergenfield, NJ 07621 201-385-0500
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† Trio Laboratories, Inc., Plainview, NY 11803 516-349-0400
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Varian Associates, Electron Device Business, Palo Alto, CA 94304 ..... 415-493-4000; 800-544-4636
† Varian Microwave Equip. Div., Varian Assocs., Inc., Santa Clara, CA 95054 408-496-6273
§† Vicor Corp., Andover, MA 01810 508-470-2900
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
Wall Industries, Exeter, NH 03833 ..... 603-778-2300;800-321-WALL
† Westcor Corporation, Los Gatos, CA 95032 408-395-7050
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 619-727-0940

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† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900 ..... D•2156,2158-2159
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† CEC Electronics Corp., Hauppauge, NY 11788, 516-582-4422 ..... D•1650-1651
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† Computer Products inc., Power Conversion America, Fremont, CA 94537-5102, 510-657-6700 ..... D•1663
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† Modular Devices, Shirley, NY 11967, 516-345-3100 ..... D•1901
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† Power Supply Concepts Inc., Florida, NY 10921, 914-651-5000 .... D•2004-2005
† Advanced Conversion Tech., Middletown, PA 17057 717-939-2300

† Avtel Div., Unitron Inc., Dallas, TX 75238 214-340-8600
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† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
† Lambda Electronics Inc., Melville, NY 11747-3700 516-694-4200
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† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Tecnetics Inc., Computer Products, Boulder, CO 80303 303-442-3837
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Varian Associates, Electron Device Business, Palo Alto, CA 94304 ..... 415-493-4000; 800-544-4636
§† Vicor Corp., Andover, MA 01810 508-470-2900
Wall Industries, Exeter, NH 03833 ..... 603-778-2300;800-321-WALL

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§† Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1805
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AMP-AKZO Corporation, Melville, NY 11747 516-454-4400
Associated Circuits Inc., Menlo Park, CA 94025 415-329-0478
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803 617-273-5800
† Diversified Systems, Inc., Indianapolis, IN 46268 317-299-9547
DOW SWITCH, Wilmington, MA 01887 617-935-6395
† Electrohome Limited, Circuit Board Operations, Kitchener, Ontario, CANADA N2G 4J6 519-744-7111
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-8600
§ ET&T Corporation, Costa Mesa, CA 92626 714-557-2703
Garry Electronics an LPL Co., Langhorne, PA 19047 215-949-2300
Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
§† Injectorall Electronics (Woman Owned), Bohemia, NY 11716 516-563-3388
Intepro Systems Inc., Billerica, MA 01821 508-663-7555
† Logic Technology, Inc., Mtn. View, CA 94043 415-967-1007
§ Longshine Technlg. Inc., San Jose, CA 95132 408-942-1746
† Metro Circuits, PJC Technologies, Inc., Rochester, NY 14613 716-254-2980
PCI, Inc., San Jose, CA 95128 408-282-0200
† Poly Circuits, Inc., Bensenville, IL 60106 708-860-3560
† Precision Graphics Inc., Raritan, NJ 08869 908-707-8880
Ragen Corp., Systems Div., N. Arlington, NJ 07032 201-997-1000
§ Regulus Systems, Foster City, CA 94404 415-593-4197
Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO 519-696-2616
† Rogers Corporation, Flexible Interconnections Div., Chandler, AZ 85244 602-963-4584
† Rogers Corporation, Soladyne Div., San Diego, CA 92111 619-279-7872
† Sheldahl, Inc., Northfield, MN 55057 507-663-8000
† Speedy Circuits, PJC Technologies, Inc., Huntington Bch., CA 92649 714-898-4901
Tadiran Electronic Industries, Inc., Port Washington, NY 11050 516-621-4980
† Teradyne Connection Sys., Teradyne, Inc., Nashua, NH 03060 603-889-5156
§ U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 213-316-9984
Vern Kiebler Electronics, Inc., Wheaton, IL 60187 708-668-5407

Printer/Plotters-2000 — ***See Vol. D***

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Printers, Digital-2000 — ***See Vol. D***

Printers, Dot Matrix Impact-2000 — ***See Vol. D***

Printers, Event-3000 — ***See Vol. D***

Printers, Jet Ink-2000 — ***See Vol. D***

Printers, Laser-2000 — ***See Vol. D***

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Probes, Logic Test-2900 — ***See Vol. D***

Probes, Microwave-3450 — ***See Vol. A***

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Probes, RF-2900 — ***See Vol. D***

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Probes, Test Lead-2900 — ***See Vol. D***

Process Control Systems-2200 — ***See Vol. D***

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Processors, Communications, Message Switching-1900 — ***See Vol. D***

Processors, Communications, Network Node-1900 — ***See Vol. D***

Processors, Communications, Standalone-1900 — ***See Vol. D***

Processors, Display-2450

Applied Data Systems, Baltimore, MD 21202 ..... 800-541-2003;410-576-0335
Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-8600
§ Graphic Strategies, Inc., Sunnyvale, CA 94089 408-745-6500
Greenspring Computers, Inc., Menlo Park, CA 94025 415-327-1200
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
§ Weitek Corp., Sunnyvale, CA 94086 408-738-8400

Processors, Image-2000 — ***See Vol. D***

Processors, Remittance-2000 — ***See Vol. D***

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Programmers, Punched Card-2000 — ***See Vol. D***

Programmers, Tape-2000 — ***See Vol. D***

PROM Programmers — See Programmers, PROM & Logic Array (Vol. A)

Protectors, Brownout-4300

† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2185-2186,2188
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•2191
GRIM Corporation, Medford, NJ 08055-0968, 609-267-7950 ..... D•1075
Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525 ..... D•2203
§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170 ..... B•1385

Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Active Control Instrumentation, Key Largo, FL 33037 305-451-1000
Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
§† Brooks Power Systems, Bensalem, PA 19020 ..... 215-244-0264;1-800-523-1551
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
† DELTEC, San Diego, CA 92110 ..... 619-291-4211;800-854-2658
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Lentronics, Prism Systems Inc., Burnaby, B.C., CANADA V5A 1X7 604-421-8733
§† North Hills Electronics Inc., Power Products Div., Glen Cove, NY 11542-3796 516-671-5700
† Pacific Power Source Corp., Huntington Bch., CA 92649 .. 714-898-2691;800-854-2433
§ Perma Power Elctrns., Chicago, IL 60648 312-763-0763
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 708-439-2800
Square D Co. Power Protection Systems, San Diego, CA 92123-1165 ... 619-279-0831
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
§ Sunshine Instruments, Philadelphia, PA 19115 ..... 215-673-5600;800-343-1199
§† Superior Electric, Bristol, CT 06010 203-582-9561
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
Thermik Corp., Thermik Sensor Technics, GmbH, New Bern, NC 28562 919-636-5720

Protectors, Surge – See Suppressors, Transient Voltage (Vol. B)

Protocol Converters-1900 – *See Vol. D*

Prototyping Equipment, Circuit Board-4200 – *See Vol. C*

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Public Address Systems-1300 – *See Vol. D*

Pullers, Circuit Board-5400 – *See Vol. C*

Pullers, Tube-5400 – *See Vol. C*

Pulleys-2500 – *See Vol. C*

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Pumps, Vacuum-4100 – *See Vol. D*

Punches, Chassis-5400 – *See Vol. C*

Pyrometers, Infrared-2900 – *See Vol. D*

Pyrometers, Optical, Noninfrared-5300

Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... D•1368
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
§ Epic, Inc., New York, NY 10038 212-349-2470
J-B-T Instruments, Inc., New Haven, CT 06508-1818 203-776-1111
§ Larson Instrument, Orangeburg, NY 10962 914-359-3800
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
§ Syscon Intl., Inc., So. Bend, IN 46601-3796 219-232-3900
Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476 707-938-2121

Pyrometers, Recording-2900 – *See Vol. D*

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Racks, Desk & Console – See Enclosures, Equipment & Panel Mounting (Vol. C)

Racks, Module – See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)

Racks, Relay & Mounting – See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)

Radar Systems (MIL)-2440

Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Datron Systems, Inc., Simi Valley, CA 93065-1650 805-584-1717
† Electronic Space Systems Corp., Concord, MA 01742 508-369-7200
† E-Systems, Greenville Div., Greenville, TX 75403-6056 903-455-3450
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
† ITT Gilfillan, ITT Defense Inc., Van Nuys, CA 91409 818-988-2600
MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400

Radar System Components-3450 – *See Vol. A*

Radio Communications Systems – See Communications Systems (Vol. D)

Radiographic Equip. – See X-ray Inspection Equip. (Vol. D)

Radiometers-2900 – *See Vol. D*

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Reactors, Charging-5600 – *See Vol. A*

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Reactors, Filter-5600 – *See Vol. A*

Reactors, Loading-5600 – *See Vol. A*

Reactors, Saturable-1800 – *See Vol. A*

Reactors (MIL)-2440

† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314, D•1915
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
§† Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
† Torotel Prods. Inc., Grandview, MO 64030-3199 816-761-6314
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Readers, Badge-2000 – *See Vol. D*

Readers, Bar Code-2000 – *See Vol. D*

Readers, Character-2000 – *See Vol. D*

Readers, Key-2000 – *See Vol. D*

Readers, Magnetic Card-2000 – *See Vol. D*

Readers, Magnetic Stripe Card-2000 – *See Vol. D*

Readers, Punched Card-2000 – *See Vol. D*

Readers, Punched Tape-2000 – *See Vol. D*

Readers, Static Card-2000 – *See Vol. D*

Readers, Time Code-2000 – *See Vol. D*

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Reamers-5400 – *See Vol. C*

Receivers, AM/FM (Incl. Precision Test)-2900 – *See Vol. D*

Receivers, Communication-1900 – *See Vol. D*

Receivers, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1217
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751 ..... B•1218-1221
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1225
† Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121 ..... B•1227-1228
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ... B•1230, D•1319
† Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1342-1343
§ S.I. Tech, Batavia, IL 60510, 708-232-8640 ..... B•1231
† Analog Modules, Inc., Longwood, FL 32750 407-339-4355
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
BT & D Technologies, Wilmington, DE 19803 302-479-0300
CATEL Telecommunications, Fremont, CA 94537 415-659-8988
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
Dymec Inc., Winchester, MA 01890 617-729-7870
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Force, Inc., Christiansburg, VA 24073 703-382-0462
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000

LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014 413-592-9123
† Math Assocs., Westbury, NY 11590 516-334-6800
3M Photodyne Products, Dynatel Systerms Division, Camarillo, CA 93010 ..... 805-388-8378;800-426-8688
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Ortel Corp., Alhambra, CA 91803 818-281-3636
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
§† SpecTran Corp., Sturbridge, MA 01566 508-347-2261
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397

Receivers, Field Intensity, Microwave — See Receivers, Microwave (Vol. D)

Receivers, Fixed Frequency-2900 — ***See Vol. D***

Receivers, Frequency Shift-1900 — ***See Vol. D***

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Receivers, Monitoring, Communications-1900 — ***See Vol. D***

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Receivers, Telemetry-1900 — ***See Vol. D***

Receivers, Tone-1900 — ***See Vol. D***

Receivers, TV — See Monitors, Video (Vol. D)

Receivers (MIL)-2440

† Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 ..... D•1067,1164
Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827, D•1077
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
California Microwave, Sunnyvale, CA 94086 408-732-4000
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-8220
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 ..... 800-336-5917;703-953-4751
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291

Receivers (MIL), Elint-2440

AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
M/A-COM Government Products, Inc., Hunt Valley, MD 21030 301-771-0077
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
ST Research Corporation, Newington, VA 22122 703-550-7000
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Receivers (MIL), ESM-2440

† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
ST Research Corporation, Newington, VA 22122 703-550-7000
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Receivers (MIL), Fiber Optic-2440

BT & D Technologies, Wilmington, DE 19803 302-479-0300
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459

Receivers (MIL), Radio-2440

Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827, D•1077
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 ..... 800-336-5917;703-953-4751
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Receivers (MIL), Surveillance-2440

Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827, D•1077
† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
M/A-COM Government Products, Inc., Hunt Valley, MD 21030 301-771-0077
† NAVAN Corporation, Media, PA 19063 215-543-8066
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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Recorders, Program Loading-2000 — ***See Vol. D***

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Recorders, Sound Level-1300 — ***See Vol. D***

Recorders, Strip Chart-3000 — ***See Vol. D***

Recorders, Transient-3000 — ***See Vol. D***

Recorders, Vibration-3000 — ***See Vol. D***

Recorders, Video-1900 — ***See Vol. D***

Recorders, X-Y — See Plotters X-Y (Vol. D)

Recorders (MIL), Magnetic Tape-2440

Penny & Giles Data Systems, Inc., Roswell, GA 30076, 404-740-0415 ..... D•1310
Phi Technologies, Inc., Oklahoma City, OK 73105, 405-521-9000 ..... D•1048-1049
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33418 407-622-3715
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
† Loral Data Systems, Data Recorders, Sarasota, FL 34230 813-371-0811
† Pacer Systems, Inc., Billercia, MA 01821 508-667-8800
† Reproduction Technologies Inc., Bristol, IN 46507-0518 219-848-5233
†# Sekai Electronics of America, Inc., La Mirada, CA 90638 714-670-1854

Recorders (MIL), RHAW-2440

† Analog Equipment Corporation, Palm Bch. Gardens, FL 33418 407-622-3715
† Loral Data Systems, Data Recorders, Sarasota, FL 34230 813-371-0811

Recording Systems (MIL)-2440

Phi Technologies, Inc., Oklahoma City, OK 73105, 405-521-9000 ..... D•1048-1049
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33418 407-622-3715
§† Astro-Med, Inc., W. Warwick, RI 02893 401-828-4000
† Image Graphics, Inc., Shelton, CT 06484 203-926-0100
† Loral Data Systems, Data Recorders, Sarasota, FL 34230 813-371-0811
† Pacer Systems, Inc., Billercia, MA 01821 508-667-8800
† Reproduction Technologies Inc., Bristol, IN 46507-0518 219-848-5233
§† Saylor Electronics Int'l, Inc., Carson City, NV 89706 702-883-4184
†# Sekai Electronics of America, Inc., La Mirada, CA 90638 714-670-1854

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Rectifiers, Surface Mount-4800 — *See Vol. A*

Rectifiers, Ultrafast-4800 — *See Vol. A*

Rectifiers (MIL), Semiconductor-2440

† Voltage Multipliers, Inc., Visalia, CA 93291, 209-651-1402 ..... A•2127
§† International Rectifier Corp., El Segundo, CA 90245 213-772-2000
† MagneTek Defense Systems, MagneTek, Inc., Anaheim, CA 92805 714-956-9200
§† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
§† Semtech, Newbury Park, CA 91320 805-498-2111
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600

Reducers, Speed — See Gear Heads & Speed Reducers (Vol. B)

Reels, Tape — See Tape Recording Accessories (Vol. D)

Reference Books — See Technical Books (Vol. D)

References, DC Voltage-2900 — *See Vol. D*

Refrigerants, Spray-1600 — *See Vol. C*

Refrigerated Cooling Equipment — See Air Conditioners (Vol. C)

Refrigerators, Environmental Test-2550 — *See Vol. D*

Regulators, Current-4000 — *See Vol. D*

Regulators, Frequency-4050 — *See Vol. D*

Regulators & References, Silicon-Also See Diodes, Zener & Stabistors-4800 — *See Vol. A*

Regulators & Stabilizers, Voltage-Also See Transformers, Voltage Regulating-4000 — *See Vol. D*

Regulators, Pulse-Width Modulating, Surface Mount-3130 — *See Vol. A*

Regulators, Voltage, Surface Mount-4800 — *See Vol. A*

Relays, Antenna — See Relays, RF (Incl. Antenna & Coaxial) (Vol. B)

Relays, Audio Operated — See Relays, Frequency Selective (Vol. B)

Relays, Coaxial — See Relays, RF (Vol. B)

Relays, Contact — See Relays, Power (Vol. B)

Relays, Cradle-4500

§ Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200 ..... B•1403
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1415,1419-1420
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... B•1464-1465
§ Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1572
§ Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
§ American Zettler, Aliso Viejo, CA 92656 714-831-5000
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000

Relays, Crystal Can, 1/2 Crystal Can-4500

† Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200 ..... B•1400-1401
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1432-1436
† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1467
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1012-1014,1482-1483
MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1551
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
† Babcock, Inc., Orange, CA 92667 714-633-3700
† Computer Components, Inc., Pelham, NY 10803 914-738-1611
§† Leach Corporation, Buena Pk., CA 90622-5032 714-739-0770
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
National Manufacturing Co., Inc., Chatham, NJ 07928 201-635-8346
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Wall, A. T., Co., Warwick, RI 02886 401-739-0740

Relays, Current Sensing-4500

† American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100 ..... B•1376-1377
§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 .. B•1404-1408
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1410-1413
§† Amperite Co., Inc., Union City, NJ 07087, 201-864-9503 ..... B•1414
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1415-1417
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
§ Cornell-Dubilier Electrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... B•1439
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441
§ CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 ..... A•2154
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1446
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1461
Fifth Dimension, Inc., Trenton, NJ 08638, 609-392-8350 ..... B•1468
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1012-1014,1482-1484
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 213-328-0060 ..... B•1492
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1493
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494
§† Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1360-1371
† Jennings, San Jose, CA 95122-2998, 408-292-4025 ..... B•1516
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1528,1534
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 ..... B•1538-1540
§ Midtex Relays, Inc., El Paso, TX 79936, 915-772-1061;1-800-MIDTEX1 ..... B•1546,1549
MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1551,1556
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1571-1572,1576
§† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 415-471-4717;800-221-7060 ..... B•1578
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
Trimble Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529 ..... B•1613
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Allec Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
† Babcock, Inc., Orange, CA 92667 714-633-3700
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Computer Components, Inc., Pelham, NY 10803 914-738-1611
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78759 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
Electronic Innovations Corp., Englewood, CO 80110 303-789-0424
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
§ Instrumentation & Control Sys. ICS,Inc., Addison, IL 60101 708-543-6200
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
§ Larson Instrument, Orangeburg, NY 10962 914-359-3800
Liberty Controls, Shorewood, IL 60435 815-725-2241
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Square D Co., Palatine, IL 60067 708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Wieland Inc., New Rochelle, NY 10801 914-633-0222
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

Relays, Differential-4500

§† Amperite Co., Inc., Union City, NJ 07087, 201-864-9503 ..... B•1414
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494
Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1527

§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1551
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
§ Action Instruments, San Diego, CA 92123 619-279-5726
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
Cardinal Control Co., Kensington, CT 06037 203-828-6379
† Computer Components, Inc., Pelham, NY 10803 914-738-1611
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
Genicom Corp., Waynesboro, VA 22980 703-949-1471
§ Larson Instrument, Orangeburg, NY 10962 914-359-3800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

Relays, Frequency Selective-4500

† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1467
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 ..... B•1545
MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1556
Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1572
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§† Leach Corporation, Buena Pk., CA 90622-5032 714-739-0770
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ McCurdy Radio Industries Limited, Toronto, Ont., CAN M4A 2L4 416-751-6262
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

Relays, General Purpose-4500

§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1410-1412
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1415,1418,1421
§ Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5200 ..... B•1429
C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1432-1438
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... B•1439
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441
§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1446
Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... B•1452
§ Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1456-1457
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•1614,1616, B•1464-1465
† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1467
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1468
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135, 408-922-9000 ..... B•1471-1480
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1012-1014,1482,1484-1485
§ Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... C•1386
§ Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000 ..... B•1486-1487
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1489
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 213-328-0060 ..... B•1492
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1493
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494
Hold-Heet Products Corp., Chicago, IL 60640, 312-728-4454;312-728-4455 ..... B•1501
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
International Rectifier Corp., El Segundo, CA 90245, 213-772-2000 ..... B•1507
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... B•1508-1510,1512-1515
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1527-1528
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 .. B•1541-1543
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ... B•1546
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 .. B•1551-1552,1554
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1558,1560,1564
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1760
§† Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... B•1584-1587
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1609-1612
Triridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529 ..... B•1613
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§ Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Babcock, Inc., Orange, CA 92667 714-633-3700
§ Brentek International, Inc., Hallam, PA 17406 717-755-8000
§ Buchanan, Amerace Corporation, Livingston, NJ 07039 201-992-8400
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 603-749-6434
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
§ Erni Components, Richmond, VA 23236 804-794-6367
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ Global Components & Controls, Eatontown, NJ 07724 201-389-1470
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§ Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
§ Interconnect Devices, Inc., Kansas City, KS 66106 913-342-5544
International Microelectronics, Arlington, TX 76003 817-561-2244
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Mallory Controls, Emerson Electric, Indianapolis, IN 46214 317-328-4010
Mouser Electronics, Mansfield, TX 76063 800-346-6873
NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
Opto 22, Huntington Bch., CA 92649 714-891-5861
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Relay Service Co., Chicago, IL 60651 312-252-2700
† Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209 516-737-0099
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 708-397-2600
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Tane Alarm Products, Floral Park, NY 11001 516-328-3351
§ T-Bar Data Switch Corp., Shelton, CT 06484 203-926-1801
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
§ TURCK Inc., Minneapolis, MN 55441-2656 ..... 612-553-9224;1-800-328-0580; 1-800-544-PROX
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

Relays, High Voltage (500 Volts & Over)-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 .. B•1404-1408
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1417,1420
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1399
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441-1443,1445
§ Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... B•1450
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1461
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1469
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 213-328-0060 ..... B•1492
Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1493
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494
International Rectifier Corp., El Segundo, CA 90245, 213-772-2000 ..... B•1507
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1517-1518
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;800-253-4650 ..... B•1520-1525
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1551
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... B•1559-1564
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1567-1569
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... B•1582
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589

Triridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529 ..... B•1613
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1118
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
§ Gordos, A Flint Industries Company, Rogers, AR 72756 501-636-5000
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§† Interconnect Devices, Inc., Kansas City, KS 66100 913-342-5544
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
§ Square D Co., Palatine, IL 60067 708-397-2600
Standex Electronics, Standex International, Cincinnati, OH 45209 513-671-3777

Relays, Hybrid-4500

§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1422
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1012-1014,1482-1483
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1527
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 ..... B•1536-1540
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 ..... B•1542
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§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1551
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-8391 ..... B•1582
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1610
Amex Electronics Corp., Gardena, CA 90248 213-532-1092
† Babcock, Inc., Orange, CA 92667 714-633-3700
Canyon Elctrns., Phoenix, AZ 85021 602-944-4421
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Control Engrg., Inc., West Springfield, MA 01089 413-781-1330
Coto Wabash, Kearney National Corporation, Providence, RI 02907 401-943-2686
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
§ Erni Components, Richmond, VA 23236 804-794-6367
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
§ Gordos, A Flint Industries Company, Rogers, AR 72756 501-636-5000
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
§ Midtex Relays, Inc., El Paso, TX 79906 ..... 915-772-1061;1-800-MIDTEX1
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Square D Co., Palatine, IL 60067 708-397-2600
§ T-Bar Data Switch Corp., Shelton, CT 06484 203-926-1801
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-820-4323;213-870-9831
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

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§ Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200 ..... B•1403
§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1404-1405,1407-1408
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1410-1412
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1415,1417,1419-1421,1426-1427
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1432-1433,1437-1438
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... B•1439
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1446
† Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1682
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... B•1464-1465
† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1467
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1468
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1012-1014,1482-1483
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 213-328-0060 ..... B•1492
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1493
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .. B•1509-1514
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1518-1519
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1527-1528,1530-1531
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 ..... B•1542
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 ..... B•1545
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1546,1549
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1551,1555
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1558-1560,1562,1564
§† Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1567-1569
§ Schrack Morth America Corp., Ronkonkoma, NY 11779-7605, 516-737-0600 ..... B•1571-1572,1575
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1609,1612
Triridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529 ..... B•1613
§ Action Instruments, San Diego, CA 92123 619-279-5726
Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501 ..... 213-328-0060;310-328-0060
† Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
Amerace Corp., Elastimold Div., Hackettstown, NJ 07840 201-852-1122
† Babcock, Inc., Orange, CA 92667 714-633-3700
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Chauvin Arnoux, Chauvin Arnoux France, Dover, NH 03820 603-749-6434
† Computer Components, Inc., Pelham, NY 10803 914-738-1611
Control Engrg., Inc., West Springfield, MA 01089 413-781-1330
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 201-694-8600
§ Dotrol Controls, Milwaukee, WI 53215 414-671-6800
§ Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
Fumas Elec., Batavia, IL 60510 708-879-6000
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-677-1311
§† Global Components & Controls, Eatontown, NJ 07724 201-389-1470
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-422-4837
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
† Kilovac Corp., Santa Barbara, CA 93140-4422 ..... 805-684-4560;800-253-4650
Liberty Controls, Shorewood, IL 60435 815-725-2241
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
Relay Service Co., Chicago, IL 60651 312-252-2700
† Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2826
§ Square D Co., Palatine, IL 60067 708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
Standex Electronics, Standex International, Cincinnati, OH 45209 513-671-3777
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ T-Bar Data Switch Corp., Shelton, CT 06484 203-926-1801
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§ TURCK Inc., Minneapolis, MN 55441-2656 ..... 612-553-9224;1-800-328-0580; 1-800-544-PROX
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440

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§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 .. B•1405-1408
§† C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430-1431
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1399
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Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1468-1469
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1493
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494
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§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ... B•1548
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1551,1556
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1562
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
Triridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529 ..... B•1613

† Babcock, Inc., Orange, CA 92667 714-633-3700
Comus International, Nutley, NJ 07110 201-667-6200
§ Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ EI & S, Prime Technology Inc., North Branford, CT 06471 203-481-5721
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§ Gordos, A Flint Industries Company, Rogers, AR 72756 501-636-5000
§ Graphics Microsystems, Inc., Dallas, TX 75225 ..... 214-340-4584;800-527-1207
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600

Relays, Meter-4500

Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 .. D•1359-1361
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 ..... B•1541
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1551
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1375,1376,2075
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1396-1397
A & D Elec. Instrs., Glendale, NY 11385 718-275-6516
Airpax Sensor Div., A North American Philips Co., Cheshire, CT 06410 .. 203-271-6000
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
§ Beckman Industrial Corp., An Affiliate of Emerson Elec. Co., San Diego, CA 92123-1898 619-495-3200
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
Calex Mfg. Co., Inc., Pleasant Hill, CA 94523 510-932-3911
Canyon Elctrns., Phoenix, AZ 85021 602-944-4421
Coto Wabash, Kearney National Corporation, Providence, RI 02907 401-943-2686
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
§ E.I.L. Instruments, Inc., Sparks, MD 21152 301-771-4800
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 516-334-0870
Gossen/Texmate, Vista, CA 92083-8397 619-598-9899
§† International Instruments, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
§ Jewell Electrical Instruments, Manchester, NH 03103 603-669-6400
§ Larson Instrument, Orangeburg, NY 10962 914-359-3800
§ LFE Instruments, Clinton, MA 01510-3099 508-835-1000
§ Martel Electronics, Salem, NH 03079 603-893-0886
§ Newport Electronics, Santa Ana, CA 92704-4426 ..... 714-540-4914;800-NEWPORT
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260

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§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1420-1422
Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5200 ..... B•1429
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... B•1439
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1446
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§ Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000 .. B•1486
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Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494,1500
International Rectifier Corp., El Segundo, CA 90245, 213-772-2000 ..... B•1507
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... B•1515
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1517
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1527-1529,1531
§ Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
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§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1547-1548
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1551
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ Klockner Moeller, Franklin, MA 02038 508-520-7080
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
§ Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

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Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1423-1425
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§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1489
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1534-1535
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§ Global Components & Controls, Eatontown, NJ 07724 201-389-1470
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831

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Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5200 ..... B•1429
§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1446
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1461
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1531
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 ..... B•1538-1539
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§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1547-1548
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1551
§† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 415-471-9717;800-221-7060 ..... B•1578-1579
Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... B•1582
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
† Babcock, Inc., Orange, CA 92667 714-633-3700
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
† Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
† Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

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Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200 ..... B•1400-1403
§† Amperite Co., Inc., Union City, NJ 07087, 201-864-9503 ..... B•1414
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1418,1420-1422
§ Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5200 ..... B•1429
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§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1432-1438
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1399
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§ Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1456-1457
§† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1467
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§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1012-1014,1482-1483
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§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
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§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
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§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1571-1576
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1581
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... B•1584-1587
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
§ Action Instruments, San Diego, CA 92123 619-279-5726
Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501 ..... 213-328-0060;310-328-0060
Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Altech Corp., Somerville, NJ 08876 908-707-8484
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§ American Zettler, Aliso Viejo, CA 92656 714-831-5000
§ Antex Electronics Corp., Gardena, CA 90248 213-532-3092
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Brentek International, Inc., Hatfam, PA 17406 717-755-8000
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 603-749-6434
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§ Global Components & Controls, Eatontown, NJ 07724 201-389-1470
Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
§ Gordos, A Flint Industries Company, Rogers, AR 72756 501-636-5000
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§ Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Liberty Controls, Shorewood, IL 60435 815-725-2241
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
Opto 22, Huntington Bch., CA 92649 714-891-5861
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Relay Service Co., Chicago, IL 60651 312-252-2700
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
§† Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
§ Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

Relays, Power-4500

§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1410-1413
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1415-1417,1419-1422,1427
§ Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5200 ..... B•1429
Cableform Inc., Troy, VA 22974, 804-589-8224 ..... D•1640
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430-1431
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1432-1438
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... B•1439
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441
§ Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... B•1450,1452
§ Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1456-1457
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1458-1461
† Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1682
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•1614, B•1464-1465
Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135, 408-922-9000 ..... B•1478-1480
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1012-1014,1482-1485
§ Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... C•1386
§ Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000 .. B•1487
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1489
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 213-328-0060 ..... B•1492
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1493
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494-1495,1498-1500
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
International Rectifier Corp., El Segundo, CA 90245, 213-772-2000 ..... B•1507
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .. B•1511,1515
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1517
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;800-253-4650 ..... B•1520-1525
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1527,1530-1531,1535
§ Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2212
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 .. B•1541-1543
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1546-1549
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 .. B•1551,1554,1556
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1560-1562,1564
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1567-1569
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1571-1576
Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 415-471-9717;800-221-7060 ..... B•1578
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... B•1582
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... B•1584-1587
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1605,1607-1608
Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501 ..... 213-328-0060;310-328-0060
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§ American Control Products, Div. of Precision Timer Co., Inc. Westbrook, CT 06498 203-399-6253
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Buchanan, Amerace Corporation, Livingston, NJ 07039 201-992-8400
Cardinal Control Co., Kensington, CT 06037 203-828-6379
† Compac, Holbrook, NY 11741 516-585-3400
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
Cross Electronics, Warrendale, PA 15086 412-776-1591
§ Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
§ Curtis Instruments, Inc., Mt. Kisco, NY 10549 914-666-2971
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
§ Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
§ Erni Components, Richmond, VA 23236 804-794-6367
† Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017 314-532-3505
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Liberty Controls, Shorewood, IL 60435 815-725-2241
§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Opto 22, Huntington Bch., CA 92649 714-891-5861
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700
Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

Relays, Printed Circuit Mounting (Incl. Transistor & DIP Case Types)-4500

Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501, 213-328-0060;310-328-0060 ..... A•2151
§ Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200 ..... B•1400-1403
§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 .. B•1404-1408

§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1410-1413
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1415-1421,1423-1427
§ Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5200 ..... B•1429
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1432-1438
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1399
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... B•1439
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441-1445
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1446,1448
§ Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... B•1450, 1452-1455
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1461
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•1614,1617, B•1464
Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1467
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1468-1469
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135, 408-922-9000 ..... B•1471-1480
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1012-1014,1482-1484
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1489
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 213-328-0060 ..... B•1492
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1493
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494-1500
Hold-Heet Products Corp., Chicago, IL 60640, 312-728-4454;312-728-4455 ..... B•1501
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
International Rectifier Corp., El Segundo, CA 90245, 213-772-2000 ..... B•1507
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .. B•1508-1515
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1516
Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;800-253-4650 ..... B•1521
Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1533
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 .. B•1541-1543
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1546-1549
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 .. B•1551-1552,1554
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1559-1560,1562-1564
§† Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1571-1574,1576
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1581
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... B•1584-1587
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1604-1608,1611
Tridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529 ..... B•1613
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
† Babcock, Inc., Orange, CA 92667 714-633-3700
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ Deltrol Controls, Milwaukee, WI 53215 414-671-6800
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
† Electro National Corp., Canton, MS 39046 601-859-5511
§ Erni Components, Richmond, VA 23236 804-794-6367
§ Global Components & Controls, Eatontown, NJ 07724 201-389-1470
§ Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
§ Gordos, A Flint Industries Company, Rogers, AR 72756 501-636-5000
§ Graphics Microsystems, Inc., Dallas, TX 75225 ..... 214-340-4584;800-527-1207
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§ Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Mallory Controls, Emerson Electric, Indianapolis, IN 46214 317-328-4010
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Opto 22, Huntington Bch., CA 92649 714-891-5861
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Silicon Power Cube Corp., Long Beach, CA 90805 213-634-9390
§ Solid State Relays, Oak Brook, IL 60521 708-932-1660
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
Thermosen, Inc., Allied Controls, Inc., Waterbury, CT 06705 203-757-4200
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

Relays, Programmable-4500

Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 ..... B•1541
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 ..... B•1545
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ... B•1547
MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... B•1556
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
Altech Corp., Somerville, NJ 08876 908-707-8484
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
Cardinal Control Co., Kensington, CT 06037 203-828-6379
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
CYTEC Corp., Penfield, NY 14526 ..... 716-381-4740;800-346-3117
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-677-1311
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Relays, RF (incl. Antenna & Coaxial)-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 .. B•1404-1408
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1417
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1432-1438
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1240
§† Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1682
† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1467
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1468
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1012-1014,1482-1484
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... B•1512
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1516,1518-1519
Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;800-253-4650 ..... B•1520-1524
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 ..... B•1545
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1558
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 .. B•1612
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
Compac, Holbrook, NY 11741 516-585-3400
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§ Gordos, A Flint Industries Company, Rogers, AR 72756 501-636-5000
§ Graphics Microsystems, Inc., Dallas, TX 75225 ..... 214-340-4584;800-527-1207
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
MarLee Switch Co., Upland, CA 91786 714-982-8988
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Nepenthe, Inc., Palo Alto, CA 94303 415-496-6666
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Thermosen, Inc., Allied Controls, Inc., Waterbury, CT 06705 203-757-4200
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831

Relays, Reed-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1404-1405,1407-1408
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1415-1417
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430-1431
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1399
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441-1444
§ Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1458,1461
§ EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 ..... B•1462-1463
§ Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000 .. B•1486
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1493

Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494,1496-1497
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 ..... B•1543
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 ..... B•1545
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1547-1548
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 .. B•1551,1554,1556
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... B•1562-1564
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1572,1574
§ Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1266
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
Triridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529 ..... B•1613
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0748 716-265-1600
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Continential Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
† Electro National Corp., Canton, MS 39046 601-859-5511
§ Electronic Applications Co., El Monte, CA 91734 818-442-3212
§ Erni Components, Richmond, VA 23236 804-794-6367
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ Graphics Microsystems, Inc., Dallas, TX 75225 ..... 214-340-4584;800-527-1207
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
§ Interconnect Devices, Inc., Kansas City, KS 66106 913-342-5544
International Microelectronics, Arlington, TX 76003 817-561-2244
† Jennings, San Jose, CA 95122-2696 408-292-4025
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
§ MKC Electronics Corp., Overland Park, KS 66215 913-894-9711
Mouser Electronics, Mansfield, TX 76063 800-346-6873
NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Solid State Relays, Oak Brook, IL 60521 708-932-1660
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
Tane Alarm Products, Floral Park, NY 11001 516-328-3351
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Thermosen, Inc., Allied Controls, Inc., Waterbury, CT 06705 203-757-4200

Relays, Reed, Surface Mount-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 .. B•1404-1408
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1425-1426
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1399
§ Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441
EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 ..... B•1462-1463
§ Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000 .. B•1486
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1493
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494,1496
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1571,1576
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Canyon Elctrns., Phoenix, AZ 85021 602-944-4421
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135 408-922-9000
International Microelectronics, Arlington, TX 76003 817-561-2244
Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777

Relays, Sealed-4500

† Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200 ..... B•1400-1401,1403
§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1404,1406-1408
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1410-1413
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1415-1417,1419-1420,1422,1426-1427
Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5200 ..... B•1429
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430-1431
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1432-1438
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1399
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... B•1439
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... B•1441
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1446
Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1456-1457
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1459-1461
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•1614-1617, B•1464-1465
† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1467
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1468-1469
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135, 408-922-9000 ..... B•1471-1479
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1012-1014,1482-1484
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1489
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 213-328-0060 ..... B•1492
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1493
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494-1496,1498-1500
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... B•1508-1511,1513-1515
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1518
Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;800-253-4650 ..... B•1520-1521,1523
Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1529,1531
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 .. B•1542-1544
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1546-1549
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1558-1561,1563-1564
§† Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1565
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1571-1572,1576
Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 415-471-9717;800-221-7060 ..... B•1578-1579
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1589
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1609-1612
Triridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529 ..... B•1613
Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501 ..... 213-328-0060;310-328-0060
§ Brentek International, Inc., Hallam, PA 17406 717-755-8000
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§ Global Components & Controls, Eatontown, NJ 07724 201-389-1470
§ Gordos, A Flint Industries Company, Rogers, AR 72756 501-636-5000
§† Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ T-Bar Data Switch Corp., Shelton, CT 06484 203-926-1801
Thermosen, Inc., Allied Controls, Inc., Waterbury, CT 06705 203-757-4200
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831

Relays, Solid State-4500

§ Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200 ..... B•1402
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1415,1422-1426
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1431
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 ..... A•2194
§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1446
§ Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... A•2086-2092, B•1450-1455
§ Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 .... B•1458-1460, D•1133
§ EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 ..... B•1462-1463
§ Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000 .. B•1487
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1489
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
§ International Rectifier Corp., El Segundo, CA 90245, 213-772-2000 ..... B•1507
International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 .... A•1731
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1527,1534-1535

Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 ..... **B•1540**
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 .. **B•1541-1544**
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 ..... **B•1545**
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... **B•1547-1549**
MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... **B•1551**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1760, C•1799**
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... **B•1565**
Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 415-471-9717;800-221-7060 ..... **B•1579**
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... **B•1581**
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... **B•1582**
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... **B•1589**
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... **B•1604-1608**
§ Action Instruments, San Diego, CA 92123 619-279-5726
Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Alpha Dist. Corp., Richfield, OH 44286 ..... 216-659-7100; 1-800-628-0841
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
Amerace Corp., Elastimold Div., Hackettstown, NJ 07840 201-852-1122
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
† Applied Controls Co., Inc., Fairfield, NJ 07004 201-227-5454
† Babcock, Inc., Orange, CA 92667 714-633-3700
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Coto Wabash, Kearney National Corporation, Providence, RI 02907 401-943-2686
Cross Electronics, Warrendale, PA 15086 412-776-1591
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
† Dionics, Westbury, NY 11590 516-997-7474
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ EDL, Inc., Danville, VA 24540 ..... 804-799-0807;1-800-DIAL EDL
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
Enerco, Inc., Seattle, WA 98108 206-762-1422
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
§ Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-677-1311
§ Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
§† Global Components & Controls, Eatontown, NJ 07724 201-389-1470
§ Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
International Microelectronics, Arlington, TX 76003 817-561-2244
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
Klockner Moeller, Franklin, MA 02038 508-520-7080
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
§ MKC Electronics Corp., Overland Park, KS 66215 913-894-9711
Motorola Inc., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., Northbrook, IL 60062 708-205-2867
Mouser Electronics, Mansfield, TX 76063 800-346-6873
National Controls Corp., W. Chicago, IL 60185 312-231-5900
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Opto 22, Huntington Bch., CA 92649 714-891-5861
Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
Phase Control Electronics, Glendale, NY 11385 718-441-4278
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
Prince Instruments, Inc., Southampton, PA 18966
§ Regent Controls, Inc., Shelton, CT 06484-0767 203-924-2924
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Solid State Relays, Oak Brook, IL 60521 708-932-1660
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
† TH Electronics, Orem, UT 84058 801-226-1383
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
§ Wheelock, Inc., Long Branch, NJ 07740 201-222-6880
Wieland Inc., New Rochelle, NY 10801 914-633-0222

Relays, Solid State, Surface Mount-4500

Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200 ..... **B•1402**
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... **B•1415,1417,1422**
Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... **A•2086-2092, B•1454-1455**
El & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 ..... **B•1462-1463**
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... **B•1464-1465**
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 .. **B•1541-1544**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1760**
Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... **B•1565**
§ Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
Midtex Relays, Inc., El Paso, TX 79906 ..... 915-772-1061;1-800-MIDTEX1
Opto 22, Huntington Bch., CA 92649 714-891-5861
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Wieland Inc., New Rochelle, NY 10801 914-633-0222

Relays, Stepping-4500

§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... **B•1432-1433,1437-1438**
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... **B•1551**
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... **B•1589**
§ Bellofram Corporation, Newell, WV 26050 ..... 304-387-1200;800-727-5646
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
§ Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
† Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Midtex Relays, Inc., El Paso, TX 79906 ..... 915-772-1061;1-800-MIDTEX1
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501

Relays, Telephone-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 .. **B•1404-1408**
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... **B•1430**
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... **B•1432-1438**
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... **B•1441**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... **B•1494**
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... **B•1511**
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... **B•1537**
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... **B•1571-1573,1576**
§ American Zettler, Aliso Viejo, CA 92656 714-831-5000
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Deltrol Controls, Milwaukee, WI 53215 414-671-6800
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
§† Interconnect Devices, Inc., Kansas City, KS 66106 913-342-5544
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Liberty Controls, Shorewood, IL 60435 815-725-2241
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Midtex Relays, Inc., El Paso, TX 79906 ..... 915-772-1061;1-800-MIDTEX1
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Wheelock, Inc., Long Branch, NJ 07740 201-222-6880

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§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... **B•1430**
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 ..... **B•1441-1443**
Hold-Heet Products Corp., Chicago, IL 60640, 312-728-4454;312-728-4455 ..... **B•1501**
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ... **B•1548**
§ MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 ..... **B•1551**
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... **B•1589**
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 ..... **B•1865**
WARREN G-V, GENERAL SIGNAL CORP., WHIPPANY, NJ 07981, 201-386-1200 ..... **B•1870**
Altech Corp., Somerville, NJ 08876 908-707-8484
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
Cambridge Aerofio, Inc., Shirley, MA 01464 508-45-2346
Douglas Randall, Pawcatuck, CT 06379 203-599-2075

§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Princo Instruments, Inc., Southampton, PA 18966
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Square D Co., Palatine, IL 60067 708-397-2600
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800

Relays, Time Delay-4500

§ **Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200** ..... B•1402
§† Amperite Co., Inc., Union City, NJ 07087, 201-864-9503 ..... B•1414
§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550** ..... B•1415
§ **Automatic Timing & Controls Co., King of Prussia, PA 19406, 215-337-5500;800-441-8245** ..... D•1128
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1446-1448
Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... B•1451
§ **Douglas Randall, Pawcatuck, CT 06379, 203-599-2075** ..... B•1458
† **Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000** ..... B•1467
Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1013,1492
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 213-328-0060 ..... B•1492
§ **Heinemann Electric Co., Lawrenceville, NJ 08648-0900, 609-882-4800** ..... B•1368-1371
Hold-Heet Products Corp., Chicago, IL 60640, 312-728-4454;312-728-4455 ..... B•1501
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550** ..... B•1502-1503
§ **Instrumentation & Control Sys., ICS,Inc., Addison, IL 60101, 708-543-6200** ..... B•1504-1505
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 ..... B•1527,1532-1532
§ Line Electric Products, Hanford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200** ..... B•1538-1540
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 .. B•1541,1544
§ **Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1** ..... B•1547-1549
§ **MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421** .. B•1551,1553,1556
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000** ..... B•1565
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621** ..... B•1567-1569
Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1571-1573,1576
† **Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 415-471-9717;800-221-7060** ..... B•1578-1579
§ **Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390** ..... B•1582
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500** ..... B•1589
WARREN G-V, GENERAL SIGNAL CORP., WHIPPANY, NJ 07981, 201-386-1200 ..... B•1870
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Air-O-Tronics, Trush, Inc., Cazenovia, NY 13035 315-655-2387
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§† Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
Amerace Corp., Elastimold Div., Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ Artisan Controls Corp., Parsippany, NJ 07054 201-428-1770
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Brentek International, Inc., Hallam, PA 17406 717-755-8000
§ Buchanan, Amerace Corporation, Livingston, NJ 07039 201-992-8400
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 201-694-8600
§ Cramer Co., Old Saybrook, CT 06475 800-247-6784
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
§ Deltrol Controls, Milwaukee, WI 53215 414-671-6800
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
Electronic Innovations Corp., Englewood, CO 80110 303-789-0424
§ Erni Components, Richmond, VA 23236 804-794-6367
§ Fumas Elec., Batavia, IL 60510 708-879-6000
§ Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-677-1311
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
† Jettron Products Inc., E. Hanover, NJ 07936 201-887-0571
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53223 414-358-4000
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
§ MKC Electronics Corp., Overland Park, KS 66215 913-894-9711
§ National Controls Corp., W. Chicago, IL 60185 312-231-5900
Nolatron, Harrisburg, PA 17111 717-564-3398
NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Regent Controls, Inc., Shelton, CT 06484-0767 203-924-2924
† Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 415-471-9717
† Sigmapower, Inc., Carson, CA 90746 ..... 213-02-Sigma
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Square D Co., Palatine, IL 60067 708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
† Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
§ Tenor Company, New Berlin, WI 53151 414-782-2900
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538 419-525-8500
Timeco, Inc., Huntington, WV 25705 304-523-6149
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
Trac Electronic Systems, Inc., Glendale, NY 11385 718-441-4769
§ TUROK Inc., Minneapolis, MN 55441-2656 ..... 612-553-9224;1-800-328-0580; 1-800-544-PROX
United Technologies Control Systems, Logansport, IN 47901 219-747-6142
§ Vanguard Relay Corp., Warwick, RI 02886 401-732-0700
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

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§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700** ..... B•1430
† **Jennings, San Jose, CA 95122-2696, 408-292-4025** ..... B•1518-1519
§ **Kilovac Corp., Santa Barbara, CA 93140-4022, 805-684-4560;800-253-4650** ..... B•1520-1525
§ **MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421** ..... B•1551
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621** ..... B•1567-1569
§ **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500** ..... B•1589
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
The Fredericks Company, Huntingdon Valley, PA 19006 215-947-2500
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600

Relays, Voltage Sensitive-4500

§ **Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200** ..... B•1403
§ **American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447** .. B•1404-1408
§ **American Zettler, Aliso Viejo, CA 92656, 714-831-5000** ..... B•1412
§† **Amperite Co., Inc., Union City, NJ 07087, 201-864-9503** ..... B•1414
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§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700** ..... B•1430
§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711** ..... B•1432-1438
† **Computer Components, Inc., Fellem, NY 11803, 914-758-1611** ..... B•1399
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1446
Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... B•1450,1452
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§† **Genicom Corp., Waynesboro, VA 22980, 703-949-1471** .. B•1013-1014,1482,1485
§ **Greyhill Inc., La Grange, IL 60525, 708-354-1040** ..... B•1489
§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000** ..... B•1493
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1494,1498
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1502-1503
§ **ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001** ..... B•1511
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770** ..... B•1531
§* **Line Electric Products, Hanford, CT 06141, 203-659-3573;1-800-331-1137** ..... B•1537
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200** ..... B•1538,1540
§ **Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1** ..... B•1547-1549
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§† **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000** ..... B•1565
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† **Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 415-471-9717;800-221-7060** ..... B•1578-1579
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244** ..... B•1584-1587
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500** ..... B•1589
WARREN G-V, GENERAL SIGNAL CORP., WHIPPANY, NJ 07981, 201-386-1200 ..... B•1870
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§ Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
§ Buchanan, Amerace Corporation, Livingston, NJ 07039 201-992-8400
Calex Mfg. Co., Inc., Pleasant Hill, CA 94523 510-932-3911
Canyon Elctrns., Phoenix, AZ 85021 602-944-4421
Cardinal Control Co., Kensington, CT 06037 203-828-6379

Control Engrg., Inc., West Springfield, MA 01089 413-781-1330
Coto Wabash, Kearney National Corporation, Providence, RI 02907 401-943-2686
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§† Electrol/Hamlin Inc., Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
§ Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
§ Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Larson Instrument, Orangeburg, NY 10962 914-359-3800
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Square D Co., Palatine, IL 60067 708-397-2600
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250 213-777-0077
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

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† **Allied Controls Incorporated, Waterbury, CT 06705-3827, 203-757-4200** ..... **B•1400-1401**
§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711** ..... **B•1432-1438**
† **Computer Components, Inc., Pelham, NY 10803, 914-738-1611** ..... **B•1399**
EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 ..... **B•1462-1463**
† **Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000** ... **B•1467,1626**
§† **Genicom Corp., Waynesboro, VA 22980, 703-949-1471** .. **B•1012-1014,1482,1485**
† **Jennings, San Jose, CA 95122-2696, 408-292-4025** ..... **B•1516,1519**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770** ..... **B•1527-1532**
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MSD, Inc., Magnecraft, Darlington, SC 29532, 803-393-5421 .. **B•1551,1555-1556**
§† **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000** ..... **B•1565**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500** ..... **B•1589**
§† **Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077** ..... **B•1604-1605,1609-1610**
† Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
Coto Wabash, Kearney National Corporation, Providence, RI 02907 401-943-2686
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
Kilovac Corp., Santa Barbara, CA 93140-4422 ..... 805-684-4560;800-253-4650
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077

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§ **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711** ..... **A•1840**
§ **Colber Corp., Irvington, NJ 07111, 201-371-9500** ..... **A•1883**
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... **A•1199,1906,1908**
§† **Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080** ..... **A•1899**
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... **A•1913**
§ **KOA Speer Electronics, Bradford, PA 16701, 814-362-5536** ..... **A•1934**
§ **KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210** ..... **A•1937-1938**
§† **Micro-Ohm Corp., Duarte, CA 91010, 818-3575377** ..... **A•1947**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1992**
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
§† International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
Mills Resistor Co., Los Alamitos, CA 90720 213-598-2454
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

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§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1908
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1897
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910
Elliott/Jordan, A Company of Vishay, Grand Junction, CO 81502, 619-690-2401 ..... A•1914-1915
† Imperial Astronics, Northridge, CA 91324, 818-886-7672 ..... A•1919-1921
§ Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1846
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1937-1938
Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ..... A•1979
† Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... B•1859
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1994
U.S. Sensor Corp., Orange, CA 92667, 714-639-7000 ..... B•1871
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
Colber Corp., Irvington, NJ 07111 201-371-9500
Degussa Corp., Temperature Sensing Products, So. Plainfield, NJ 07080
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Heraeus USA Ltd., Medina Grove, IL 60033 708-470-8440
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
§ Mills Resistor Co., Los Alamitos, CA 90720 213-598-2454
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§ RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1109 818-781-1642
Tepro of Florida, Clearwater, FL 33575 813-796-1044
† Thermometrics, Inc., Edison, NJ 08817-4695 908-287-2870
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300
Western Electm. Comps. Corp., Camarillo, CA 93010 805-482-8002
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791
§† YSI Incorporated, Yellow Springs, OH 45387 513-767-7241

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† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1837
Angstrohm Precision, Inc., A Company of Vishay, Hagerstown, MD 21740, 301-739-8722 ..... A•1844-1845
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1847
§† Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•1848-1849
Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1880
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1883
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1199,1900-1902,1905,1907
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1891,1894,1897-1899
Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910-1911
Elliott/Jordan, A Company of Vishay, Grand Junction, CO 81502, 619-690-2401 ..... A•1914-1915
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1913
† Imperial Astronics, Northridge, CA 91324, 818-886-7672 ..... A•1919,1921
International Manufacturing Services, Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1922
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1929
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1932
† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1936
Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1946
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1950
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ... A•1958,1960-1962
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965-1967
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1968-1970
† Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1027
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1975
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•1976-1977
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... A•1979-1980
Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... B•1859
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-6004 .. A•1986-1991
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1992-1995
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1997
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2001-2002,2004,2007,2076
§† Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
§† International Resistive Company, Boone, NC 28607 704-264-8861
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbolt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Nytron Inductors, Inc., Darlington, SC 29532 803-393-5421
† Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
Pico Electronics, Inc., Mt. Vernon, NY 10552 914-699-5514,800-431-1064
§† RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§† Tepro of Florida, Clearwater, FL 33575 813-796-1044
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567

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§ American Zettler, Aliso Viejo, CA 92656 714-831-5000
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000

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Mark Polarized Corp., Hauppauge, NY 11788 516-273-1122

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Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1342-1343
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 ..... 800-336-5917;703-953-4751
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600

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BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600 ..... B•1879
BEI Motion Systems Company, Digital Products Div., Little Rock, AR 72203, 501-851-4000 ..... B•1879
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 ..... B•1879
BEI Motion Systems Company, Itek Encoder Div., Needham Hgts., MA 02194, 617-455-1414 ..... B•1879-1880
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... B•1879
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1920, D•2243
U. S. Digital Corp., Vancouver, WA 98665, 206-576-0514;800-736-0194 (Sales) ..... B•1952-1955
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 .. 707-584-7558
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Data Technology, Inc., Woburn, MA 01811 617-935-8820
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
§† Dova Controls, Redmond, WA 98052-5165 206-881-7414
Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Encoder Products, Sandpoint, ID 83864 208-263-8541
The Fredericks Company, Huntingdon Valley, PA 19006 215-947-2500
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
§ Kistler Instruments Corp., Amherst, NY 14221-2171 716-691-5100
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
† Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
† Sundstrand Data Control Inc., Sundstrand Corporation, Redmond, WA 98073-9701 206-885-3711
† Teledyne Gurley, Troy, NY 12181 ..... 518-272-6300;800-759-1844
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
Trans-Tek, Ellington, CT 06029 203-872-8351

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Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1320-1321
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† EEV Inc., Elmsford, NY 10523 914-592-6050
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Loral Fairchild, Imaging Sensors, Milpitas, CA 95035 408-433-2500
PULNiX America, Inc., Sunnyvale, CA 94086 408-733-1560
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611

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† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751 ... B•1218-1220,1223
† Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ... B•1342-1343
Aborn Electronics Inc., San Jose, CA 95131 ... 408-436-5444
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 ... 908-464-3550
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089 ... 708-215-9600
Conax Buffalo Corporation, Buffalo, NY 14225 ... 716-684-4500
Dolan-Jenner Inds., Woburn, MA 01801 ... 617-935-7444
§ Efector, Inc., Exton, PA 19341 ... 215-524-2000;800-441-8246
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 ... 514-424-3300
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 ... 408-738-4266
Fiberoptic Systems, Inc., Simi Valley, CA 93063 ... 805-583-2088
§ FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ... 708-932-9380;800-468-6009
† Galileo Electro-Optics Corp., Sturbridge, MA 01566 ... 508-347-9191
Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 ... 203-677-1311
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 ... 918-438-7800
§ Hewlett-Packard Co., Cupertino, CA 95014 ... 800-752-0900
§ IDEC Corporation, Sunnyvale, CA 94089-2211 ... 408-747-0550
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 ... 219-465-2200
3M Photodyne Products, Dynatel Systerms Division, Camarillo, CA 93010 ... 805-388-8378;800-426-8688
3M Private Network Products, 3M, Austin, TX 78769-2963 ... 512-984-1800; 800-745-7459
MetriCor, Inc., Woodinville, WA 98072 ... 206-483-5577
Micro Switch, A Honeywell Div., Freeport, IL 61032 ... 815-235-6600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 ... 708-843-7900
§† Radiant Communications Corp., South Plainfield, NJ 07080 ... 908-757-7444
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
Scanning Devices, Inc., Waltham, MA 02154 ... 617-891-8991
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 ... 206-834-2500
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265 ... 515-225-6933
† Teledyne Ryan Electronics, San Diego, CA 92123 ... 619-560-6400
† Texas Optoelectronics, Inc., Garland, TX 75042 ... 214-487-0085
Transonic Systems Inc., Ithaca, NY 14850 ... 607-257-5300
§ Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 ... 409-693-5397
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187 ... 315-685-8945
† York Technology, Inc., Burbank, CA 91502 ... 818-955-8927

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§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ... B•1319
§ Industrial Computer Designs, Inc., Westlake Village, CA 91361, 818-889-3179;800-423-3179 ... D•1179
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ... B•1323
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ... B•1341
† Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ... B•1342-1343
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ... B•1345
Aborn Electronics Inc., San Jose, CA 95131 ... 408-436-5444
§ Allegro MicroSystems. Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 ... 508-795-1300
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 ... 908-464-3550
§ CCD Imaging, Fairchild Weston Systems, Inc., Milpitas, CA 95035 ... 408-433-2500
EG&G Gamma Scientific. Div. of EG&G Inc., San Diego, CA 92123 ... 619-279-8034
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 ... 408-738-4266
Fiberoptic Systems, Inc., Simi Valley, CA 93063 ... 805-583-2088
§ FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ... 708-932-9380;800-468-6009
General Numeric Corporation, Elk Grove Village, IL 60007 ... 708-640-1595
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Ramsey, NJ 07446 ... 201-825-9696
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN ... 0534-52-2141
Hecon Corp., Eatontown, NJ 07724 ... 908-542-9200
§† Honeywell Microswitch Div., Richardson, TX 75081 ... 214-470-4271
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ... 201-291-0500;800-631-2165
LEL Co., Cresskill, NJ 07626 ... 201-569-8641
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 ... 219-465-2200
Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB ... 0264-324155
NEC Electronics, Inc., Mountain View, CA 94039 ... 415-960-6000
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 ... 708-843-7900
§ Optek Technology Inc., Carrollton, TX 75006 ... 214-323-2200
Opto Diode Corp., Newbury Park, CA 91320 ... 805-499-0335
Opto Technology, Inc., Wheeling, IL 60090 ... 708-537-4277
Philips Components Discrete Products Division, Mineral Wells, TX 76067 ... 817-325-7871
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
Rodann Electronics Mfg. Co., Brea, CA 92621 ... 714-529-1301;800-366-7010
Scanning Devices, Inc., Waltham, MA 02154 ... 617-891-8991
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717
† Silicon Sensors, Dodgeville, WI 53533 ... 608-935-2707
† Texas Optoelectronics, Inc., Garland, TX 75042 ... 214-487-0085
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 ... 201-575-5586
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187 ... 315-685-8945

Sensors, Liquid Flow-5500

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 ... B•1878
Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ... B•1683
ABB Kent-Taylor Inc., ASea Brown Boveri, Rochester, NY 14692 ... 716-235-5000
A M Sensors, Inc., Salem, NH 03079 ... 603-898-1543
† Computer Instruments Corp., Westbury, NY 11590 ... 516-476-8400
§ Efector, Inc., Exton, PA 19341 ... 215-524-2000;800-441-8246
E-T-A Circuit Breakers, Chicago, IL 60648 ... 708-647-8303
Fluid Components, Inc., San Marcos, CA 92069 ... 619-744-6950
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 ... 203-677-1311
† Intek, Inc., Westerville, OH 43081 ... 614-895-0301
Johnson Yokogawa Corp., Newnan, GA 30265 ... 404-254-0400
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 ... 305-973-6166
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 ... 815-235-6600
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 ... 609-589-7500
† Thermometrics, Inc., Edison, NJ 08817-4695 ... 908-287-2870
Transonic Systems Inc., Ithaca, NY 14850 ... 607-257-5300

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§ Contaq Technologies Corp., Bristol, VT 05443, 802-453-3332 ... B•1889
Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ... B•1683
A M Sensors, Inc., Salem, NH 03079 ... 603-898-1543
† Computer Instruments Corp., Westbury, NY 11590 ... 516-476-8400
Conax Buffalo Corporation, Buffalo, NY 14225 ... 716-684-4500
Fluid Components, Inc., San Marcos, CA 92069 ... 619-744-6950
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 ... 203-677-1311
Gordon Products, Brookfield, CT 06804 ... 203-775-4501
§ Hamlin Inc., Lake Mills, WI 53551 ... 414-648-3000
Intek, Inc., Westerville, OH 43081 ... 614-895-0301
Lundahl Instruments, Inc., Ezra C. Lundahl Inc., Logan, UT 84321 ... 801-753-7300
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 ... 815-235-6600
Schlumberger Industries, Tranducers Div., Houston, TX 77082 ... 713-558-2587
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 ... 919-677-0100
§ TURCK Inc., Minneapolis, MN 55441-2656 ... 612-553-9224 1-800-328-0580 1-800-544-PROX

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§ Elan Technical Corp., Fairfield, CT 06430 ... 203-335-2115
Hokuriku USA Ltd., Morton Grove, IL 60053 ... 708-470-8440
§ Hy-Cal Engineering, El Monte, CA 91731 ... 818-444-4000
§ Moisture Register Products Div., Aqua Measure Instrument Co., LaVerne, CA 91750-0369 ... 714-392-5833
MULTISENS Inc, Laval, Que., CANADA H7S 2E8 ... 514-629-5646
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
Primo Company Limited, Tokyo, JAPAN 181 ... 0422-43-3121
Princo Instruments, Inc., Southampton, PA 18966
§ S-Products Inc., Fairfield, CT 06430 ... 203-331-9546
Stephens Analytical, Inc., Montreal, Que., CA H4S 1L1 ... 514-332-1230

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Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717

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§ RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ... A•1982
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Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 ... 714-858-9488
§ Elan Technical Corp., Fairfield, CT 06430 ... 203-335-2115
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 ... 800-422-4342
Gordon Products, Brookfield, CT 06804 ... 203-775-4501
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007 ... 215-781-0700; 800-523-8989
MetriCor, Inc., Woodinville, WA 98072 ... 206-483-5577
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 ... 815-235-6600
§ TEGAM, Inc., Madison, OH 44057 ... 800-666-1010

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§ B & B Motor & Control Corp, B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
§† Berg, W. M., Inc., East Rockaway, NY 11518 516-599-5010
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571

§ Machine Components Corp., Plainview, NY 11803 516-694-7222
§† Norelcom Inds., Farmingdale, NY 11735 516-249-7245
§ PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300

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† **Ad-Vance Magnetics, Inc., Rochester, IN 46975, 219-223-3158** ..... **C•1686**
§† **Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886** ..... **C•1723**
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† **GSI Corp., Timonium, MD 21093, 410-252-1768** ..... **C•1757**
† **Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136, 717-424-8510** ..... **B•1018, C•1697**
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§† Daburn Electronics & Cable Corp., Northvale, NJ 07647 201-768-5400
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-574-5400
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
† Magnetic Radiation Labs, Itasca, IL 60143 708-285-0800
† Maine Poly, Inc., Greene, ME 04236 207-946-7440
§† Parker Seal Group, Irvine, CALIFORNIA 92715 714-851-3763
Tech-Etch, Inc., Plymouth, MA 02360 508-747-0300

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§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Swedlow, Inc., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800

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† Aydin Corp., Horsham, PA 19044 215-657-7510
Berkeley Nucleonics Corp., Richmond, CA 94804 510-234-1100
California Microwave, Sunnyvale, CA 94086 408-732-4000
Cober Electronics, Stamford, CT 06902 203-327-0003
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-4858 818-882-6333
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060 703-552-2111
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
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† Lucas Zeta, Inc., Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
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† Republic Electronics Co., Hauppauge, NY 11788 516-273-9800
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
ST Research Corporation, Newington, VA 22122 703-550-7000
§† Sysiron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300

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† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
Intronics, Inc., Canton, MA 02021 617-828-4992
† Locus, Inc., State College, PA 16804 814-466-6275
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† Republic Electronics Co., Hauppauge, NY 11788 516-273-9800
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
ST Research Corporation, Newington, VA 22122 703-550-7000
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† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751** ..... **B•1218-1220,1283-1291**
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† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060 703-552-2111
§ HBM, Inc., Marlboro, MA 01752 508-624-4500
† Kirkwood Industries Inc., Cleveland, OH 44135 216-267-6200
The J. M. Ney Company, Bloomfield, CT 06002 203-242-2281
† Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
§† Superior Carbon Products, Inc., Walnut Grove, MS 39189 601-253-2442
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
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§† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
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§† Garry Electronics an LPL Co., Langhorne, PA 19047 215-949-2300
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
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§ Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240
†# Spectrum Devices, Sugar Land, TX 77478-2420 713-242-6417
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§ Voltarc Technologies, Inc., Fairfield, CT 06430 203-255-2633
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1720
§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
Andon Elctrns. Corp., Lincoln, RI 02865, 401-333-0388 ..... C•1279
§ Aries Electronics, Frenchtown, NJ 08825, 908-996-6841 ..... C•1281,1284
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703, 508-222-2202 ..... C•1290
Connector Corp., Chicago, IL 60646, 312-539-3108 ..... C•1327
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... C•1332-1333
Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 ..... B•1150
§† Jan Hardware Mfg. Co., Melville, NY 11747, 718-361-0800 ..... C•1588
Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571 ..... C•1405
Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1179
Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188,1193-1195
Texas Instruments, Connector System, Attleboro, MA 02703, 508-699-5269;508-699-3450 ..... C•1150,1551-1555
U.S. Terminals Inc., Cincinnati, OH 45243, 513-561-8145 ..... C•1563
† EBY Company, Philadelphia, PA 19124 215-537-4700
EDA Inc., Div. of Connector, La Habra, CA 90631 213-697-7151
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Garry Electronics an LPL Co., Langhorne, PA 19047 215-949-2300
Mark Eyelet Inc., AMP, Inc., Wolcott, CT 06716 203-756-8847
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 03-3471-8548
§† PCD, Peabody, MA 01960 508-532-8800
§† Precicontact, Inc., Langhorne, PA 19047 215-757-1202
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500
§† Wells Electronics, Inc., South Bend, IN 46613 219-287-5941

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Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
Assembly Specialists, Chelmsford, MA 01824 508-250-5900
† CAD Engrg. & Assembly Inc., Mentor, OH 44060 216-255-7744
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§† Chemtronics Inc., Hauppauge, NY 11788 ..... 516-582-3322;800-645-5244
§† Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081 201-467-8100
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407 914-241-1008
† Fusion Inc., Willoughby, OH 44094 216-946-3300
§† Gardiner Solder Co., Div. of Gardiner Metal Co., Chicago, IL 60632 312-847-0100
† GSI Corp., Timonium, MD 21093 410-252-1768
§† Metcal, Inc., Menlo Park, CA 94025 415-325-3291
† Miller, L.C., Co., Monterey Pk, CA 91754 213-268-3611
Multicore Solders, Richardson, TX 75081 214-238-1214
§† OK Industries, Inc., Yonkers, NY 10701 914-969-6800
§† Reade Advanced Materials, Riverside, RI 02915-0039 401-433-7000
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 213-316-9984

Solenoids, Linear-4550

† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2186, B•1615
Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ... B•1438
§ Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1616-1619
§ Detroit Coil Co., Ferndale, MI 48220, 313-398-5600 ..... B•1620
§† Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641, 312-283-4000 ..... B•1621-1623
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† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1626
Liberty Controls, Shorewood, IL 60435, 815-725-2241 ..... B•1627
§† Linear Motions Co., Valinda, CA 91744, 818-918-7806 ..... B•1628
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1629,1631
§† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ..... B•1633
§ Regdon Solenoid, Inc., Westmont, IL 60559, 708-789-0600 ..... B•1634-1637
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
Copal (USA), Inc., Torrance, CA 90501 213-618-0225
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
§† Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
Dynalloy, Inc., Irvine, CA 92715 714-476-1206
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
The Five Star Co., Plantsville, CT 06479 203-628-5561
§ Global Components & Controls, Eatontown, NJ 07724 201-389-1470
§ Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
Harting Elektronik, Inc., Hoffman Estates, IL 60195 708-519-7700
† IMC Magnetics Corp., Arizona Div., Tempe, AZ 85281 602-968-4441
Infranor, Naugatuck, CT 06770 ..... 203-729-8258;800-BE-SERVO
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
†# United States Electronics, Springfield, NJ 07081 201-912-0111
† West Coast Elec. Mfg., Paramount, CA 90723 213-633-1010

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Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1616-1619
Detroit Coil Co., Ferndale, MI 48220, 313-398-5600 ..... B•1620
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1629-1630
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† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
† Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200

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Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ... B•1438
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† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1537
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1629-1631
§† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ..... B•1633
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§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
§† Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
§ Global Components & Controls, Eatontown, NJ 07724 201-389-1470
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200

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Detroit Coil Co., Ferndale, MI 48220, 313-398-5600 ..... B•1620
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641, 312-283-4000 ..... B•1621-1623
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1629

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† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
§† Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081 201-467-8100
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
† IMC Magnetics Corp., Arizona Div., Tempe, AZ 85281 602-968-4441
† Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
† OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200

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Sonar Systems-2440

Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000

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Source & Detector Assemblies (SDAs)-3700

Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
Silonex Inc., Plattsburgh, NY 12901 518-561-3160
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

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Connector Corp., Chicago, IL 60646, 312-539-3108 ..... C•1326
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1942
§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170 ..... B•1385
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•1153
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030

§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
EG&G, Inc., Electronics Components Div., Salem, MA 01970 508-745-3200
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
§ Hobson Bros., Chicago, IL 60630-3884 312-283-3600
Ion Physics Co., Atkinson, NH 03811 603-893-6687
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
† Joslyn Electronic Systems, Goleta, CA 93116 ..... 800-752-8068; 805-968-3551
† Lightning Protection Corp., Santa Barbara, CA 93160 ..... 805-967-5089/4577
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043

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Accusonic Systems Corp., A DSG Company, New Hyde Park, NY 11040 516-328-3300
§† Audiosone, Inc., Stratford, CT 06497 203-377-4475
§† MG Electronics, Hauppauge, NY 11788 516-582-3400
† MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409 612-825-1010
† Oaktron Corporation, Mtx, Monroe, WI 53566 608-328-5560
§ Poly-Planar Inc., Warminster, PA 18974 215-675-7805
† Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757 ..... 516-957-8700; 800-645-5516
† Telectro Systems Corp., Corona, NY 11368 718-651-8900

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AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
† Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1217
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
# Clifford of Vermont, Inc., Bethel, VT 05032 ..... 802-234-9921;800-451-4381
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
† Power Technology, Inc., Little Rock, AR 72219-1117 501-568-1995
§ Shattuck Industries, Ben Lomond, CA 95005 408-336-5145
§† Western Electronic Products Co., San Clemente, CA 92672 714-492-4677

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Splices, Fiberoptic-2475

† Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1217
§† AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
§ Electronic Components & Matls. Div., GTE Products Corp., Warren, PA 16365 814-723-2000
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080 201-769-3200
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459

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§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
Power Functions Engineering, Garland, TX 75042 214-278-0996
§ Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397

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Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1252
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1361,1363
Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564 ..... B•1275

Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635, 602-459-1150 ..... B•1280-1282
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1312
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1314
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1318
ADVANCED MICRO SYSTEMS, INC., Hudson, NH 03051-4920 603-882-1447
Airpax-International Division, A North American Philips Co., Cheshire, CT 06410 203-271-6000
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042 516-488-6700
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 .. 707-584-7558
§ Daedal, Harrison City, PA 15636 412-744-4451
Design Components, Inc., Franklin, MA 02038 ..... 508-528-7300;800-341-4811
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
† Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
§ Empire Magnetics, Rohnert Park, CA 94928 707-584-2801
Escap Products, Hauppauge, NY 11788 516-234-3900
General Controls, Inc., Elk Grove Village, IL 60007 312-595-2152
Maxwell Electronics, Research Triangle Park, NC 27609 919-846-1633
Oriental Motor USA Corp., Super Vexta, Torrance, CA 90505-5217 213-515-2264
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400

Steppers, Indexing, Switch-5100

† Machine Components Corp., Plainview, NY 11803 516-694-7222
§ ServoByte Inc., Millbury, MA 01527 508-865-0225

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Amber Inds., Inc., Dallas, TX 75379, 214-490-9801 ..... B•1351
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•1170
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1569 ..... D•1659
† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2185-2186
Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... C•1330
Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... B•1840-1841
Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... B•1367
GRIM Corporation, Medford, NJ 08055-0968, 609-267-7950 ..... D•1075
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... D•2201
Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525 ..... D•2203
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1075
§ ITW Paktron, Div. of Illinois Tool Works, Lynchburg, VA 24502, 804-239-6941 ..... A•1076-1077
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1849-1850
L-Com Inc., N. Andover, MA 01845, 508-682-6936 ..... C•1424
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1086,1089,1942-1944
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2212-2213
§† MCG Elctrns., Deer Park, NY 11729, 516-586-5125 ..... B•1375-1376
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118-2119
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170 ..... B•1385
PPD, Inc., Raleigh, NC 27613, 919-781-3955 ..... B•1386-1387
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2224
Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... A•1638
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 ..... B•1391
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1867
Todd Products Corp., Brentwood, NY 11717, 516-231-3366 ..... D•2077
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... A•1646-1647
Wickmann USA, Inc., Wickmann-Werke GmbH, Atlanta, GA 30331, 404-699-7820 ..... B•1392-1394
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•2128-2129
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 .. 919-738-1121
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
§ Atlantic Scientific Corporation, Melbourne, FL 32901 1-800-544-4737
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Brooks Electronics, Philadelphia, PA 19140 215-228-4433
§† Brooks Power Systems, Bensalem, PA 19020 ..... 215-244-0264;1-800-523-1551
§† Bud Industries, Inc., Willoughby, OH 44094-0431 216-946-3200
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
§ Computerware, Inc., Vienna, VA 22182-2266 703-621-8200
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Cuesta Systems Corporation, San Luis Obispo, CA 93401 ..... 805-541-4160; 800-332-3440
§† Current Technology, Inc., Richardson, TX 75081-4802 214-238-5300
§ The Cyltc Corporation, Westlake VL, CA 91361 805-379-3155
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
§ Datatran Corp., Denver, CO 80223 303-778-0870
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
Dowty Control Technologies, Boonton, NJ 07005-0239 201-334-3100
§ Dynatech Computer Power, Inc., Scotts Valley, CA 95066 408-438-5760
† EEV Inc., Elmsford, NY 10523 914-592-6050
§† EFI Elctrns., Salt Lake City, UT 84119 ..... 801-977 9009;800-221-1174
U.S. Elco Inc., Santa Clara, CA 95054 ..... 1-800-888-ELCO
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921 401-943-1164
§ Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Entrelec Div/GEC Alsthom International, Inc., Irving, TX 75038 214-550-9025
§ E.P.D./General Power Corp., Anaheim, CA 92805-8508 ..... 714-520-0881; 1-800-343-1813
§ FIC Corp., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
GBC, Inc., Lamp Division, Ocean, NJ 07712 908-774-8502
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
§† General Semiconductor Ind., Inc., Square D Company, Tempe, AZ 85281 602-968-3101
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136 717-424-8510
† International Power Machines, Garland, TX 75042 800-527-1208
Inter-Technical Group inc., WIMA Div., Elmsford, NY 10523 914-347-2474
§† JMK, Inc., Amherst, NH 03031 603-886-4100
† Joslyn Electronic Systems, Goleta, CA 93116 ..... 800-752-8068; 805-968-3551
§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359 215-837-0700
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
Ketema/Rodan Division, Anaheim, CA 92806 714-630-0081
† Lightning Protection Corp., Santa Barbara, CA 93160 ..... 805-967-5089/4577
Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
Magnetek Triad, Huntington, IN 46750 219-356-7100
Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
North Hills Electronics Inc., Power Products Div., Glen Cove, NY 11542-3796 516-671-5700
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Omega Engineering, Stamford, CT 06907 800-826-6342
† Pacific Power Source Corp., Huntington Bch., CA 92649 .. 714-898-2691;800-854-2433
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Perma Power Elctrns., Chicago, IL 60648 312-763-0763
Phase Control Electronics, Glendale, NY 11385 718-441-4278
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§† Power Integrity Corp., Greensboro, NC 27429-0682 ..... 919-379-9773;800-237-6260
§ Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO 519-696-2616
Sanford-Miller Corp., Lynbrook, NY 11563 ..... 516-593-2025;800-645-5900
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308

Semtech, Newbury Park, CA 91320 ... 805-498-2111
§ Shape Electronics, Inc., Lombard, IL 60148 ... 708-620-8394
Shindengen America Inc., Westlake Vl, CA 91361 ... 800-634-3654
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 ... 201-321-3400
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ... 609-866-8888;800-257-8384
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 ... 708-439-2800
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
Square D Co. Power Protection Systems, San Diego, CA 92123-1165 ... 619-279-0831
Staffall Inc., Cranston, RI 02910 ... 401-461-5554
Stetron International, Inc., Buffalo, NY 14203 ... 716-854-3443
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 ... 812-332-1435
§ Sunshine Instruments, Philadelphia, PA 19115 ... 215-673-5600;800-343-1199
§† Superior Electric, Bristol, CT 06010 ... 203-582-9561
§† Surgeonics Limited, Fort Edward, NY 12828 ... 518-747-2156
Sutton Designs, Inc., Ithaca, NY 14850 ... 800-326-8119
Sylvania GTE Control Devices, Standish, ME 04084 ... 207-642-4535
§ Teccor Electronics, Inc., Irving, TX 75038 ... 214-580-1515
§ Techni-Tool, Plymouth Meeting, PA 19462 ... 215-825-4990
§ Telebyte Technology, Inc., Greenlawn, NY 11740 ... 516-423-3232;800-835-3298
Texas Instruments, Connector System, Attleboro, MA 02703 ... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 ... 508-699-3800
§ TII Industries Inc., Copiague, NY 11726 ... 516-789-5000
§† Transtector Systems, Inc., Hayden Lake, ID 83835 ... 800-829-2901
§ Tripp-Lite, Chicago, IL 60610-4188 ... 312-329-1777
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 ... 403-259-3200
§ U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 ... 213-316-9984
Victoreen, Inc., Solon, OH 44139-3395 ... 216-248-9300;216-248-9043
† Victor Elec. Wire & Cable, W. Warwick, RI 02893 .. 401-821-1700;SALES 401-821-7800
Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
† The Wiremold Company, W. Hartford, CT 06110 ... 203-233-6251
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 ... 619-727-0940

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Surveillance (MIL), EW Drone-2440

§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277 ... 213-316-4114
ST Research Corporation, Newington, VA 22122 ... 703-550-7000

Surveillance Systems (MIL)-2440

AEL Defense Corp., Lansdale, PA 19446 ... 215-822-2929
† Cohu, Inc., Elctrns. Div., San Diego, CA 92123 ... 619-277-6700
† Condor Systems, Inc., San Jose, CA 95124 ... 408-371-9580
† Corvus Microwave Inc., Syracuse, NY 13211-2100 ... 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 ... 213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ... 214-470-2137
† E-Systems, Greenville Div., Greenville, TX 75403-6056 ... 903-455-3450
M/A-COM Government Products, Inc., Hunt Valley, MD 21030 ... 301-771-0077
† NAVAN Corporation, Media, PA 19063 ... 215-543-8066
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000
† Teledyne Ryan Electronics, San Diego, CA 92123 ... 619-560-6400

Switch Arrays-5100

CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ... B•1669-1672
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ... B•1673
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514, 219-295-3575 ... B•1676-1677
Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ... B•1686
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ... C•1584
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ... B•1698-1699
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ... B•1815
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ... B•1818
Lucas Duralith Corporation, Millville, NJ 08332, 609-825-6900 ... B•1822
McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ... B•1735
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ... B•1743
MOLEX, Inc., Lisle, IL 60532, 708-969-4550 ... C•1474
Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ... B•1784,1786
Amber Inds., Inc., Dallas, TX 75379 ... 214-490-9801
§ Dreefs Switch, Inc., Waukegan, IL 60087 ... 708-662-7667;800-323-9605
§† EECO Incorporated, Santa Ana, CA 92702-0659 ... 714-835-6000
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ... 214-470-2137
Lamb Industries, Inc., Portland, OR 97225 ... 503-297-8878;800-824-9374
† Machine Components Corp., Plainview, NY 11803 ... 516-694-7222
MarLee Switch Co., Upland, CA 91786 ... 714-982-8988

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† Advanced Systems Concepts, Inc., Altadena, CA 91001, 818-791-0983 .. D•1144
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ... B•1656
§ Altech Corp., Somerville, NJ 08876 ... 908-707-8484
§ Cole Hersee Co., Boston, MA 02127-2467 ... 617-268-2100
§ COMCAB, Nashport, OH 43830 ... 614-828-2468
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921 ... 401-943-1164
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA ... 2615567-68;2613521-22-23
Lamb Industries, Inc., Portland, OR 97225 ... 503-297-8878;800-824-9374
† Machine Components Corp., Plainview, NY 11803 ... 516-694-7222

Switches, Cam-5100

§ Altech Corp., Somerville, NJ 08876, 908-707-8484 ... B•1643
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ... B•1652-1653
Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ... B•1656
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ... B•1662
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ... B•1694
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800 .... B•1711
J. R. Merritt Controls, Inc., Norwalk, CT 06854, 203-855-9100;800-333-5762 ... D•1139
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ... B•1738
† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ... B•1766
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ... B•1769
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ... B•1789
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ... 915-592-4888;800-592-4888
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 ... 414-382-2000
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 ... 203-399-6253
Astrosystems, Lake Success, NY 11042 ... 516-328-1600
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 ... 508-685-4371
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ... 215-337-5500; 800-441-8245
§ Chicago Lock Co., Chicago, IL 60641 ... 312-282-7177
† Cole Instrument Corp., Santa Ana, CA 92704 ... 714-556-3100
† Computer Conversions Corp., E. Northport, NY 11731 ... 516-261-3300
§ Dreefs Switch, Inc., Waukegan, IL 60087 ... 708-662-7667;800-323-9605
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
Enprotech Corp., Kalamazoo, MI 49007 ... 616-381-0665
† EnTech Corporation, Simsbury, CT 06070 ... 203-658-2740;203-651-9557
§ Entrelec Div/GEC Alsthom International, Inc., Irving, TX 75038 ... 214-550-9025
Ghielmetti, Inc., Westlake Village, CA 91361 ... 800-228-1097
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634 ... 312-282-4040
§† Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 ... 312-421-1090
Maxmar Controls Inc., Pleasantville, NY 10570 ... 914-747-3540
† Precision Mechanisms, Westbury, NY 11590 ... 516-ED3-5955
Relay Service Co., Chicago, IL 60651 ... 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
† RLC Electronics, Inc., Mt. Kisco, NY 10549 ... 914-241-1334
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 ... 919-266-3671
Techniques, Inc., Englewood, NJ 07631 ... 201-569-5900

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American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ... B•1645
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ... B•1646-1647
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ... B•1662
§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ... B•1675
§† Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1680
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ... B•1689-1692
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ... B•1699,1705
§ Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... B•1817
§ IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 ... B•1722-1723
† Janco Corp., Burbank, CA 91508, 818-846-1800 ... B•1726-1727
† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ... A•2051
Mepcopal Company, San Diego, CA 92121, 619-453-0332 ... B•1737
MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ... B•1745
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ... B•1746,1748-1751
§† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ... B•1755
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ... B•1789
Airflyte Elctrns. Co., Bayonne, NJ 07002 ... 201-436-2230
§ Alps Electric (USA), Inc., San Jose, CA 95134 ... 408-432-6000
Augat Inc., Attleboro, MA 02703 ... 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 ... 508-685-4371
§ C & K Components, Inc., Newton, MA 02158-1082 ... 617-964-6400
† Cole Instrument Corp., Santa Ana, CA 92704 ... 714-556-3100
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 ... 708-952-8800
CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
CTS Corporation, Microelectronics business unit, W. Lafayette, IN 47906 ... 317-463-2565
§† EECO Incorporated, Santa Ana, CA 92702-0659 ... 714-835-6000
ELMA Electronic Inc., Fremont, CA 94538 ... 415-656-3400

E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Enerco, Inc., Seattle, WA 98108 206-762-1422
§ Emi Components, Richmond, VA 23236 ..... 804 794-6367
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ Inter-Market, Glenview, IL 60025 708-729-5330
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
† Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
§ Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Standard Gingsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
TELTEC, INC., Minneapolis, MN 55425 612-854-9632
§ Via West Interface, Inc., Tucson, AZ 85705 ..... 602-623-5716;1-800-266-5716

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American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1662
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1660
§† Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1675
§ Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1680
IMO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0469 ..... B•1722-1723
§ Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... B•1764
§ Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 .. B•1772,1777
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1789
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
§ EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
Meissner Industries, Dover, NJ 07801 201-366-1700
§† OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Veeder-Root, Simsbury, CT 06070-2003 203-651-2700

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American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... B•1646-1647
§ Aries Electronics, Frenchtown, NJ 08825, 908-996-6841 ... B•1649, C•1281-1282
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1650-1651
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ..... B•1655
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1654
§ CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514, 219-295-3575 ..... B•1676-1677
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1690,1692
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... C•1584
§† Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1698-1699,1701
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... B•1817
JAE Electronics Inc., Irvine, CA 92718, 714-753-2600 ..... B•1724-1725
Kycon Cable & Connector, Inc., San Jose, CA 95125, 408-295-1110 ..... C•1423
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374 ..... B•1728-1729
§ Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... B•1737
MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1746-1752
§ Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 .. B•1772,1777
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§† American Research & Engineering, Elgin, IL 60123 708-888-7245
§ Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
§ Assmann Electronics, Inc., Assmann Electronics GMBH, Chandler, AZ 85226 602-940-0004
§ Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
Direct Sound Corporation, New York, NY 10011 212-691-9050
EAO Switch Corp., Milford, CT 06460 203-877-4577
§ EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
General Electric Materials Technology, Buena Park, CA 90620 714-761-5684
§ Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
International Microelectronics, Arlington, TX 76003 817-561-2244
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
§ Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
§ Weitz Electronics/Marvwa USA 718-523-3688

Switches, Fiber Optic-2475

† ADC Telecommunications, Inc., Minneapolis, MN 55435, 612-835-6800 ..... C•1157-1159
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... B•1646-1647
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1705
† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 ..... B•1762-1763
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
† Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-677-1311
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 ..... 800-336-5917;703-953-4751
MarLee Switch Co., Upland, CA 91786 714-982-8988
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
† UCE, Inc., Norwalk, CT 06854 203-838-7509
† York Technology, Inc., Burbank, CA 91502 818-955-8927

Switches, Float-5100

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 ..... B•1878
Comus International, Nutley, NJ 07110, 201-667-6200 ..... B•1668
Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1683
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1760
† Signal Systems International, Lavalette, NJ 08735, 201-793-4668 ..... B•1779
WECO Electrical Connectors, Inc., Mooers, NY 12958, 518-298-4810 .... C•1568
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-677-1311
† Pressure Controls, Inc., Belleville, NJ 07109 201-751-5002
§ SOR, Inc., Lenexa, KS 66215 913-888-2630
† Square D Co., Palatine, IL 60067 708-397-2600

Switches, Foot Pedal, Mat, Ribbon, etc.-5100

§ Altech Corp., Somerville, NJ 08876, 908-707-8484 ..... B•1643, C•1168
J. R. Merritt Controls, Inc., Norwalk, CT 06854, 203-855-9100;800-333-5762 ..... D•1139
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1766
WECO Electrical Connectors, Inc., Mooers, NY 12958, 518-298-4810 .... C•1568
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Herga Inc. Herga Electric Limited, West Chester, PA 19380 215-430-1970
§ Lektra Service Corp., Bronx, NY 10474 212-617-7786
§† Linemaster Switch, Woodstock, CT 06281-0238 203-974-1000
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ Marsh Products, Inc., Spectrum Companies, Intl., Batavia, IL 60510 708-879-8008
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Square D Co., Palatine, IL 60067 708-397-2600
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312

Switches, Hall Effect-5100

BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ..... B•1653
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... B•1672
Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1683
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1684
§ Linemaster Switch, Woodstock, CT 06281-0238 203-974-1000
§ Machine Components Corp., Plainview, NY 11803 516-694-7222
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300

Switches, High Voltage (Over 250 Volts)-5100

C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... **B•1430**
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... **B•1660**
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... **B•1459**
Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... **B•1682**
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... **B•1684**
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... **B•1694**
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... **B•1706**
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... **B•1708**
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800 .... **B•1711**
† Janco Corp., Burbank, CA 91508, 818-846-1800 ..... **B•1726-1727**
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;800-253-4650 ..... **B•1520**
McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... **B•1735-1736**
§ Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... **A•1964**
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... **B•1568**
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... **B•1782-1783**
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§† ASM Corporation, Smithfield, NC 27577 919-934-3104
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
† EG&G, Inc., Electronics Components Div., Salem, MA 01970 508-745-3200
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† Jennings, San Jose, CA 95122-2696 408-292-4025
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ..... 203-855-9100;800-333-5762
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
† Radio Switch Corp., Marlboro, NJ 07746 908-462-6100
Rosemount Analytical Inc., Cedar Grove, NJ 07009 800-367-7242
§ Square D Co., Palatine, IL 60067 708-397-2600
† Tech Laboratories Inc., Palisades Pk, NJ 07650 201-944-2221
Teledyne Kinetics, Div. of Teledyne, Inc., Solana Beach, CA 92075 619-755-1181
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191

Switches, Illuminated-5100

Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... **B•1648**
Aztec Industries, Inc., Mesa, AZ 85210, 602-833-3131;800-729-3132 ..... **B•1799**
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ..... **B•1655**
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... **B•1654**
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... **B•1671-1672**
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... **B•1675**
CW Industries, Southhampton, PA 18966, 215-355-7080 ..... **B•1678-1679**
Direct Sound Corporation, New York, NY 10011, 212-691-9050 ..... **B•1681**
Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... **B•1687**
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... **B•1689-1690,1693**
George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... **B•1809**
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... **B•1709**
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800 .... **B•1710**
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... **B•1712-1715,1718**
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... **B•1734, 1736**
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... **B•1742**
MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... **B•1745**
§† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ..... **B•1758**
Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... **B•1787**
Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... **B•1784-1785**
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... **B•1790-1791**
Aerospace Optics, Inc., Fort Worth, TX 76112 817-451-1141
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332
§ NKK Switches of America, Inc., Scottsdale, AZ 85260 602-991-0942
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500

Switches, Intelligent-5100

American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... **B•1645**
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137

Switches, Interlock-5100

† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... **B•1656**
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... **B•1661**
§† C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... **B•1430**
Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... **B•1683**
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... **B•1684-1685**
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... **B•1686**
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... **B•1689-1690**
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... **B•1738-1739,1741-1742**
MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... **B•1745**
† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 ..... **B•1762-1763**
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... **B•1769**
† Signal Systems International, Lavalette, NJ 08735, 201-793-4668 ..... **B•1779**
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... **B•1782-1783**
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... **B•1784,1786**
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089 708-215-9600
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
† Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634 312-282-4040
† Kilovac Corp., Santa Barbara, CA 93140-4422 ..... 805-684-4560;800-253-4650
† Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 708-964-2330

Switches, Keyboard-5150

† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... **B•1656**
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... **B•1661,1802**
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... **B•1671-1672**
§ DataLux Corp., Winchester, VA 22601, 703-662-1500 ..... **B•1804**
Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... **B•1680**
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... **B•1689-1692**
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... **B•1806**
§ Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135, 408-922-9000 ..... **B•1808**
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... **B•1809**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... **B•1815**
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... **B•1712-1714**
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... **B•1818**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 ..... **B•1823**
MOLEX, Inc., Lisle, IL 60532, 708-969-4550 ..... **C•1474**

§ **Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000** ..... **B•1765,1827**
RDI Elctrns., Inc., New Rochelle, NY 10801, 914-632-7274 ..... **B•1767**
§ **Schurter, Inc., Petaluma, CA 94952, 707-778-6311** ..... **B•1771**
†# **Veetronix, Inc., Lexington, NE 68850, 308-324-4600** ..... **B•1790-1791**
Advanced Connector Technology, Ventura, CA 93001 805-653-5753
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
§ Corby Industries, Inc., Allentown, PA 18103 215-433-1412
DOW SWITCH, Wilmington, MA 01887 617-935-6395
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
International Microelectronics, Arlington, TX 76003 817-561-2244
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
Low Key Corporation, Strong Group, Gloucester, MA 01930 508-281-0448
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ Marsh Products, Inc., Spectrum Companies, Intl., Batavia, IL 60510 708-879-8008
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Membrane Switch & Panel Co., Inc., Santa Ana, CA 92705 714-541-5775
Mouser Electronics, Mansfield, TX 76063 800-346-6873
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332
§ NKK Switches of America, Inc., Scottsdale, AZ 85260 602-991-0942
NMB Technologies, Chatsworth, CA 91311 818-341-3355
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
Technical Panels, Inc., Temple City, CA 91780 ..... 800-343-1170;818-285-3105
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
Vetra Systems Corp., Plainview, NY 11803 516-454-6469
Westlake Components International, Westlake Village, CA 91361 800-228-1097

Switches, Key Lock-5100

BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ..... **B•1652**
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ..... **B•1655**
† **Capitol Switch Inc., Bethel, CT 06801, 203-744-3300** ..... **B•1656**
§ **Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281** ..... **B•1659**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... **B•1661**
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100** ..... **B•1660**
§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577** ..... **B•1685**
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... **B•1694**
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... **B•1695**
George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... **B•1809**
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... **B•1709**
§ **Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800** ..... **B•1710-1711**
† **Janco Corp., Burbank, CA 91508, 818-846-1800** ..... **B•1726-1727**
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374 .. **B•1728**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600** .. **B•1741-1742**
MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... **B•1745**
§† **OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200** ..... **B•1759**
§† **Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794** ..... **B•1761**
§ **Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722** ..... **B•1764**
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... **B•1769**
§ **Schurter, Inc., Petaluma, CA 94952, 707-778-6311** ..... **B•1771**
§ Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
Ark Les Corporation, Watertown, MA 02172 617-924-2330
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
§† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
§ Chicago Lock Co., Chicago, IL 60641 312-282-7177
§ COMCAB, Nashport, OH 43830 614-828-2468
§ Corby Industries, Inc., Allentown, PA 18103 215-433-1412
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§ Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
§ Direct Sound Corporation, New York, NY 10011 212-691-9050
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
Entrelec Div/GEC Alsthom International, Inc., Irving, TX 75038 214-550-9025
§ Furnas Elec., Batavia, IL 60510 708-879-6000
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
International Microelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
ITW Switches, Illinois Tool Works, Chicago, IL 60634 312-282-4040
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
† Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ..... 203-855-9100;800-333-5762
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NKK Switches of America, Inc., Scottsdale, AZ 85260 602-991-0942
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 708-397-2600
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277

Switches, Leaf, Single/Multiple-5100

Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1656
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... **B•1778**
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 708-964-2330

Switches, Lever-5100

Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... **B•1141**
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ..... **B•1652-1653**
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ..... **B•1655**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400** ..... **B•1654**
† **Capitol Switch Inc., Bethel, CT 06801, 203-744-3300** ..... **B•1656**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200** ..... **B•1661-1665**
§† **Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321** ... **B•1680**
§ **Direct Sound Corporation, New York, NY 10011, 212-691-9050** ..... **B•1681**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600** .. **B•1738-1743**
§ **MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007** ..... **B•1745**
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942** ..... **B•1746-1752**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1760**
§† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171** ..... **B•1762-1763**
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... **B•1768-1769**
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... **B•1778**
† **Signal Systems International, Lavalette, NJ 08735, 201-793-4668** ..... **B•1779**
§ **Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700** ..... **B•1764**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
AMP, Harrisburg, PA 17105 ..... 717-564-0100;800-522-6752
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§ Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ Furnas Elec., Batavia, IL 60510 708-879-6000

§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
Hamlin Inc., Lake Mills, WI 53551 414-648-3000
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634 312-282-4040
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ..... 203-855-9100;800-333-5762
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
§† Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§† OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
† Radio Switch Corp., Marlboro, NJ 07746 908-462-6100
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277

Switches, Limit-5100

Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1720
§ Altech Corp., Somerville, NJ 08876, 908-707-8484 ..... B•1643
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ..... B•1652-1653
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1663
† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1151
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1708
† Janco Corp., Burbank, CA 91508, 818-846-1800 ..... B•1726-1727
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1738-1739
§ MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1760
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 ..... B•1762-1763
Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1771
† Signal Systems International, Lavalette, NJ 08735, 201-793-4668 ..... B•1779
Sumtak Electronics, Daido Corporation, Somerset, NJ 08875, 908-805-0008 ..... B•1950-1951
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
Astrosystems, Lake Success, NY 11042 516-328-1600
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§† Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ Furnas Elec., Batavia, IL 60510 708-879-6000
† Giannini Institute, Indio, CA 92201 619-347-2833
§ Gordon Products, Brookfield, CT 06804 203-775-4501
§ Go Switch, Louisville, KY 40233 502-969-2386
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634 312-282-4040
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA 2615567-68;2613521-22-23
† Machine Components Corp., Plainview, NY 11803 516-694-7222
† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
Magnetoelastic Devices, Pittsfield, MA 01202 413-445-5608
Maxmar Controls Inc., Pleasantville, NY 10570 914-747-3540
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§† Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
Parker Hannifin Corp., Cleveland, OH 44112-1290 ..... 800-272-7537;800-C-PARKER
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543 ..... 914-698-2026;800-431-2625 (outside NY)
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Saint Switch, Inc., St. Charles, IL 60174 708-377-3779
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 708-397-2600
† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
§ United Electric Controls, Watertown, MA 02272-9143 617-926-1000
§ Veeder-Root, Simsbury, CT 06070-2003 203-651-2700

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Switches, low Voltage-5100

† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1656
§ Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281 ..... B•1657
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1663
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... B•1669-1672
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1678-1679
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1824
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1746-1752
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1656-1657
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... B•1791
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§ Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
ELMA Electronic Inc., Fremont, CA 94538 ..... 415 656 3400
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
§ General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-3023
Imaging & Sensing Technology Corp., Horseheads, NY 14845 ..... 607 796-3372
ITT Schadow, Eden Prairie, MN 55344 612-934-4400
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
Lamb Industries, Inc., Portland, OR 97225 ..... 503-297-8878;800-824-9374
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610

Switches, Matrix-5100

† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1656
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ... B•1573
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1240
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1690
Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074 .... D•1180-1181
L-Com Inc., N. Andover, MA 01845, 508-682-6936 ..... C•1424
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ..... B•1820-1821
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... D•1192-1193
§ T-Bar Data Switch Corp., Shelton, CT 06484, 203-926-1801 ..... B•1788
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0748 716-265-1600
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
Amber Inds., Inc., Dallas, TX 75379 214-490-9801
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
Bytex Corp., Southborough, MA 01772 508-480-0840
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
§ Covid, Inc., Tempe, AZ 85281 602-966-2221
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
† The Graphics Technology Co., Austin, TX 78746 512-328-9284
† GRIM Corporation, Medford, NJ 08055-0968 609-267-7950
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634 312-282-4040
† Jennings, San Jose, CA 95122-2696 408-292-4025
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Keithley Instrs., Cleveland, OH 44139 800-552-1115
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
§ Mantex Corp., Oxford, MI 48371 313-628-8210
† MarLee Switch Co., Upland, CA 91786 714-982-8988
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
§ McCurdy Radio Industries Limited, Toronto, Ont., CAN M4A 2L4 416-751-6262

§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
§† Oxley Inc., Branford, CT 06405 203-488-1033
P.G. Electronics Ltd., Weston, Ont., CANADA M9M2Z8 416-741-7662
Racal-Milgo, Sunrise, FL 33323-2899 ..... 305-846-1601;800-327-4440
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Stoelting Co., Wood Dale, IL 60191 708-860-9700
Technical Panels, Inc., Temple City, CA 91780 ..... 800-343-1170;818-285-3105
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Telenex Corporation, A Unit of General Signal Corp., Mt. Laurel, NJ 08054 609-234-7900
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Switches, Membrane-5150

Aztec Industries, Inc., Mesa, AZ 85210, 602-833-3131;800-729-3132 ..... B•1799
Bergquist, Minneapolis, MN 55435, 800-347-4572 ..... B•1800-1801
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400** ..... B•1654
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1802
§ **CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300** ..... B•1670
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1815
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1818-1819
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ..... B•1820-1821
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Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1824
§ **MOLEX, Inc., Lisle, IL 60532, 708-969-4550** ..... C•1476
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ..... B•1825
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† S & S Associates, Inc., San Luis Obispo, CA 93401, 805-544-2500 ..... C•1094-1095
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6211 ..... B•1771
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A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
† Basic Electronics, Inc., Stanton, CA 90680 714-530-2400
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
† C.A.M. Graphics Co., Inc., Amityville, NY 11701 516-842-3400
C.P. Clare Corp., Chicago, IL 60645 312-262-7700
Conductive Rubber Technology, Inc., Bothell, WA 98021 206-486-8559
† DOW SWITCH, Wilmington, MA 01887 617-935-6395
EECO Incorporated, Santa Ana, CA 92702-0658 714-835-6000
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Endicott Research Group, Endicott, NY 13760 607-754-9187
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
† GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
The Hall Company, Urbana, OH 43078 513-652-1376
† Hallmark Technologies, Mt. Dora, FL 32757 800-874-3063
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
LaFrance Corp., Philadelphia, PA 19153-3893 215-365-8000
§ Mantex Corp., Oxford, MI 48371 313-628-8210
§ Marsh Products, Inc., Spectrum Companies, Intl., Batavia, IL 60510 708-879-8008
Membrane Switch & Panel Co., Inc., Santa Ana, CA 92705 714-541-5775
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Miller Dial Corp., El Monte, CA 91731 818-444-4555
Moxness Products, Inc., Versa Technologies, Racine, WI 53405 ..... 414-554-5050; 800-558-5706
OMNI Switch USA, Inc., Phoenix, AZ 85027 602-582-0629
Paneltec, Santa Clara, CA 95054 408-496-1175
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
† Sheldahl, Inc., Northfield, MN 55057 507-663-8000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0360
† Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003 ..... 214-231-6663; 214-924-3289;1-800-331-6600
† Square D Co., Palatine, IL 60067 708-397-2600
Technical Panels, Inc., Temple City, CA 91780 ..... 800-343-1170;818-285-3105
§ Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386
Westlake Components International, Westlake Village, CA 91361 800-228-1097

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C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
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§ **Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116** ..... B•1683
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1696-1697
§† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645** ..... B•1809
§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000** ..... B•1706
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600** ..... B•1741
† **Signal Systems International, Lavalette, NJ 08735, 201-793-4668** ..... B•1779
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1782-1783
Aerodyne Controls Corporation, Ronkonkoma, NY 11779 516-737-1900
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
International Microelectronics, Arlington, TX 76003 817-561-2244
Mouser Electronics, Mansfield, TX 76063 800-346-6873
† Select Controls Inc., Bohemia, NY 11716 516-467-8577
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600

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§ Altech Corp., Somerville, NJ 08876, 908-707-8484 ..... B•1643
§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1648
§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600** ..... B•1652
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1656
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1663
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... B•1671-1672
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1673-1675
§ Direct Sound Corporation, New York, NY 10011, 212-691-9050 ..... B•1681
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1686-1687
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1692
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1694
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... B•1809
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1698,1700-1701
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1709
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† Janco Corp., Burbank, CA 91508, 818-846-1800 ..... B•1726-1727
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§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-624-9374 ..... B•1728-1729
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1736-1739,1742-1743
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§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1746-1752
§† Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 ..... B•1761
† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 ..... B•1762-1763
§ Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... B•1764
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-6000 ..... B•1827
Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-0028;800-431-2625 (outside NY) ..... B•1766
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§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1771
Shogyo International Corp., Great Neck, NY 11021, 516-466-0311 ..... B•1779
§ Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1787
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1784-1786
§ T-Bar Data Switch Corp., Shelton, CT 06484, 203-926-1921 ..... B•1788
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... B•1790-1791
Wilbrecht Electronics, St. Paul, MN 55107, 612-222-2781 ..... A•2077, B•1793
Advanced Connector Technology, Ventura, CA 93001 805-653-5753
Aerodyne Controls Corporation, Ronkonkoma, NY 11779 516-737-1900
Aerospace Optics, Inc., Fort Worth, TX 76112 817-451-1141
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
† Basic Electronics, Inc., Stanton, CA 90680 714-530-2400
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
Conductive Rubber Technology, Inc., Bothell, WA 98021 206-486-8559
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ DataLux Corp., Winchester, VA 22601 703-662-1500
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§ Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101 718-937-8000
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400

E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
#Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
†EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
§†Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§Gaynor Electric Co., Thomaston, CT 06787-0316 203-283-4388
§Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065 805-522-7958
†Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
International Microelectronics, Arlington, TX 76003 817-561-2244
ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§ITT Schadow, Eden Prairie, MN 55344 612-934-4400
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
†Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
§†Machine Components Corp., Plainview, NY 11803 516-694-7222
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ..... 203-855-9100;800-333-5762
Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§†OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
§Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
Relay Service Co., Chicago, IL 60651 312-252-2700
§Seacor, Inc., Westwood, NJ 07675 201-666-5600
†Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
†Square D Co., Palatine, IL 60067 708-397-2600
†Stacoswitch, Costa Mesa, CA 92626 714-549-3041
§Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
†Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 708-964-2330

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§AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... B•1646-1647
§Aries Electronics, Frenchtown, NJ 08825, 908-996-6841 ... B•1649, C•1281-1282
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§C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1654
†Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1656
§Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1663
§CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... B•1669-1671
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ... B•1673
§†CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1678-1679
§†Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1680
†Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1682
§Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1690
§†Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1694
§Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1702
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1717
§IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 ..... B•1722-1723
†Janco Corp., Burbank, CA 91508, 818-846-1800 ..... B•1726-1727
§MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745
§†OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ..... B•1756-1757,1759
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1760
†Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 ..... B•1762-1763
Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... B•1764
RDI Elctrns., Inc., New Rochelle, NY 10801, 914-632-7274 ..... B•1767
†Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1568
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... B•1769
§Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 ..... B•1772-1774,1777
†Signal Systems International, Lavalette, NJ 08735, 201-793-4668 ..... B•1779
Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1787
§Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1785-1786
†Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1789
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Wilbrecht Electronics, St. Paul, MN 55107, 612-222-2791 ..... A•2077, B•1793
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... B•1959
Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
†Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
§Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§†ASM Corporation, Smithfield, NC 27577 919-934-3104
Augat Inc., Attleboro, MA 02703 617-222-2202
§Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
§Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
Chicago Lock Co., Chicago, IL 60641 312-282-7177
†Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
§CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§EDL, Inc., Danville, VA 24540 ..... 804-799-0807;1-800-DIAL EDL
§†EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
#Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
†EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
§†Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
§ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
†Kilovac Corp., Santa Barbara, CA 93140-4422 ..... 805-684-4560;800-253-4650
Lamb Industries, Inc., Portland, OR 97225 ..... 503-297-8878;800-824-9374
†Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
§†Machine Components Corp., Plainview, NY 11803 516-694-7222
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
†Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
Radio Switch Corp., Marlboro, NJ 07746 908-462-6100
†RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§Seacor, Inc., Westwood, NJ 07675 201-666-5600
§Spectrol Electronics Corp., Ontario, CA 91761 714-923-3313
§Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
†Teledyne Microwave, Mountain View, CA 94043 415-968-2211
†Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007

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†ADC Telecommunications, Inc., Minneapolis, MN 55435, 612-835-6800 ..... C•1157-1159
OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ..... B•1754
§†Optek Technology Inc., Carrollton, TX 75006, 214-323-2200 ..... B•1333
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 ..... B•1777
§Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
§Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
BT & D Technologies, Wilmington, DE 19803 302-479-0300
†Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
#Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 612-443-2500
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§Isocom Inc., Campbell, CA 95008 408-370-2212
§Marktech International Corp., Latham, NY 12110 518-786-6591
§Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
§Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
§SC Technology, Inc., Livermore, CA 94550 415-373-9230
Silonex Inc., Plattsburgh, NY 12901 518-561-3160
Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
†UCE, inc., Norwalk, CT 06854 203-838-7509

Switches, Paddle Handle-5100

§Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1141,1648
†Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1656
§†Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1680
§Direct Sound Corporation, New York, NY 10011, 212-691-9050 ..... B•1681
§ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1717
§Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374 ..... B•1728-1729
§McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1734
§Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1742-1743
§MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745
§NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1746-1747,1749,1752
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Airpax-Cambridge Division, A North American Philips Co., Cambridge, MD 21613 301-228-4600
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§ Dreefs Switch, Inc., Waukegan, IL 60087 .... 708-662-7667;800-323-9605
§ Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101 718-937-8000
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
EnTech Corporation, Simsbury, CT 06070 .... 203-658-2740;203-651-9557
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Line Electric Products, Hartford, CT 06141 .... 203-659-3573;1-800-331-1137
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Manufacturers Components, Inc., Hialeah, FL 33016 .... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700
§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487

Switches, Peripheral-5100

† Advanced Systems Concepts, Inc., Altadena, CA 91001, 818-791-0983 .... D•1144
American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 .... B•1645
§ T-Bar Data Switch Corp., Shelton, CT 06484, 203-926-1801 .... B•1788
Aztec Industries, Inc., Mesa, AZ 85210 .... 602-833-3131;800-729-3132
§ Dataprobe, Englewood, NJ 07631 201-569-6464
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921 401-943-1164
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
MarLee Switch Co., Upland, CA 91786 714-982-8988
† Terminal Data Corp., Rockville, MD 20855 301-921-8282
§ Via West Interface, Inc., Tucson, AZ 85705 .... 602-623-5716;1-800-266-5716

Switches, Photoelectric-3700

§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 .... B•1319
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1709
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .... B•1320-1321
§ Optek Technology Inc., Carrollton, TX 75006, 214-323-2200 .... B•1333
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089 708-215-9600
§ Elector, Inc., Exton, PA 19341 .... 215-524-2000;800-441-9246
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Ramsey, NJ 07446 201-825-9696
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 612-443-2500
§ Isocom Inc., Campbell, CA 95008 408-370-2212
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
§ Redington Counters, Windsor, CT 06095 203-688-6205
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
Silonex Inc., Plattsburgh, NY 12901 518-561-3160
† Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487

Switches, Port Sharing-5100

† Advanced Systems Concepts, Inc., Altadena, CA 91001, 818-791-0983 .... D•1144
Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 .... B•1656
§ L-Com Inc., N. Andover, MA 01845, 508-682-6936 .... C•1424
§ T-Bar Data Switch Corp., Shelton, CT 06484, 203-926-1801 .... B•1788
§ Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
§ Dataprobe, Englewood, NJ 07631 201-569-6464
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921 401-943-1164
# Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
Information Transfer Inc., Bloomfield, NY 14469 716-657-7074
§ Telebyte Technology, Inc., Greenlawn, NY 11740 .... 516-423-3232;800-835-3298
§ Terminal Data Corp., Rockville, MD 20855 301-921-8282
§ Via West Interface, Inc., Tucson, AZ 85705 .... 602-623-5716;1-800-266-5716

Switches, Power-5100

§ Altech Corp., Somerville, NJ 08876, 908-707-8484 .... B•1643
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 .... B•1141
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1650
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 .... B•1652
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 .... B•1655
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1664
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1430-1431
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 .... B•1500
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 .... B•1669-1670,1672
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514, 219-295-3575 .... B•1676
§† CW Industries, Southhampton, PA 18966, 215-355-7080 .... B•1678-1679
§ Direct Sound Corporation, New York, NY 10011, 212-691-9050 .... B•1681
† Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1682
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 .... B•1683
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 .... B•1685
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 .... B•1687
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55402, 612-375-9639;800-677-8719 .... B•1689-1690,1692
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 .... B•1694
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 .... C•1386
Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 .... B•1706
§† Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4000 .... B•1368
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 .... B•1708
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800 .... B•1710-1711
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 .... [illegible]
† Janco Corp., Burbank, CA 91508, 818-846-1800 .... B•1720-1727
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;[illegible] .... B•1520,[illegible]
§ Lamb Industries, Inc., Portland, OR 97215, 503-287-8878;800-824-[illegible] .... B•1728-1729
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 .... B•1823
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 .... D•2212
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 .... B•1734-1736
Mechanical Products Inc., Jackson, MI 49204, 517-782-0391 .... B•1279,1361
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .... B•1738-1739,1742
§ MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 .... B•1745
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 .... B•1746,1750-1752
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 .... A•1964
† Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 .... B•1761
Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 .... B•1764, C•1504-1505
§ Preh Electronic Industries, Inc., Lake Zurich, IL [illegible] .... [illegible]
† Rose Engineering Corp., Campbell, CA 95008, 408-[illegible] .... [illegible]
§ Schurter, Inc., Petaluma, CA 94952, 707-778-[illegible] .... [illegible]
§ Shallco, Inc., Smithfield, NC 27577, 919-934-[illegible]; 1-800-[illegible] .... [illegible]
Shogyo International Corp., Great Neck, NY 11021, [illegible] .... [illegible]
Stancor Electronics, Stancor International, Cincinnati, OH [illegible] .... [illegible]
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 .... B•1784, 1785
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 .... B•1789
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§† ASM Corporation, Smithfield, NC 27577 919-934-3104
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
Delta Products Corporation, Fremont, CA 94538 415-770-0660
§ Dreefs Switch, Inc., Waukegan, IL 60087 .... 708-662-7667;800-323-9605
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
† EnTech Corporation, Simsbury, CT 06070 .... 203-658-2740;203-651-9557
§ Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
Ferraz Corporation, Parsippany, NJ 07054 .... 201-428-8400;800-526-9067
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
† Jennings, San Jose, CA 95122-2696 408-292-4025
Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Manufacturers Components, Inc., Hialeah, FL 33016 .... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050

J. R. Merritt Controls, Inc., Norwalk, CT 06854 ..... 203-855-9100;800-333-5762
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§† OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
Otto Controls, Otto Engineering, Carpentersville, IL 60110 708-428-7171
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
† Radio Switch Corp., Marlboro, NJ 07746 908-462-6100
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
Schaffner EMC, Inc. Instr. Div., Union, NJ 07083 ..... 908-851-0644;800-367-5566
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
† Square D Co., Palatine, IL 60067 708-397-2600
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
Teledyne Kinetics, Div. of Teledyne, Inc., Solana Beach, CA 92075 619-755-1181
§ USD Products , Div. of Bussmann, Chicago, IL 60656 708-867-4600
Weber U.S., Inc., Weber AG, Malvern, PA 19355 215-651-0770

Switches, Pressure-5100

Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1760
† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1766
† Signal Systems International, Lavalette, NJ 08735, 201-793-4668 ..... B•1779
§ Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
§† Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058 213-589-6181
Cambridge Aerofio, Inc., Shirley, MA 01464 508-45-2346
§ Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
Custom Control Sensors, Inc., Chatsworth, CA 91313-2516 818-341-4610
† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342 818-362-7151
† Electro National Corp., Canton, MS 39046 601-859-5511
Herga Inc. Herga Electric Limited, West Chester, PA 19380 215-430-1970
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Leybold Inficon Inc., E. Syracuse, NY 13057 315-434-1100
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Norgren, Littleton, CO 80120-1663 303-794-2611
Precise Sensors, Inc., Monrovia, CA 91016 818-358-4578
† Pressure Controls, Inc., Belleville, NJ 07109 201-751-5002
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
§ SOR, Inc., Lenexa, KS 66215 913-888-2630
† Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
§ United Electric Controls, Watertown, MA 02272-9143 617-926-1000

Switches, Program-5100

American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1664
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ... B•1673
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514, 219-295-3575 ..... B•1676
§† Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1680
§ Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... B•1817
§ IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 ..... B•1722-1723
§ Jolo Industries, Inc., Garden Grove, CA 92643, 714-554-6840 ..... C•1408-1409
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1746,1752
OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ..... B•1755
§ Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... B•1764
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 .. B•1772,1777
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1789
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Altech Corp., Somerville, NJ 08876 908-707-8484
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§† American Research & Engineering, Elgin, IL 60123 708-888-7245
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
Colorado Data Systems, Inc., Englewood, CO 80110 ..... 303-762-1640; 800-TEK-4VXI
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
§ Cramer Co., Old Saybrook, CT 06475 800-247-6784
§ Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Inter-Market, Glenview, IL 60025 708-729-5330
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
† Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
Techniques, Inc., Englewood, NJ 07631 201-569-5900
§ Tenor Company, New Berlin, WI 53151 414-782-3800

Switches, Programmable-5100

ADC Telecommunications, Inc., Minneapolis, MN 55435, 612-835-6800 ..... C•1157-1158
American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
§ AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... B•1646-1647
§ Aries Electronics, Frenchtown, NJ 08825, 908-996-6841 ... B•1649, C•1281-1282
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ... B•1673
WECO Electrical Connectors, Inc., Mooers, NY 12958, 518-298-4810 .... C•1568
Aerospace Optics, Inc., Fort Worth, TX 76112 817-451-1141
CYTEC Corp., Penfield, NY 14526 ..... 716-381-4740;800-346-3117
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Ramsey, NJ 07446 201-825-9696
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
IVO Industries, Inc., Eatontown, NJ 07724 ..... 908-542-5151;800-932-0489
Maxmar Controls Inc., Pleasantville, NY 10570 914-747-3540
Precision Filters, Ithaca, NY 14850 607-277-3550
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Switches, Proximity-5100

§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ..... B•1652
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1430
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1461
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... B•1809
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1708
§ IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 ..... B•1722-1723
† Signal Systems International, Lavalette, NJ 08735, 201-793-4668 ..... B•1779
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1782-1783
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1947
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
† Computer Components, Inc., Pelham, NY 10803 914-738-1611
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
† Electro National Corp., Canton, MS 39046 601-859-5511
§ Electronic Counters & Controls, Inc., LFE Corp., Libertyville, IL 60048 ..... 708-362-8910; 800-422-3224
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ..... 708-932-9380;800-468-6009
§ Furnas Elec., Batavia, IL 60510 708-879-6000
† Giannini Institute, Indio, CA 92201 619-347-2833
§ Gordon Products, Brookfield, CT 06804 203-775-4501
§ Go Switch, Louisville, KY 40233 502-969-2386
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA 2615567-68;2613521-22-23
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§ Norgren, Littleton, CO 80120-1663 303-794-2611
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
§ Redington Counters, Windsor, CT 06095 203-688-6205
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 415-471-9717
Sensor Corp., Scottdale, PA 15683 412-887-4080
Sentech, Inc., Cheltenham, PA 19012 215-663-0422
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
† Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Tane Alarm Products, Floral Park, NY 11001 516-328-3351
§ TURCK Inc., Minneapolis, MN 55441-2656 ..... 612-553-9224;1-800-328-0580; 1-800-544-PROX
§ Veeder-Root, Simsbury, CT 06070-2003 203-651-2700

Switches, Pushbutton-5100

§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 .... B•1141,1648
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ...... B•1652-1653
C & K Components, Inc., Clayton, NC 27520, 919-553-3101 .... B•1655
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 .... B•1654
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 .... B•1656
§ Carlingswitch, Inc., Plainville, CT 06062-1166, 203-793-9281 .... B•1658
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1661,1664
§ CRL Components, Inc., Norborn Group, Fort Dodge, IA 50501, 515-573-1300 .... B•1671-1672
§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 .... B•1675
§† Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1680
§ Direct Sound Corporation, New York, NY 10011, 212-691-9050 .... B•1581
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 .... B•1684-1685
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3089, 818-442-7180 .... B•1686-1687
§ Electronic Components Group, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9609;800-677-0710 .... B•1689-1693
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 .... B•1809
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1700-1701
† IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1709
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 .... B•1712-1715
JAE Electronics Inc., Irvine, CA 92718, 714-753-2600 .... B•1725
§† Janco Corp., Burbank, CA 91502, 818-846-1800 .... B•1726-1727
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8478;800-824-9374 .... B•1728-1729
§† Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ...... B•1742
MOLEX, Inc., Lisle, IL 60532, 708-969-4550 .... C•1474
§ MORS/ASC, Wakefield, MA 01880-4414, 617-246-1007 .... B•1745
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 .... B•1746-1752
§ Oak Grigsby Inc., Sugar Grove, IL [illegible], 708-556-4200 .... B•1754
§† [illegible] Controls, Cheshire, CT 06410-1511, 203-272-279[illegible] .... B•1761
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 .... B•1760-1763
[illegible], Lake Zurich, IL 60047-1575, 708-438-4800 .... B•1765,1827
§ Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) .... B•1766
† [illegible], Inc., New Rochelle, NY 10801, 914-632-7274 ..... A•2069, B•1767
[illegible] Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 .... B•1768-1769
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 .... B•1771
Shin-Etsu Polymer America, Inc., Union City, CA 94587, 415-475-9000 ... C•1521
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ... ... B•1778
§ [illegible] Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 .... B•1787
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 .... B•1784,1786
§ T-Bar Data Switch Corp., Shelton, CT 06484, 203-926-1801 .... B•1788
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600 .... B•1790-1791
[illegible] .... B•1793
Advanced Connector Technology, Ventura, CA 93001 805-650-5753
Advanced Input Devices, Coeur D'Alene, ID 83814 208-765-8000
Aerospace Optics, Inc., Fort Worth, TX 76117 817-451-1141
§ Allen-Bradley Co., Rockwell International Corp., Milwaukee, WI 53201 414-382-2000
Allied Controls Incorporated, Waterbury, CT [illegible] 203-757-4200
Alpha Products, Inc., Westlake Village, CA 91362 818-889-8304
§ Alps Electric (USA) Inc., San Jose, CA [illegible] 408-432-6000
§ [illegible] Inc., Rowland Heights, CA 91748 213-666-1564
Ark Les Corporation, Watertown, MA [illegible] 617-924-2330
Ark-Les Corp, Raleigh, NC 27609 919-231-2000
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc. Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C. 886-2-9174302
§ Cole Hersee Co., Boston, MA 02127-2487 617-268-2100
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§ CTS Corp,Electrocomponents business unit (formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ DataLux Corp., Winchester, VA 22601 703-662-1500
§ Dreefs Switch, Inc., Waukegan, IL 60087 .... 708-662-7667;800-323-9605
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ...... 201-288-4477; 800-447-5639
† EnTech Corporation, Simsbury, CT 06070 .... 203-658-2740;203-651-9557
† Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ Entrelec Div/GEC Alsthom International, Inc., Irving, TX 75038 214-550-9025
§ Gaynor Electric Co., Thomaston, CT 06787-0316 203-283-4388
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
† Giannini Institute, Indio, CA 92201 619-347-2833
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§† Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Inter-Market, Glenview, IL 60025 708-729-5330
International Microelectronics, Arlington, TX 76003 317-561-2244
International Resource Svcs., Miami, FL 33166 305-884-2924
ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 708-949-3505
§ Klockner Moeller, Franklin, MA 02038 508-520-7080
Line Electric Products, Hartford, CT 06141 .... 203-659-3573;1-800-331-1137
Littelfuse, Inc., Des Plaines, IL 60016 .... 708-824-1188;708-824-0400
† Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
† Milross Controls, Inc., Southampton, PA 18966 215-355-0200
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
Saint Switch, Inc., St. Charles, IL 60174 708-377-3779
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
† Secme, Inc., Secme, Irvine, CA 92714 714-261-0610
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
† Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487
Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
§ Tektone Sound & Signal, Lake Park, FL 33403 407-844-2383
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 708-364-2330

Switches, Reed-5100

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 .... B•1878
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 .... B•1656
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1430-1431
Comus International, Nutley, NJ 07110, 201-667-6200 .... B•1668
Coto Wabash, Kearney National Corporation, Providence, RI 02907, 401-943-2686 .... B•1441
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 .... B•1461
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 .... B•1809
§† Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 .... B•1706,1903
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 .... B•1707
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 .... B•1708
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 .... A•1266, B•1782-1783
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 .... B•1868
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600 .... B•1791
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Electric Device, Canfield, OH 44406 216-533-1111
† Electro National Corp., Canton, MS 39046 601-859-5511
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
International Microelectronics, Arlington, TX 76003 817-561-2244
MarLee Switch Co., Upland, CA 91786 714-982-8988
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Norgren, Littleton, CO 80120-1663 303-794-2611
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Professional Components Grp, Slatersville, RI 02876 401-762-3800
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191

Switches, RF-5100

§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1678-1679
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1240
§† Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1682
Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1708
† Janco Corp., Burbank, CA 91508, 818-846-1800 ..... B•1726-1727
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1516,1519
Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;800-253-4650 ..... B•1520
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1568
† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827, D•1077
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
§ ASI Instruments, Inc., Houston, TX 77024 800-245-7056
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Compac, Holbrook, NY 11741 516-585-3400
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
DOW SWITCH, Wilmington, MA 01887 617-935-6395
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065 805-522-7958
Information Transfer Inc., Bloomfield, NY 14469 716-657-7074
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
§ K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Kay Elemetrics Corp., Pine Brook, NJ 07058-2025 201-227-2000
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
MACOM, Inc., Burlington, MA 01803 617-272-3000
† MarLee Switch Co., Upland, CA 91786 714-982-8988
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
Peca, Inc., Bensalem, PA 19020 215-245-1550
† Radio Switch Corp., Marlboro, NJ 07746 908-462-6100
Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sector Microwave Ind. Inc., Deer Park, NY 11729 516-242-2300
† Sivers IMA AB, Culver City, CA 90230 213-306-4248
§ SOR, Inc., Lenexa, KS 66215 913-888-2630
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Switches, Rocker-5100

§ AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... B•1646-1647
§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1648
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ..... B•1655
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1654
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1656
§ Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281 ..... B•1657
§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1675
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1678-1679
§ Direct Sound Corporation, New York, NY 10011, 212-691-9050 ..... B•1681
EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1684
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1692
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... C•1386
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1698-1699
§† Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1368-1369
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1717-1718
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374 ..... B•1728-1729
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1734-1736
† Measurement Systems, Inc., Norwalk, CT 06854, 203-838-5561 ..... D•1138
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1739,1742-1743
§ MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1746-1752
† Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 ..... B•1761
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ... C•1486-1487
§ Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... B•1764
RDI Elctrns., Inc., New Rochelle, NY 10801, 914-632-7274 ..... B•1767
Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1771
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1778
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1784-1785
Airpax-Cambridge Division, A North American Philips Co., Cambridge, MD 21613 301-228-4600
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Ark Les Corporation, Watertown, MA 02172 617-924-2330
§ Ark-Les Corp, Raleigh, NC 27620 919-231-2000
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
CTS Corporation, Elkhart, IN 46514 219-293-7511
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
§ Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101 718-937-8000
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
§ Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-3023
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090 708-537-1800
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
International Microelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 708-949-8505
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ..... 609-866-8888;800-257-8384
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Weber U.S., Inc., Weber AG, Malvern, PA 19355 215-651-0770

Switches, Rotary-5100

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230 ..... B•1243
§ Altech Corp., Somerville, NJ 08876, 908-707-8484 ..... B•1643
AME Corporation, Towaco, NJ 07082-0195, 201-263-1700 ..... B•1644
§ AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... B•1646-1647
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ..... B•1655
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1654
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1660
Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412, 708-455-8830 ..... C•1743
§† CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... B•1669-1670
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1690,1692-1693

§† **Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200** ..... B•1694
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... B•1695
§† **Grayhill Inc., La Grange, IL 60525, 708-354-1040** ..... B•1702-1705
§ **Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800** ..... B•1710-1711
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... B•1817
§† **ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040** ..... B•1716
JAE Electronics Inc., Irvine, CA 92718, 714-753-2600 ..... B•1724-1725
§† **Janco Corp., Burbank, CA 91508, 818-846-1800** ..... B•1726-1727
§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374** ..... B•1728-1729
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751** ..... B•1218-1220
† **Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621** ..... B•1731
† **Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555** ..... A•2051
McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1735
§ **Mepcopal Company, San Diego, CA 92121, 619-453-0332** ..... B•1737
J. R. Merritt Controls, Inc., Norwalk, CT 06854, 203-855-9100;800-333-5762 ..... D•1139
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942** ..... B•1746,1748-1752
§† **OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200** ..... B•1754-1757,1759
§† **Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600** ..... A•1964
§ **Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722** ..... B•1764
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621** ..... B•1568
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... B•1769
§ **Schurter, Inc., Petaluma, CA 94952, 707-778-6311** ..... B•1771
§ **Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135** .. B•1772-1777
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1778
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221** ..... B•1789
§ Alien- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
Ark Les Corporation, Watertown, MA 02172 617-924-2330
Ark-Les Corp, Raleigh, NC 27620 919-231-2000
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§† ASM Corporation, Smithfield, NC 27577 919-934-3104
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
Carson Manufacturing Co., Inc., Indianapolis, IN 46220 317-257-3191
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C. 886-2-9174302
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
§ COMCAB, Nashport, OH 43830 614-828-2468
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
CTS Corporation, Microelectronics business unit, W. Lafayette, IN 47906 317-463-2565
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 708-662-7667;800-323-9605
Duncan Electronics, Inc., Costa Mesa, CA 92626 714-545-8261
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
§ EECO Incorporated, Santa Ana, CA 92702-0359 714-835-6000
§† Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
† Electro National Corp., Canton, MS 39046 601-859-5511
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ Entrelec Div/GEC Alsthom International, Inc., Irving, TX 75038 214-550-9025
§ Erni Components, Richmond, VA 23236 804-794-6367
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-3023
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
† Giannini Institute, Indio, CA 92201 619-347-2833
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
International Microelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 708-949-8505
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA 2615567-68;2613521-22-23
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
Methode Electronics, Inc., Chicago, IL 60656 708-867-9600
† Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
Otto Controls, Otto Engineering, Carpentersville, IL 60110 708-428-7171
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
† Radio Switch Corp., Marlboro, NJ 07746 908-462-6100
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Spectrol Electronics Corp., Ontario, CA 91761 714-923-3313
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
Tettex Instruments, Inc., Fairview Village, PA 19409-0261 215-539-6050
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800

Switches, Sealed-5100

AME Corporation, Towaco, NJ 07082-0195, 201-263-1700 ..... B•1644
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1141,1648
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1650-1651
Aztec Industries, Inc., Mesa, AZ 85210, 602-833-3131;800-729-3132 ..... B•1799
§ **BURGESS-SAIA, inc., Buffalo Grove, IL 60089, 708-215-9600** ..... B•1652-1653
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ..... B•1655
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400** ..... B•1654
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200** ..... B•1661,1663,1665
§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700** ..... B•1430-1431
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100** ..... B•1660
Comus International, Nutley, NJ 07110, 201-667-6200 ..... B•1668
§ **CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300** ..... B•1669-1672
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1675
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514, 219-295-3575 ..... B•1676-1677
§ **CW Industries, Southhampton, PA 18966, 215-355-7000** ..... B•1678-1679
§† **Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-921-4321** ... B•1680
Direct Sound Corporation, New York, NY 10011, 212-691-9050 ..... B•1681
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1461
§ **Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116** ..... B•1683
§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577** ..... B•1684-1685
§ **Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719** ..... B•1689-1692
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1694
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... B•1695
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1696-1697
§† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645** ..... B•1809
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040** ..... B•1699-1701,1703
§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000** ..... B•1706
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1707
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1708
† **IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311** ..... B•1814
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1815
§ **Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217** .... B•1817
§† **ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040** ..... B•1716,1720-1721
IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 ..... B•1722-1723
JAE Electronics Inc., Irvine, CA 92718, 714-753-2600 ..... B•1724-1725
† **Janco Corp., Burbank, CA 91508, 818-846-1800** ..... B•1726-1727
Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;800-253-4650 ..... B•1520-1521
§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374** ..... B•1728-1729
† **Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621** ..... B•1731
§ **McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200** ..... B•1735
Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... B•1737
§† **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600** ..... B•1738,1740-1743
§ **MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007** ..... B•1745
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942** ..... B•1746-1752
§† **OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200** ..... B•1755-1759
† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171** ..... B•1762-1763
§ **Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722** ..... B•1764
§† **Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY)** ..... B•1766
RDI Elctrns., Inc., New Rochelle, NY 10801, 914-632-7274 ..... B•1767
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... B•1769
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 ..... B•1772-1773,1775,1777
§ **Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240** ..... B•1787
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1782-1783
§ **T-Bar Data Switch Corp., Shelton, CT 06484, 203-926-1801** ..... B•1788
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221** ..... B•1789

Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1868
†# **Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... B•1790-1791**
Advanced Connector Technology, Ventura, CA 93001 805-653-5753
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
† Aerospace Optics, Inc., Fort Worth, TX 76112 817-451-1141
§† American Research & Engineering, Elgin, IL 60123 708-888-7245
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§ COMCAB, Nashport, OH 43830 614-828-2468
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
† Giannini Institute, Indio, CA 92201 619-347-2833
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
Inter-Market, Glenview, IL 60025 708-729-5330
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
† Jennings, San Jose, CA 95122-2696 408-292-4025
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 ..... 800-336-5917;703-953-4751
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
MOLEX, Inc., Lisle, IL 60532 708-969-4550
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Saint Switch, Inc., St. Charles, IL 60174 708-377-3779
Schroff Incorporated, Warwick, RI 02886 401-732-3770
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
† Signal Systems International, Lavalette, NJ 08735 201-793-4668
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007

Switches, Slide-5100

Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1141,1648
§ **Aries Electronics, Frenchtown, NJ 08825, 908-996-6841 ..... B•1649, C•1281**
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ..... B•1655
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1654**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1664
§ **CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514, 219-295-3575 ..... B•1677**
§† **CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1678-1679**
§ **Direct Sound Corporation, New York, NY 10011, 212-691-9050 ..... B•1681**
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1692
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1698-1699
§ **Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800 ..... B•1710-1711**
§ **ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1716-1717**
JAE Electronics Inc., Irvine, CA 92718, 714-753-2600 ..... B•1724-1725
§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374 ..... B•1728-1729**
MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1746-1747,1749-1752**
§ **Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... B•1764**
§ **Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000 ..... B•1765**
† **RDI Elctrns., Inc., New Rochelle, NY 10801, 914-632-7274 ..... A•2063, B•1767**
† **Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1778**
Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1787
§ **Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1786**
Wilbrecht Electronics, St. Paul, MN 55107, 612-222-2791 ..... A•2077, B•1793
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§† American Research & Engineering, Elgin, IL 60123 708-888-7245
§ Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
§ Ark Les Corporation, Watertown, MA 02172 617-924-2330
§ Ark-Les Corp, Raleigh, NC 27620 919-231-2000
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
CTS Corporation, Elkhart, IN 46514 219-293-7511
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ Daburn Electronics & Cable Corp., Northvale, NJ 07647 201-768-5400
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Gaynor Electric Co., Thomaston, CT 06787-0316 203-283-4388
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Guardian Elec. Mfg. Co., Koike Electric, Woodstock, IL 60098 815-337-0050
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
International Resource Svcs., Miami, FL 33166 305-884-2924
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 708-949-8505
§ Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Lutron Electronics Co., Coopersburg, PA 18036 215-282-3800
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
Nobie U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
† Roanwell, New York, NY 10014 212-989-1090
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800

Switches, Snap Action (All Types)-5100

§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1650-1651**
§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ..... B•1652-1653**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1654**
Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281 ..... B•1657
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1664-1665**
§ **CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... B•1671-1672**
§† **CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1678-1679**
§ **Direct Sound Corporation, New York, NY 10011, 212-691-9050 ..... B•1681**
§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1684-1685**
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1692
§† **Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1694**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1696
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1700-1701**
† **Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1368,1370**
§† **ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1718-1721**
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1818
§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374 ..... B•1728-1729**
§ **McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1735-1736**
§† **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1738-1739,1742**
§ **MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745**
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1746-1752**
§† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 ..... B•1762-1763**
§ **Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... B•1764, C•1501,1504-1505**
§ **Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1771**
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
Airpax-Cambridge Division, A North American Philips Co., Cambridge, MD 21613 301-228-4600
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
§ Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
Ark Les Corporation, Watertown, MA 02172 617-924-2330
§† Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100

Augat Inc., Attleboro, MA 02703 ... 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 ... 508-685-4371
Aztec Industries, Inc., Mesa, AZ 85210 ... 602-833-3131;800-729-3132
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058 ... 213-589-6181
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 ... 813-573-2525
§† C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 ... 203-269-8701
Chicago Lock Co., Chicago, IL 60641 ... 312-282-7177
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C. ... 886-2-9174302
§ Cole Hersee Co., Boston, MA 02127-2467 ... 617-268-2100
† Control Products, Inc., E. Hanover, NJ 07936 ... 201-887-9400
§† Crouzet Corporation, Carrollton, TX 75006-2503 ... 214-250-1647;1-800-527-5311
CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 ... 219-295-3575
§ CUI Stack Inc., Beaverton, OR 97005 ... 503-643-4899
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 ... 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 ... 213-660-1310
ELMA Electronic Inc., Fremont, CA 94538 ... 415-656-3400
† Elmwood Sensors, Pawtucket, RI 02861 ... 401-727-1300
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
EnTech Corporation, Simsbury, CT 06070 ... 203-658-2740;203-651-9557
§ Entech Systems, Inc., Simsbury, CT 06070 ... 203-651-9557
§ FENWAL Inc., Ashland, MA 01721 ... 508-881-2000
§ GC-Thorsen, Rockford, IL 61105-1209 ... 815-968-9661
§ Go Switch, Louisville, KY 40233 ... 502-969-2386
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ... (0)911/65521 or 65520
The Hall Company, Urbana, OH 43078 ... 513-652-1376
† Haydon Switch & Instrument, Waterbury, CT 06705 ... 203-756-7441
§ ICO-RALLY Corporation, Palo Alto, CA 94303 ... 415-856-9900
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-5475
International Microelectronics, Arlington, TX 76003 ... 817-561-2244
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 ... 312-421-1090
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 ... 708-949-0505
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA ... 2615567-68;2613521-22-23
Leecraft Mfg., Long Island City, NY 11101 ... 718-392-8800
§ Linemaster Switch, Woodstock, CT 06281-0238 ... 203-974-1000
Littelfuse, Inc., Des Plaines, IL 60016 ... 708-824-1188;708-824-0400
§† Machine Components Corp., Plainview, NY 11803 ... 516-694-7222
§ Mantex Corp., Oxford, MI 48371 ... 313-628-8210
Manufacturers Components, Inc., Hialeah, FL 33016 ... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 ... 315-655-8050
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ... 203-855-9100;800-333-5762
Milross Controls, Inc., Southampton, PA 18966 ... 215-355-0200
Mouser Electronics, Mansfield, TX 76063 ... 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 ... 708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 ... 708-843-7900
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630 ... 714-527-0561
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 ... 315-468-6211
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
† Roanwell, New York, NY 10014 ... 212-989-1090
† Saint Switch, Inc., St. Charles, IL 60174 ... 708-377-3779
Schroff Incorporated, Warwick, RI 02886 ... 401-732-3770
§ Seacor, Inc., Westwood, NJ 07675 ... 201-666-5600
† Secme, Inc., Secme, Irvine, CA 92714 ... 714-261-0610
Shin-Etsu Polymer America, Inc., Union City, CA 94587 ... 415-475-9000
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ... 609-866-8888;800-257-8384
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 ... 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 ... 800-482-2828
† Square D Co., Palatine, IL 60067 ... 708-397-2600
Square D. Company, Control Products, Knightdale NC 27545 ... 919-266-3671
§ Stancor, White-Rodgers, Logansport, IN 46947 ... 219-722-2244
† Sundstrand Data Control Inc., Sundstrand Corporation, Redmond, WA 98073-9701 ... 206-885-3711
§ Switches Unlimited, Inc., Woodside, NY 11377 ... 718-478-5000;800-221-0487
† Tech Laboratories Inc., Palisades Pk., NJ 07650 ... 201-944-2221
Texas Instruments, Connector System, Attleboro, MA 02703 ... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 ... 508-699-3800
§ Toko America, Inc., Mt. Prospect, IL 60056 ... 708-297-0070
§ Torq Corp., Bedford, OH 44146 ... 216-232-4100
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 ... 708-964-2330
§ United Electric Controls, Watertown, MA 02272-9143 ... 617-926-1000
Westlake Components International, Westlake Village, CA 91361 ... 800-228-1097

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American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ... B•1645
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ... B•1652-1653
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ... B•1662
§ Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ... A•2086-2092, B•1450-1452,1454-1455
§ Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ... B•1459-1460, D•1133
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ... B•1684
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ... A•1369
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 ... A•1749
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ... A•1751
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ... B•1742
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ... A•2118-2119
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ... B•1769
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ... B•1959
AEL Defense Corp., Lansdale, PA 19446 ... 215-822-2929
Aeroflex Laboratories Inc., ARX Inc., Plainview, NY 11803 ... 516-694-6700
Amplitronix Inc., Philadelphia, PA 19154 ... 215-464-4000
† Analog Devices, Inc., Norwood, MA 02062-9106 ... 617-329-4700
§† ANZAC, M/A-COM, Burlington, MA 01803 ... 617-273-3333
Astro-Geo-Marine, Inc., Ventura, CA 93003 ... 805-654-8300
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058 ... 213-589-6181
Cambridge Aeroflo, Inc., Shirley, MA 01464 ... 508-45-2346
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2S8 ... 514-739-3274
§ C & K Components, Inc., Newton, MA 02158-1082 ... 617-964-6400
§ Cole Hersee Co., Boston, MA 02127-2467 ... 617-268-2100
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 ... 515-573-1000
Cross Electronics, Warrendale, PA 15086 ... 412-776-1591
† Daico Industries, Inc., Compton, CA 90220 ... 213-631-1143
† Dionics, Westbury, NY 11590 ... 516-997-7474
Dynage/Controls, Inc., Canistota, SD 57012 ... 605-296-3407
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 ... 414-449-7487
§ Efector, Inc., Exton, PA 19341 ... 215-524-2000;800-441-8246
§ Electromatic Controls Corp., Hoffman Estates, IL 60195 2010 ... 708-882-5757
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ... 214-470-2137
Enerco, Inc., Seattle, WA 98108 ... 206-762-1422
† Genisco Technology Corp., La Mirada, CA 90638 ... 714-523-7001
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ... (0)911/65521 or 65520
HEI Inc., Optoelectronics Div., Victoria, MN 55386 ... [illegible]
§† Honeywell Microswitch Div., Richardson, TX 75081 ... 214-470-4271
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634 ... 312-282-4040
† JFW Industries, Inc., Indianapolis, IN 46227 ... [illegible]
§ Linemaster Switch, Woodstock, CT 06281-0238 ... 203-974-1000
§ Lutron Electronics Co., Coopersburg, PA 18036 ... [illegible]
§† Machine Components Corp., Plainview, NY 11803 ... 516-694-7222
MACOM, Inc., Burlington, MA 01803 ... [illegible]
† M/A COM Control Components Div., M/A-COM, [illegible] ... [illegible]
† MarLee Switch Co., Upland, CA 91786 ... 714-982-6965
Matrix Systems Corp., Calabasas, CA 91302 ... 818-222-2301
† Merrimac Industries, West Caldwell, NJ 07006 ... 201-575-1300
Microphase, Norwalk, CT 06856 ... 203-866-0000
OakGrigsby Inc., Sugar Grove, IL 60554 ... 708-556-4200
Olektron Corp., Signal Technology Corp., Webster, MA 01570 ... 508-943-7440
Omega Engineering, Stamford, CT 06907 ... 800-826-6342
Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 ... 708-843-7900
§ Omron Electronics, Inc., F A Systems Div, Schaumburg, IL 60173 ... 708-843-7900
§ Payne Engineering, Scott Depot, WV 25560 ... 304-757-7353
Phase Control Electronics, Glendale, NY 11385 ... 718-441-1078
Power Functions Engineering, Garland, TX 75042 ... 214-272-0996
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ... 408-727-1500;800-843-1515
Regent Controls, Inc., Shelton, CT 06484-0767 ... 203-924-2024
† RLC Electronics, Inc., Mt. Kisco, NY 10549 ... 914-241-1334
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94541 ... 415-471-9717
§† Siliconix Inc., Santa Clara, CA 95054 ... 408-988-8000
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-9901 ... 609-589-7500
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 ... 617-491-1670
Tele-Tech Corporation, Bozeman, MT 59715 ... 406-586-0291
Tempo Instrument, Inc., Commack, NY 11725 ... 516-864-3700
Triac Electronic Systems, Inc., Glendale, NY 11385 ... 718-441-4759
§ United Electric Controls, Watertown, MA 02272-9143 ... 617-926-1000
† Watkins-Johnson Co., Palo Alto, CA 94304 ... 415-493-4141
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 ... 602-254-1570

Switches, Step Type-5100

BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ... B•1652
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ... B•1660
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ... B•[illegible]
§ Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ... B•1675
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ... B•1461
† Janco Corp., Burbank, CA 91508, 818-846-1800 ... B•1726-1727
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ... B•1731
J. R. Merritt Controls, Inc., Norwalk, CT 06854, 203-855-9100;800-333-5762 ... D•1139
§ Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ... A•1964
† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ... B•1766
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ... B•1769
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ... B•1771
§ Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 ... B•1773,1777
Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ... B•1787
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ... B•1789
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ... B•1790
Airflyte Elctrns. Co, Bayonne, NJ 07002 ... 201-436-2230
§ Alps Electric (USA), Inc., San Jose, CA 95134 ... 408-432-6000
§ Amerace Corporation, Hackettstown, NJ 07840 ... 201-852-1122
§† ASM Corporation, Smithfield, NC 27577 ... 919-934-3104

§ Buchanan, Amerace Corporation, Livingston, NJ 07039 201-992-8400
† Electro National Corp., Canton, MS 39046 601-859-5511
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634 312-282-4040
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Tenor Company, New Berlin, WI 53151 414-782-3800

Switches, Surface Mount-5100

§ Aries Electronics, Frenchtown, NJ 08825, 908-996-6841 ... B•1649, C•1281-1282
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ..... B•1652-1653
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ..... B•1655
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1654
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1661,1663
Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1660
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... B•1671-1672
Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1675
Direct Sound Corporation, New York, NY 10011, 212-691-9050 ..... B•1681
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1684-1685
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1690,1692
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1698
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1706
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1815
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1712,1716-1717
§ Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... B•1737
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1740
MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1746-1747,1749-1752
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 708-438-4000 ..... B•1765
Rundel Products, Allied Controls Incorporated, Waterbury, CT 06705, 203-757-4200 ..... B•1769
§ Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1787
Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1784
Wilbrecht Electronics, St. Paul, MN 55107, 612-222-2791 ..... A•2077, B•1793
§ American Research & Engineering, Elgin, IL 60123 708-888-7245
Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C. 886-2-9174302
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
§ CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
§ EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-3023
ITT Schadow, Eden Prairie, MN 55344 612-934-4400
K-Two Industries, Palo Alto, CA 94306 408-720-9316
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
OMNI Switch USA, Inc., Phoenix, AZ 85027 602-582-0629
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277

Switches, Tap — See Switches, Rotary (Vol. B)

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Airpax-Frederick Division, A North American Philips Co., Frederick, MD 21701, 301-663-5141 ..... B•1832
Approved Purification Corp., Stamford, CT 06907, 203-357-0141 ..... B•1878
Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 ..... B•1842-1843
Fenwal Electronics, Inc./APD, Milford, MA 01757, 508-478-6000 ..... B•1845
Hold-Heet Products Corp., Chicago, IL 60640, 312-728-4454;312-728-4455 ..... B•1501
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1740
§ Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673 ..... B•1861
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 ..... B•1391,1865
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1867-1869
WARREN G-V, GENERAL SIGNAL CORP., WHIPPANY, NJ 07981, 201-386-1200 ..... B•1870
§ Aqualarm, Marine Safety Systems, Inc., Chula Vista, CA 91911 619-575-4011
§ Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058 213-589-6181
Burling Instruments, Inc., Chatham, NJ 07928-0298 201-635-9481
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-45-2346
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
† Chatham Controls, Chatham, NJ 07928 201-635-8892
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ EliWell-USA Ltd., EliWell, S.P.A., NYC, NY 10022 212-832-9393
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Ketema/Rodan Division, Anaheim, CA 92806 714-630-0081
Princo Instruments, Inc., Southampton, PA 18966
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Stancor, White-Rodgers, Logansport, IN 46947 219-722-2244
† Sundstrand Data Control Inc., Sundstrand Corporation, Redmond, WA 98073-9701 206-885-3711
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
Thermik Corp., Thermik Sensor Technics, GmbH, New Bern, NC 28562 919-636-5720
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ United Electric Controls, Watertown, MA 02272-9143 617-926-1000
§ West Electronic Sales Team, Westminster, CA 92683 .... 714-898-0120;213-495-5569
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002

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American Control Technology, Inc., West Dundee, IL 60118-2100, 708-426-6780 ..... B•1645
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1654
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ..... B•1664-1665
§† Crouzet Corporation, Carrollton, TX 75006-2503, 214-250-1647;1-800-527-5311 ..... B•1675
§† Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1680
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1709
§ Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... B•1817
§ IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 ..... B•1722-1723
JAE Electronics Inc., Irvine, CA 92718, 714-753-2600 ..... B•1725
MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1789
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C. 886-2-9174302
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
§† EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Erni Components, Richmond, VA 23236 804-794-6367
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
§ Inter-Market, Glenview, IL 60025 708-729-5330
International Microelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 708-843-7900
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277

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§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1141,1648
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ..... B•1655
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1654
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1656
§ Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281 ..... B•1657-1658
§ Direct Sound Corporation, New York, NY 10011, 212-691-9050 ..... B•1681
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-8719 ..... B•1689-1690
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1699
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 ..... B•1707
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878;800-824-9374 ..... B•1728-1729
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1734
§† Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1743

§ MORS/ASC, Wakefield, MA 01880-4444, 617-246-1007 ..... B•1745
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1746-1752
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 ..... B•1762-1763
§ Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... B•1764
RDI Elctrns., Inc., New Rochelle, NY 10801, 914-632-7274 ..... B•1767
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1778
Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1784
§ T-Bar Data Switch Corp., Shelton, CT 06484, 203-926-1801 ..... B•1788
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1789
Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
Advanced Systems Concepts, Inc., Altadena, CA 91001 818-791-0983
† Airpax Cambridge Division, A North American Philips Co., Cambridge, MD 21613 301-228-4600
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Amptronix, Inc., Rowland Heights, CA 91748 213-666-1564
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
Ark-Les Corporation, Watertown, MA 02172 617-924-2330
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
§† Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-6701
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C. 886-2-9174302
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§† Crouzet Corporation, Carrollton, TX 75006-2503 ..... 214-250-1647;1-800-527-5311
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
Duralcoil, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101 ..... 718-937 8000
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
§ Gaynor Electric Co., Thomaston, CT 06787-0316 203-283-4388
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-3023
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
§ ICC-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Initronics Industries, St. Petersburg, FL 33716 813-572-9010
International Microelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l Ltd., Syosset, NY 11791-6093 516-937-3475
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA 2615567-68;2613521-22-23
Key Elements Corp., Pine Brook, NJ 07058-2025 201-227-2000
† Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
Littelfuse, Inc., Des Plaines, IL 60016 ..... 708-824-1188;708-824-0400
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Optrex/Satori, Torrance, CA 90503 213-214-1791
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
§ RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Saint Switch, Inc., St. Charles, IL 60174 708-377-3779
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§† Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277

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† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1656
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-677-6719 ..... B•1689-1692
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1814
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Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
§ Bowmar Instrument Corp., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
C.A.M. Graphics Co., Inc., Amityville, NY 11701 516-842-3400
§ Elector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Enerco, Inc., Seattle, WA 98108 206-762-1422
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
The Hall Company, Urbana, OH 43078 513-652-1376
† Hallmark Technologies, Mt. Dora, FL 32757 800-874-9063
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
† Holt Inc., Irvine, CA 92718 714-859-8800
§ Lutron Electronics Co., Coopersburg, PA 18036 215-282-3800
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Miller Dial Corp., El Monte, CA 91731 818-444-4555
MOLEX, Inc., Lisle, IL 60532 708-969-4550
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543 ..... 914-698-2026;800-431-2625 (outside NY)
Relay Service Co., Chicago, IL 60651 312-252-2700
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
Technical Panels, Inc., Temple City, CA 91780 ..... 800-343-1170;818-285-3105
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
§ Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400

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† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ..... B•1656
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CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... B•1669-1670
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514, 219-295-3575 ..... B•1677
§† Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1680
† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1694
† Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 ..... B•1842
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§† Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1698-1699,1702-1704
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ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1718-1721
† Janco Corp., Burbank, CA 91508, 818-846-1800 ..... B•1726-1727
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 ..... B•1823
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1738-1739,1742-1743
† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ..... B•1755,1758
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ..... D•1143
† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 ..... B•1762-1763
Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... B•1764
§ Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 ..... B•1772-1773,1776-1777
§ T-Bar Data Switch Corp., Shelton, CT 06484, 203-926-1801 ..... B•1788
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1789
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... B•1959
† Accudyne Corp., Janesville, WI 53547 608-752-4053
Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
† Advanced Systems Concepts, Inc., Altadena, CA 91001 818-791-0983
§† Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
ASM Corporation, Smithfield, NC 27577 919-934-3104
§† Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§† EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
† Jennings, San Jose, CA 95122-2696 408-292-4025
† Kilovac Corp., Santa Barbara, CA 93140-4422 ..... 805-684-4560;800-253-4650
† Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
† Machine Components Corp., Plainview, NY 11803 516-694-7222
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300

† Saint Switch, Inc., St. Charles, IL 60174 708-377-3779
† Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312

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CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514, 219-295-3575 ..... B•1677
§† **Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1680**
† **Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1682**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1696-1697
† **General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749**
§† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ..... B•1809**
† **Janco Corp., Burbank, CA 91508, 818-846-1800 ..... B•1726-1727**
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... B•1959
Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
ASM Corporation, Smithfield, NC 27577 919-934-3104
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
† Jennings, San Jose, CA 95122-2696 408-292-4025
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
§ K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
† Machine Components Corp., Plainview, NY 11803 516-694-7222
† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† MarLee Switch Co., Upland, CA 91786 714-982-8988
OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007

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Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1706
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1712-1714,1719
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1818
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1824
OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ..... B•1755,1757
Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1787
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0748 716-265-1600
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
DataLux Corp., Winchester, VA 22601 703-662-1500
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
JAE Electronics Inc., Irvine, CA 92718 714-753-2600
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610

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LEM U.S.A., Inc., Milwaukee, WI 53218 414-353-0711
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1151**
Fasco Industries, Inc., Hawker Siddelem No. 200, Chesterfield, MO 63017, 314-532-3505 ..... C•1623
† American Electronics, Fullerton, CA 92631 714-871-3020
† Astro Instrument Corp., Deerfield, FL 33442-3019 305-698-6000
Astrosystems, Lake Success, NY 11042 516-328-1600
§ Eaton Corp., Electronic Instrument Div., Los Angeles, CA 90066 213-822-3061
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
† Magtech Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308 205-880-0444

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Television Systems & Equipment, Cable (CATV) & Master Antenna (MATV) — See CATV Systems & Equipment (Vol. D)

Television Systems & Equipment Closed Circuit-1900 — *See Vol. D*

Temperature Compensators-5300

Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 ..... **B•1834-1837**
Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... **B•1846**
Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... **B•1859**
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... **B•1866,1869**
U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ..... **B•1871**
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
§ EDL, Inc., Danville, VA 24540 ..... 804-799-0807;1-800-DIAL EDL
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
§ KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Precision Resistor Co., Inc., Largo, FL 34647-1421 813-541-5771
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002

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Terminal Boards-2100 — *See Vol. C*

Terminal Boards, Blocks, Strips (MIL)-2440

Beau Products Div., Vernitron Corp., Laconia, NH 03247, 603-524-5101 ..... **C•1293-1294**
§† **Jan Hardware Mfg. Co., Melville, NY 11747, 718-361-0800** ..... **C•1588-1589**
Andon Elctrns. Corp., Lincoln, RI 02865 401-333-0388
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
B.R.T.B. Inc., Markham, Ont., CANADA L6G 1A7 416-475-8903
Clifford of Vermont, Inc., Bethel, VT 05032 ..... 802-234-9921;800-451-4381
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Doran Manufacturing Co., Cincinnati, OH 45225 513-681-5424
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Entrelec Div/GEC Alsthom International, Inc., Irving, TX 75038 214-550-9025
† FIC Corp., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
Marco Manufacturing Co., Inc., Philadelphia, PA 19145 215-463-2332
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§† PCD, Peabody, MA 01960 508-532-8800
§ Reliance Comm/Tec, Reliance Electric, Cleveland, OH 44117 800-245-4501
Trompeter Electronics, Inc., Westlake Village, CA 91362-4047 818-707-2020

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Terminals (MIL), Ground Data-2440

U.S. Terminals Inc., Cincinnati, OH 45243, 513-561-8145 ..... **C•1563**
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Miltope Corp., Melville, NY 11747 516-420-0200
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010

Terminations, Antenna-Also See Dummy Loads-2500 — *See Vol. C*

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Terminations, Fiber Optic-2475

† **ADC Telecommunications, Inc., Minneapolis, MN 55435, 612-835-6800** ..... **C•1157-1159**
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... **C•1175**
DuPont Connector Systems, DuPont Elctrns., Wilmington, DE 19880-0019, 800-237-2374 ..... C•1350
† **Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727** ..... B•1217
† **Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121** ..... B•1227
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Dubbeldee Harris Diamond Corp.:D. Drukker & Zn. N.V., Mt. Arlington, NJ 07856 201-770-1420
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
Fiberguide Industries Inc., Stirling, NJ 07980 908-647-6601
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
† Light Control Systems Inc., M/A COM Inc., Tyngsboro, MA 01879 508-649-9870
† Math Assocs., Westbury, NY 11590 516-334-6800
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
§ Thomas & Betts Corporation, Electronics Div., Greenville, SC 29616-2401 803-676-2900
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123

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Test Assemblies (MIL)-2440

§ **Qualitec Technologies, Inc., Fremont, CA 94538, 415-498-1046** ..... **D•1313**
Assembly Specialists, Chelmsford, MA 01824 508-250-5900
† Cardinal Control Co., Kensington, CT 06037 203-828-6379
Computer Doctors, College Park, MD 20740 ..... 1-800-RAM-STAR;301-474-3095
GRIM Corporation, Medford, NJ 08055-0968 609-267-7950
Pacific Power Source Corp., Huntington Bch., CA 92649 .. 714-898-2691;800-854-2433
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123

Test Benches (MIL)-2440

† Melles Griot, Inc., Irvine, CA 92714 714-261-5600

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Test Equipment, Closed Circuit TV-Also See Television Systems & Equipment, Closed-Circuit-2900 — *See Vol. D*

Test Equipment, Color TV-2900 — *See Vol. D*

Test Equipment, Data Communications, Monitors & Recorders-2900 — *See Vol. D*

Test Equipment, Fiber Optic-2475

Advantest America, Inc., Lincolnshire, IL 60069, 708-634-2552 ..... D•1214-1215
† **Anritsu, Oakland, NJ 07436, 201-337-1111;800-255-7234 ..... D•1218**
Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100 ..... D•1229
Advantest Corporation, Tokyo 163, JAPAN 03-3342-7500
Ametek Controls Div., Ametek Fiber Optic Products, Feasterville, PA 19047 215-355-6900
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Biddle Instruments, Blue Bell, PA 19422 215-646-9200
Cabletron Systems, Inc., Rochester, NH 03867 603-332-9400
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
§ Dupont Electro-Optic Products, Dupont Electronics, Research Triangle Park, NC 27709 ..... 1-800-888-LAN1;919-481-5100
Dymec Inc., Winchester, MA 01890 617-729-7870
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Force, Inc., Christiansburg, VA 24073 703-382-0462
Φ Genstar Rental Electronics, Inc., Woodland Hills, CA 91367 ..... 800-331-3440 (in CA); 800-227-8409
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
Hamamatsu Photonic Systems Corp., Industrial Video, Wakefield, MA 01880 617-245-8100
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† INTELCO, Acton, MA 01720 508-264-4485
† Lightwave Communications, Inc., Ridgefield, CT 06877 203-438-3591
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 ..... 800-336-5917;703-953-4751
† Math Assocs., Westbury, NY 11590 516-334-6800
3M Photodyne Products, Dynatel Systerms Division, Camarillo, CA 93010 ..... 805-388-8378;800-426-8688
Olympus Corporation, Industrial Fiberoptics Division, Lake Success, NY 11042-1179 516-488-3880
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Photon, Inc., Santa Clara, CA 95054-3432 408-492-9449
† Power Technology, Inc., Little Rock, AR 72219-1117 501-568-1995
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Soltec Corp., San Fernando, CA 91340-1597 ..... 818-365-0800;800-423-2344
Tektronix Inc., Beaverton, OR 97077 800-835-9433
TLC Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
Velmex, Inc., East Bloomfield, NY 14443 ..... 716-657-6151;800-642-6446
† York Technology, Inc., Burbank, CA 91502 818-955-8927

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Ball Corp., Efratom Division, Irvine, CA 92718-1605, 714-770-5000 ..... A•1307
Cirris Systems Corp., Salt Lake City, UT 84119, 801-973-4600;800-441-9910 ..... D•1235
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258-1265
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... D•1270
Kikusui International Corp., Torrance, CA 90503, 213-371-4662;800-545-8784 ..... D•2211
† **Sunrise Electronics, Inc., Glendora, CA 91740, 818-914-1926 ..... D•1329**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1198
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
Astrosystems, Lake Success, NY 11042 516-328-1600
† Atec, Inc., Houston, TX 77055 713-468-7971
† Axis Corporation, San Diego, CA 92123 619-560-7737
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Blue M, A Unit of General Signal, Blue Island, IL 60406 708-385-9000
Cincinnati Sub-Zero Prods., Cincinnati, OH 45241 513-772-8810
† Colorado Data Systems, Inc., Englewood, CO 80110 ..... 303-762-1640; 800-TEK-4VXI
Custom Sci. Instrs., Cedar Knolls, NJ 07927 201-538-8500
§ EDL, Inc., Danville, VA 24540 ..... 804-799-0807;1-800-DIAL EDL
† Electro Optical Industries Inc., Santa Barbara, CA 93111 ..... 805-964-6701 (ext. 280)
Elgar/Intepro Systems, San Diego, CA 92121 ..... 619-458-0261;1-800-733-5427
Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-8600
† Everett/Charles Test Equipment, Inc., Pomona, CA 91767 714-621-9511
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Fastek Test Systems, Div. of International Fastek Corp., Vista, CA 92083 619-598-9990
GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
† Hayes Instrument Service Inc., Billercia, MA 01821 508-663-4800
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
Itronic-Fuchs Corp., Buford, GA 30518 404-945-3844
§† Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025 201-227-2000
Kenmar Manufacturing Services, Kenmar Business Groups, Inc., Raleigh, NC 27604 919-876-6049
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
LTX Corporation, Westwood, MA 02090 617-461-1000
Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818 219-489-2511
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
North Atlantic Industries, Hauppauge, NY 11788 516-582-6500
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 818-341-5151
† Production Automation, Inc., Santa Clara, CA 95054 408-980-9880
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Schenck Pegasus Corp., Troy, MI 48083 313-689-9000
† Sencore, Sioux Falls, SD 57107 ..... 1-800-736-2673; 605-339-0100
Sensidyne, Inc., Clearwater, FL 34620 ..... 813-530-3602;1-800-451-9444
§ TEGAM, Inc., Madison, OH 44057 800-666-1010
† Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† Trio-Tech International, San Fernando, CA 91340 818-365-9200
† VA-Tran Systems Inc., Chula Vista, CA 91911 619-423-4555
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Weico Wire & Cable, Inc., Edgewood, NY 11717 516-254-2970
† Zehntel Systems, Div.of Teradyne Inc., Walnut Creek, CA 94598 415-932-6900

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Test Methods (MIL)-2440

Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•2221
Product Technology, Inc., Irvine, CA 92714, 714-474-9999 ..... C•1634
§† **Qualitec Technologies, Inc., Fremont, CA 94538, 415-498-1046 ..... D•1313**
LTX Corporation, Westwood, MA 02090 617-461-1000
RTS Systems, Telex Communications, Inc., Burbank, CA 91506 818-566-6700
† Zehntel Systems, Div.of Teradyne Inc., Walnut Creek, CA 94598 415-932-6900

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§† **Qualitec Technologies, Inc., Fremont, CA 94538, 415-498-1046 ..... D•1313**
† **Sunrise Electronics, Inc., Glendora, CA 91740, 818-914-1926 ..... D•1329**
† Atec, Inc., Houston, TX 77055 713-468-7971
† Axis Corporation, San Diego, CA 92123 619-560-7737
† Cabletest Products Co., Malden, MA 02148 617-665-2932
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Comtech Microwave Corp., Comtech Corp., Hauppauge, NY 11788 516-435-4646
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499 206-657-7474
† Electro Optical Industries Inc., Santa Barbara, CA 93111 ..... 805-964-6701 (ext. 280)
† ETM Electromatic Inc, Newark, CA 94560 415-797-1100
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
Kenmar Manufacturing Services, Kenmar Business Groups, Inc., Raleigh, NC 27604 919-876-6049
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
† Production Automation, Inc., Santa Clara, CA 95054 408-980-9880
Rapid Systems Inc., Seattle, WA 98103 206-547-8311
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Wavetek San Diego, Inc. , Wavetek Corp., San Diego, CA 92123 619-279-2200

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Testers, (MIL)-2440

Kikusui International Corp., Torrance, CA 90503, 213-371-4662;800-545-8784 ..... D•2211
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•2218
§† Qualitec Technologies, Inc., Fremont, CA 94538, 415-498-1046 ..... D•1313
† Axis Corporation, San Diego, CA 92123 619-560-7737
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
† Production Automation, Inc., Santa Clara, CA 95054 408-980-9880
† Trio-Tech International, San Fernando, CA 91340 818-365-9200

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† Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 ..... B•1834-1837
§ Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... B•1839-1841
Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 ..... B•1843
§† Fenwal Electronics, Inc./APD, Milford, MA 01757, 508-478-6000 ..... B•1845
§† Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1846-1848
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1849-1851
† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... B•1853
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1854, C•1799
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1973
† Sensor Scientific, Inc., Fairfield, NJ 07006, 201-227-7790;800-524-1610 ..... B•1862-1863
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 ..... B•1865
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1866-1869
† U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ..... B•1871
Advanced Thermal Products, Inc., St. Marys, PA 15857 814-834-1541
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
Alpha Thermistor, Inc., San Diego, CA 92121 ..... 619-549-4660;800-235-5445
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
Cambridge Aerotio, Inc., Shirley, MA 01464 508-45-2046
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
† Digitec, Marion, OH 43302 614-387-3444
§ Dowty Custom Elctrns., Inc., Thermocontrol Div., Brandon, VT 05733 802-247-6811
§ EDL, Inc., Danville, VA 24540 ..... 804-799-0807;1-800-DIAL EDL
Electro-Dyn Electronics, Niagara Falls, NY 14301 716-284-8747
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
GIC Thermodynamics, Royal Oak, MI 48073 313-280-1648
§† Gordon Co.:Watlow, Richmond, IL 60071 815-678-2211
§ Industrial Computer Designs, Inc., Westlake Village, CA 91361 ..... 818-889-3179; 800-423-3179
Interelectronics Corp., Congers, NY 10920 ..... 914-EL8-8000
International Microelectronics, Arlington, TX 76003 817-561-2244
International Resistive Company, Boone, NC 28607 704-264-8861
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871

† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
† Quality Thermistor, Boise, ID 83709 208-377-3373
§ RFL Inds., Inc., (DBA) Dowty Elctrns. Co., Brandon, VT 05733 802-247-6811
§ Science/Electronics, Dayton, OH 45401-0986 513-859-5555
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Sunshine Instruments, Philadelphia, PA 19115 ..... 215-673-5600;800-343-1199
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§ TEGAM, Inc., Madison, OH 44057 800-666-1010
† Thermometrics, Inc., Edison, NJ 08817-4695 908-287-2870
§ United Electric Controls, Watertown, MA 02272-9143 617-926-1000
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
§† Victory Engineering Corp., Springfield, NJ 07081 201-379-5900
§† Weed Instrument Co., Inc., Round Rock, TX 78680-0300 512-255-7043
West Electronic Sales Team, Westminster, CA 92683 ..... 714-898-0120;213-495-5569
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002

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§† Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1008-1009
Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 ..... B•1834-1837
§ Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... B•1839-1841
Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 ..... B•1843
Fenwal Electronics, Inc./APD, Milford, MA 01757, 508-478-6000 ..... B•1845
§ Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1846-1848
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 .. B•1850
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... B•1853
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1856-1857
† Sensor Scientific, Inc., Fairfield, NJ 07006, 201-227-7790;800-524-1610 ..... B•1862-1863
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1866-1869
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Electro-Dyn Electronics, Niagara Falls, NY 14301 716-284-8747
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
Instrulab, Dayton, OH 45404 513-223-2241
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Quality Thermistor, Boise, ID 83709 208-377-3373
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538 419-525-8500
† Thermometrics, Inc., Edison, NJ 08817-4695 908-287-2870
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002

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Best Technology Inc., Seattle, WA 98109, 206-382-1300 ..... B•1833
Calex Mfg. Co., Inc., Pleasant Hill, CA 94523, 510-932-3911 ..... D•1008
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... D•1252
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899 ..... D•1382
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1945, C•1799, D•1013
PPM, Inc., Cleveland, OH 44139, 216-349-2300 ..... D•1311
Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... B•1858
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1382
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1399,1401
Acculex Corporation, Taunton, MA 02780 508-880-3660
† Alberox Corporation, New Bedford, MA 02745 508-995-1725
Alpha-M Corp., Dallas, TX 75229 214-406-0424
§ Alpha Wire Corp., Elizabeth, NJ 07207-0711 908-925-8000
ARi Industries, Inc., Addison, IL 60101 ..... 708-953-9100;800-237-6725
§ Athena Controls, Inc., Plymouth Meeting, PA 19462 215-828-2490
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§† Bailey Controls Co., Wickliffe, OH 44092 216-585-8500
Ballantine Laboratories, Noise Unlimited Inc., Cedar Knolls, NJ 07927 ... 201-984-1900
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
Bartlett Instrument Co., Ft. Madison, IA 52627 319-372-8366
§ Beckman Industrial Corp., An Affiliate of Emerson Elec. Co., San Diego, CA 92123-1898 619-495-3200
Burling Instruments, Inc., Chatham, NJ 07928-0298 201-635-9481
Ceramaseal, New Lebanon, NY 12125 518-794-7800
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Conax Buffalo Corporation, Buffalo, NY 14225 716-684-4500
§ Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
† DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
† Digitec, Marion, OH 43302 614-387-3444
§ Dowty Custom Elctrns., Inc., Thermocontrol Div., Brandon, VT 05733 ... 802-247-6811
§ EDL, Inc., Danville, VA 24540 ..... 804-799-0807;1-800-DIAL EDL
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
† Electro Physics Co., Inc., Waukegan, IL 60085 708-249-5801
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
† GIC Thermodynamics, Royal Oak, MI 48073 313-280-1648
§† Gordon Co.:Watlow, Richmond, IL 60071 815-678-2211
Hades Manufacturing Corp., Farmingdale, NY 11735 516-249-4244
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
Incotherm Limited, Hereford HR4 9SL ..... (44) 432 355880
Julie Research Labs., New York, NY 10001 212-633-6625
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
† Minco Products, Minneapolis, MN 55432 612-571-3121
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§ Pyrocom Co., Seattle, WA 98133 206-365-3535
§ RFL Inds., Inc., (DBA) Dowty Elctrns. Co., Brandon, VT 05733 802-247-6811
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1796 617-527-4385
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
§ Science/Electronics, Dayton, OH 45401-0986 513-859-5555
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
§ S. F. Products Corporation, Chester, NJ 07930 201-271-4009
† Simmonds Precision Engine Systems, BF Goodrich Aerospace, Norwich, NY 13815 607-335-5000
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
§ Sunshine Instruments, Philadelphia, PA 19115 ..... 215-673-5600;800-343-1199
† Syscon Intl., Inc., So. Bend, IN 46601-3796 219-232-3900
§ TEGAM, Inc., Madison, OH 44057 800-666-1010
Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
† Thermometrics, Inc., Edison, NJ 08817-4695 908-287-2870
§ United Electric Controls, Watertown, MA 02272-9143 617-926-1000
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300
§† Weed Instrument Co., Inc., Round Rock, TX 78680-0300 512-255-7043
§ WestCon, Marion, OH 43302 614-382-5771
§ West Instrument, A Mark IV Company, Des Plaines, IL 60018-1919 708-390-7711

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† Airpax-Frederick Division, A North American Philips Co., Frederick, MD 21701, 301-663-5141 ..... B•1832
† Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 ..... B•1842
Fenwal Electronics, Inc./APD, Milford, MA 01757, 508-478-6000 ..... B•1845
§ Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673 ..... B•1861
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 ..... B•1391,1865
Advanced Thermal Products, Inc., St. Marys, PA 15857 814-834-1541
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058 213-589-6181
§† Bud Industries, Inc., Willoughby, OH 44094-0431 216-946-3200
Burling Instruments, Inc., Chatham, NJ 07928-0298 201-635-9481
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
† Chatham Controls, Chatham, NJ 07928 201-635-8892
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ EliWell-USA Ltd., EliWell, S.P.A., NYC, NY 10022 212-832-9393
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Ramsey, NJ 07446 201-825-9696
† Honeywell Inc., Commercial Bldgs. Grp., MN 27-4231, Minneapolis, MN 55408 612-870-2294
§ Jewell Electrical Instruments, Manchester, NH 03103 603-669-6400
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
§ Letco International, New Braunfels, TX 78131-1200 512-625-6993

§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
Phase Control Electronics, Glendale, NY 11385 718-441-4278
Princo Instruments, Inc., Southampton, PA 18966
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Thermik Corp., Thermik Sensor Technics, GmbH, New Bern, NC 28562 919-636-5720
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538 419-525-8450
§ United Electric Controls, Watertown, MA 02272-9143 617-926-1000
WARREN G-V, GENERAL SIGNAL CORP., WHIPPANY, NJ 07981 201-386-1200

Thermowells-5300

Conax Buffalo Corporation, Buffalo, NY 14225 716-684-4500
§ DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
§ GIC Thermodynamics, Royal Oak, MI 48073 313-280-1648
§† Gordon Co.:Watlow, Richmond, IL 60071 815-678-2211
Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
Minco Products, Minneapolis, MN 55432 612-571-3121
Omega Engineering, Stamford, CT 06907 800-826-6342
Princo Instruments, Inc., Southampton, PA 18966
§ Pyrocom Co., Seattle, WA 98133 206-365-3535
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538 419-525-8500
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800

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§† Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
† Powertech, Inc., Fairlawn, NJ 07410 201-791-5050

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† **Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561** ..... D•1143
† **Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700** ..... A•1827
† Accusonic Division, Ferranti O.R.E. Inc., Falmouth, MA 02541 508-548-5800
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
† Datron Systems, Inc., Simi Valley, CA 93065-1650 805-584-1717
† DBA Systems, Inc., Melbourne, FL 32902-0550 305-727-0660
Dowty Avionics, Arcadia, CA 91006 818-445-5955
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-4858 818-882-6333
Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
† E-Systems, Greenville Div., Greenville, TX 75403-6056 903-455-3450
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† MFG, Parabam Div., Carson, CA 90745 213-549-5044
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300

Training Systems (MIL)-2440

† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
† Data-Design Labs., Cucamonga, CA 91730 714-987-2511
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
† E-Systems, Greenville Div., Greenville, TX 75403-6056 903-455-3450
GP Training Systems, Div. of General Physics Corp., Pottstown, PA 19464 215-327-3550
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
† Simulaser Corp., City of Industry, CA 91746 818-369-1355
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000

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§ **S.I. Tech, Batavia, IL 60510, 708-232-8640** ..... B•1231
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
H & L Instruments, Burlingame, CA 94010 415-342-7850

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Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1721
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 ..... 800-336-5917;703-953-4751

Transducer Elements-5500

† **Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650** ..... B•1892
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091, 708-251-3600 ..... D•1040-1041
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1916-1917
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1946
† **Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777** ..... A•2078
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
§ Data Instruments, Inc., Acton, MA 01720 508-264-9550
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ HBM, Inc., Marlboro, MA 01752 508-624-4500
Jewell Electrical Instruments, Manchester, NH 03103 603-669-6400
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
§ Rye Industries, Inc., Fuquay-Varina, NC 27526 919-557-0511
Spectrol Electronics Corp., Ontario, CA 91761 714-923-3313
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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Transducers, Audio-5500

Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000 ..... D•1028-1029
† **Blatek, Inc., State College, PA 16801, 814-231-2085;814-231-2086** ..... B•1885
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 ..... D•1031
§ **Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970** ..... D•1034-1035
§ **International Components Corp., Melville, NY 11747, 516-293-1500** ..... D•1038

Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091, 708-251-3600 ..... **D•1040-1041**
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 ..... **D•1044**
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **B•1922-1923, D•1047**
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... **A•1700**
§† Projects Unlimited, Dayton, OH 45414, 513-890-1918 ..... **D•1050-1052**
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... **D•1058**
Sonicall, Inc., Signal Hill, CA 90806, 213-490-2143 ..... **D•1061**
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512 ..... **D•1062-1065**
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... **D•1066**
§ AKG Acoustics, Inc., San Leandro, CA 94577 415-351-3500
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
§ Rye Industries, Inc., Fuquay-Varina, NC 27526 919-557-0511
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
† Stanton Magnetics, Inc., Plainview, NY 11803-1511 516-349-0235
# Tauber Elctrns. Inc., San Diego, CA 92117 619-274-7242
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 300-874-7123
§ Wheelock, Inc., Long Branch, NJ 07740 201-222-6880

Transducers, Ceramic-5500

Blatek, Inc., State College, PA 16801, 814-231-2085;814-231-2086 ..... **B•1885**
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 ..... **D•1044**
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056. 708-824-1133 ..... **A•1700**
Projects Unlimited, Dayton, OH 45414, 513-890-1918 ..... **D•1052**
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111 805-683-2575
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
Motorola Inc., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., Northbrook, IL 60062 708-205-2867
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
§ Stetco, Inc., Franklin Pk, IL 60131 708-671-4208
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Transducers, Displacement-5500

† **Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700** ..... **A•1720**
Blatek, Inc., State College, PA 16801, 814-231-2085;814-231-2086 ..... **B•1885**
§ Contaq Technologies Corp., Bristol, VT 05443, 802-453-3332 ..... **B•1889**
§ Data Instruments, Inc., Acton, MA 01720, 508-264-9550 ..... **B•1891**
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... **B•1903**
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... **B•1904-1905**
† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... **A•2047-2048**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. **B•1916-1917**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ... **B•1945-1946, D•1422**
Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... **B•1766**
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... **B•1947**
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... **A•2072**
† **Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777** ..... **A•2078**
§ AEMC Corporation, Boston, MA 02111 ..... 617-451-0227;800-343-1391
Astrosystems, Lake Success, NY 11042 516-328-1600
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Celesco Transducer Prods., Inc., Canoga Pk, CA 91304-5005 818-884-6860
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Computer Instruments Div., Hempstead, NY 11550 516-483-8200
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
HBM, Inc., Marlboro, MA 01752 508-624-4500
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
Kaman Instrumentation, Colo Springs, CO 80907 1-719-599-1892
§† Kavlico Corp., Moorpark, CA 93021 805-523-2000
LEL Co., Cresskill, NJ 07626 201-569-8641
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
Magnetoelastic Devices, Pittsfield, MA 01202 413-445-5608
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
MTS Systems, Minneapolis, MN 55424 612-937-4000
NMB Technologies, Chatsworth, CA 91311 818-341-3355
Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
Omutec, Odetics, Inc., Anaheim, CA 92802 714-758-0200
Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
Sensotec, Inc., Columbus, OH 43212 614-486-7723
† Sentech, Inc., Cheltenham, PA 19012 215-663-0422
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400
Stoelting Co., Wood Dale, IL 60191 708-860-9700
† Teledyne Gurley, Troy, NY 12181 ..... 518-272-6300;800-759-1844
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
Trans-Tek, Ellington, CT 06029 203-872-8351
TRW Technar, Inc., TRW, Inc., Irwindale, CA 91706 818-334-0250
Unimeasure, Inc., Corvallis, OR 97330 503-757-3158
§ Veeder-Root, Simsbury, CT 06070-2003 203-651-2700
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Flow-5500

Blatek, Inc., State College, PA 16801, 814-231-2085;814-231-2086 ..... **B•1885**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. **B•1916-1917**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1945**
Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... **B•1766**
ABB Kent-Taylor Inc., ASea Brown Boveri, Rochester, NY 14692 716-235-5000
Accusonic Division, Ferranti O.R.E. Inc., Falmouth, MA 02541 508-548-5800
A M Sensors, Inc., Salem, NH 03079 603-898-1543
§† Bailey Controls Co., Wickliffe, OH 44092 216-585-8500
Cambridge Aerofio, Inc., Shirley, MA 01464 508-45-2346
† Computer Instruments Div., Hempstead, NY 11550 516-483-8200
† EG & G Flow Technology, Inc., Phoenix, AZ 85072 602-437-1315
§† Fenwal Electronics, Inc./APD, Milford, MA 01757 508-478-6000
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
GP:50 New York, Grand Island, NY 14072 716-773-9300
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
† Intek, Inc., Westerville, OH 43081 614-895-0301
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
† Kurz Instruments Inc., Monterey, CA 93940 800-424-7356
# Meriam Instrument, Scott Fetzer, Cleveland, OH 44102 216-281-1100
Micronel U.S., Vista, CA 92083 619-727-7400
§† MKS Instruments, Inc., Andover, MA 01810 508-975-2350
Motion Sensors, Inc., Cranford, NJ 07701 908-709-0025
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
Motorola Inc., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., Northbrook, IL 60062 708-205-2867
Panametrics, Waltham, MA 02154-3497 617-899-2740
PMT Division, Ametek, Inc., Feasterville, PA 19053 215-355-6900
Schlumberger Industries, Tranducers Div., Houston, TX 77082 713-558-2587
Sensym, Inc., Sunnyvale, CA 94089 408-744-1500
Transonic Systems Inc., Ithaca, NY 14850 607-257-5300
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057

Transducers, Force-5500

§ Data Instruments, Inc., Acton, MA 01720, 508-264-9550 ..... **B•1891**
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 ..... **B•1892**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1946**
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... **B•1947**
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... **B•1959**
† A. L. Design, Inc., Buffalo, NY 14217 716-875-6240
BLH Electronics, Inc., Canton, MA 02021-9111 617-821-2000
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Cambridge Technology, Inc., Watertown, MA 02172 617-923-1181
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
DJ Instruments, Inc., N. Billerca, MA 01862 508-667-5301
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
HBM, Inc., Marlboro, MA 01752 508-624-4500
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
§† Interface, Inc., Scottsdale, AZ 85260 602-948-5555
§ Kavlico Corp., Moorpark, CA 93021 805-523-2000
§† Kistler Instruments Corp., Amherst, NY 14221-2171 716-691-5100
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
Lebow Products, Eaton Corp., Troy, MI 48084 313-643-0220
Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
Magnetoelastic Devices, Pittsfield, MA 01202 413-445-5608
NMB Technologies, Chatsworth, CA 91311 818-341-3355
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
Sensor Developments inc., Lake Orion, MI 48361 313-391-3000
Sensotec, Inc., Columbus, OH 43212 614-486-7723

Stoelting Co., Wood Dale, IL 60191 708-860-9700
Unimeasure, Inc., Corvallis, OR 97330 503-757-3158
Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Frequency – See Transducers, Volt, Watt, Current, etc. (Vol. B)

Transducers, Humidity-5500

Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1945-1946, D•1369,1422
ABB Kent-Taylor Inc., ASea Brown Boveri, Rochester, NY 14692 716-235-5000
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
§ EliWell-USA Ltd., EliWell, S.P.A., NYC, NY 10022 212-832-9393
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
§† Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
§ Marcon America Corp., Vernon Hills, IL 60061 312-913-9980
MULTISENS Inc, Laval, Que., CANADA H7S 2E8 514-629-5646
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
† Thunder Scientific Corp., Albuquerque, NM 87123 ..... 505-265-8701;800-872-7728

Transducers, Incremental Digital Position, Rotary – See Encoders, Shaft Angle (Vol. B)

Transducers, Liquid Level-5500

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 ..... B•1878
Blatek, Inc., State College, PA 16801, 814-231-2085;814-231-2086 ..... B•1885
§ Contaq Technologies Corp., Bristol, VT 05443, 802-453-3332 ..... B•1889
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1903
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1946, D•1368-1369,1422
ABB Kent-Taylor Inc., ASea Brown Boveri, Rochester, NY 14692 716-235-5000
American Magnetics, Oak Ridge, TN 37831-2509 615-482-1056
A M Sensors, Inc., Salem, NH 03079 603-898-1543
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
Gordon Products, Brookfield, CT 06804 203-775-4501
Intek, Inc., Westerville, OH 43081 614-895-0301
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
Lundahl Instruments, Inc., Ezra C. Lundahl Inc., Logan, UT 84321 ..... 801-753 7300
Meriam Instrument, Scott Fetzer, Cleveland, OH 44102 216-281-1100
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
MTS Systems, Minneapolis, MN 55424 612-937-4000
Precise Sensors, Inc., Monrovia, CA 91016 818-358-4578
Schlumberger Industries, Tranducers Div., Houston, TX 77082 713-558-2587
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
§ SOR, Inc., Lenexa, KS 66215 913-888-2630
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
§ Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
§ TURCK Inc., Minneapolis, MN 55441-2656 ..... 612-553-9224;1-800-328-0580; 1-800-544-PROX
Wabash Magnetics, Wabash, IN 46992 219-563-2191

Transducers, Magnetic Pickup-5500

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1720
Airpax-Cheshire Division, A North American Philips Co., Cheshire, CT 06410, 203-271-6000 ..... B•1875
Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ..... D•1226-1227
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1903
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1904-1905
† International Electro Magnetics, Inc., Palatine, IL 60067, 708-358-4622 ... D•1036
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091, 708-251-3600 ..... D•1040-1041
† Magnetic Shield Corporation, Perfection Mica Co., Bensenville, IL 60106, 708-766-7800 ..... C•1698-1699
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1920, D•2243
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1916-1917
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ..... B•1940,1944
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1783
Airpax Sensor Div., A North American Philips Co., Cheshire, CT 06410 .. 203-271-6000
§ AKG Acoustics, Inc., San Leandro, CA 94577 415-351-3500
§ ALTEK Corporation, Silver Springs, MD 20904-7802 301-572-2555
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
§ Dynapar, Gurnee, IL 60031 312-662-2666
§ Electronic Counters & Controls, Inc., LFE Corp., Libertyville, IL 60048 ..... 708-362-8910; 800-422-3224
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
§ Grado Laboratories, Brooklyn, NY 11220 718-435-5340
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390; 800-999-3390
Motion Sensors, Inc., Cranford, NJ 07701 908-709-0025
Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ Richard-Lee Co., Cranford, NJ 07016 201-276-0710
§ Rye Industries, Inc., Fuquay-Varina, NC 27526 919-557-0511
Sentech, Inc., Cheltenham, PA 19012 215-663-0422
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400
§ TURCK Inc., Minneapolis, MN 55441-2656 ..... 612-553-9224;1-800-328-0580; 1-800-544-PROX
§ Veeder-Root, Simsbury, CT 06070-2003 203-651-2700
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300

Transducers, Magnetostrictive-5500

Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ..... D•1227
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091, 708-251-3600 ..... D•1040-1041
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000

Transducers, Piezoelectric-5500

Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000 ..... D•1028-1029
† Blatek, Inc., State College, PA 16801, 814-231-2085;814-231-2086 ..... B•1885
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 ..... D•1031
International Components Corp., Melville, NY 11747, 516-293-1500 ..... D•1039
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091, 708-251-3600 ..... D•1040-1041
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1916-1917
Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. B•1921
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. D•1046-1047
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1700
§† Projects Unlimited, Dayton, OH 45414, 513-890-1918 ..... D•1050-1052
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512 ..... D•1062,1064
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... D•1066
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
§ Endevco Corporation, Allied Signal Aerospace Co., San Juan Capistrano, CA 92675 714-493-8181
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Entran Devices, Fairfield, NJ 07004 ..... 201-227-1002;800-635-0650
§ Ercona, Patchogue, NY 11772 516-758-0700
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111 805-683-2575
§† Kistler Instruments Corp., Amherst, NY 14221-2171 716-691-5100
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
MULTISENS Inc, Laval, Que., CANADA H7S 2E8 514-629-5646
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
† Pind Testers Inc., Irvine, CA 92718 714-380-1551
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000
† Sundstrand Data Control Inc., Sundstrand Corporation, Redmond, WA 98073-9701 206-885-3711
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
† Wilcoxon Research, Rockville, MD 20850 301-330-8811

Transducers, Position, Linear-5500

§ Contaq Technologies Corp., Bristol, VT 05443, 802-453-3332 ..... B•1889
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ..... D•1152-1153
§ Data Instruments, Inc., Acton, MA 01720, 508-264-9550 ..... B•1891
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1903
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1904-1905
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1916-1917
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... D•1422
Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1766
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1947
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... A•2072
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2078-2079
§ AEMC Corporation, Boston, MA 02111 ..... 617-451-0227;800-343-1391
Astrosystems, Lake Success, NY 11042 516-328-1600
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91304-5005 818-884-6860
† Component Specialties Corp., Temple City, CA 91780 213-283-0015

† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§ Dova Controls, Redmond, WA 98052-5165 206-881-7414
Enprotech Corp., Kalamazoo, MI 49007 616-381-0665
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
HBM, Inc., Marlboro, MA 01752 508-624-4500
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
† JDK Controls, Inc., Newbury Park, CA 91320-1593 805-499-7779
§† Kavlico Corp., Moorpark, CA 93021 805-523-2000
Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
Magnetoelastic Devices, Pittsfield, MA 01202 413-445-5608
Maxmar Controls Inc., Pleasantville, NY 10570 914-747-3540
Motion Sensors, Inc., Cranford, NJ 07701 908-709-0025
MULTISENS Inc, Laval, Que., CANADA H7S 2E8 514-629-5646
NMB Technologies, Chatsworth, CA 91311 818-341-3355
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
Omutec, Odetics, Inc., Anaheim, CA 92802 714-758-0200
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
Sensotec, Inc., Columbus, OH 43212 614-486-7723
† Sentech, Inc., Cheltenham, PA 19012 215-663-0422
§ Spectrol Electronics Corp., Ontario, CA 91761 714-923-3313
† Teledyne Gurley, Troy, NY 12181 ..... 518-272-6300;800-759-1844
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
Trans-Tek, Ellington, CT 06029 203-872-8351
TRW Technar, Inc., TRW, Inc., Irwindale, CA 91706 818-334-0250
§ TURCK Inc., Minneapolis, MN 55441-2656 ..... 612-553-9224;1-800-328-0580; 1-800-544-PROX
Unimeasure, Inc., Corvallis, OR 97330 503-757-3158
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
Vibrac, Amherst, NH 03031 603-882-6777
§ Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397

Transducers, Position, Rotary-5500

BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600 ..... B•1879
BEI Motion Systems Company, Digital Products Div., Little Rock, AR 72203, 501-851-4000 ..... B•1879
BEI Motion Systems Company, Itek Encoder Div., Needham Hgts., MA 02194, 617-455-1414 ..... B•1879-1881
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... B•1879
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ..... D•1152
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1920, D•2243
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1947
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1196
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2078-2079
Astrosystems, Lake Success, NY 11042 516-328-1600
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117 805-968-0782
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§ Dova Controls, Redmond, WA 98052-5165 206-881-7414
§ Dynapar, Gurnee, IL 60031 312-662-2666
§ Electronic Counters & Controls, Inc., LFE Corp., Libertyville, IL 60048 ..... 708-362-8910; 800-422-3224
Enprotech Corp., Kalamazoo, MI 49007 616-381-0665
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
Hecon Corp., Eatontown, NJ 07724 908-542-9200
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
† JDK Controls, Inc., Newbury Park, CA 91320-1593 805-499-7779
† Kavlico Corp., Moorpark, CA 93021 805-523-2000
Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† Magtech Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581
Maxmar Controls Inc., Pleasantville, NY 10570 914-747-3540
Motion Sensors, Inc., Cranford, NJ 07701 908-709-0025
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
Omutec, Odetics, Inc., Anaheim, CA 92802 714-758-0200
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400
§ Spectrol Electronics Corp., Ontario, CA 91761 714-923-3313
† Teledyne Gurley, Troy, NY 12181 ..... 518-272-6300;800-759-1844
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
† Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
Trans-Tek, Ellington, CT 06029 203-872-8351
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
§ Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397

Transducers, Power — See Transducers, Volt, Watt, Currents, etc. (Vol. B)

Transducers, Pressure-5500

§ Data Instruments, Inc., Acton, MA 01720, 508-264-9550 ..... B•1891
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 ..... B•1892,1896-1897
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1916-1917
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1945-1946
Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1766
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1948-1949
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1375
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1947
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 .. A•2072, B•1031
ABB Kent-Taylor Inc., ASea Brown Boveri, Rochester, NY 14692 716-235-5000
† A. L. Design, Inc., Buffalo, NY 14217 716-875-6240
§† Bailey Controls Co., Wickliffe, OH 44092 216-585-8500
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058 213-589-6181
§ Bellofram Corporation, Newell, WV 26050 ..... 304-387-1200;800-727-5646
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Cambridge Aerofio, Inc., Shirley, MA 01464 508-45-2346
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4410
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91304-5005 818-884-6860
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
† Computer Instruments Div., Hempstead, NY 11550 516-483-8200
§ Crystal Engineering Corp., Los Osos, CA 93402 ..... 805-528-2155;800-444-1850
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
DJ Instruments, Inc., N. Billerca, MA 01862 508-667-5301
Domino, Inc., Fort Wayne, IN 46899 219-456-5512
§ Dynisco, Sharon, MA 02067 617-784-8400
† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342 818-362-7151
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887 508-658-5410
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
§ Endevco Corporation, Allied Signal Aerospace Co., San Juan Capistrano, CA 92675 714-493-8181
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983 203-848-9271
Gould Inc., Test and Measurement Group, Valley View, OH 44125 216-328-7000
GP:50 New York, Grand Island, NY 14072 716-773-9300
The Graphics Technology Co., Austin, TX 78746 512-328-9284
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
HBM, Inc., Marlboro, MA 01752 508-624-4500
Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
ITT Conoflow, ITT Fluid Technology Corp., St. George, SC 29477 803-563-9281
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
Kaman Instrumentation, Colo Springs, CO 80907 1-719-599-1892
§ Kavlico Corp., Moorpark, CA 93021 805-523-2000
Keller-PSI, Oceanside, CA 92056 619-967-6066
§† Kistler Instruments Corp., Amherst, NY 14221-2171 716-691-5100
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Lebow Products, Eaton Corp., Troy, MI 48084 313-643-0220
LEL Co., Cresskill, NJ 07626 201-569-8641
§ Leybold Inficon Inc., E. Syracuse, NY 13057 315-434-1100
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
Mensor Corporation, San Marcos, TX 78666 512-396-4200
Meriam Instrument, Scott Fetzer, Cleveland, OH 44102 216-281-1100
MetriCor, Inc., Woodinville, WA 98072 206-483-5577
§† MKS Instruments, Inc., Andover, MA 01810 508-975-2350
Motorola Inc., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., Northbrook, IL 60062 708-205-2867
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
MULTISENS Inc, Laval, Que., CANADA H7S 2E8 514-629-5646
NMB Technologies, Chatsworth, CA 91311 818-341-3355
§ Norgren, Littleton, CO 80120-1663 303-794-2611
Optimum Applied Systems, Dobbs Ferry, NY 10522-1696 914-693-9001
† Paine Corporation, Seattle, WA 98144 ..... 206-329-8600;800-426-0366
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
† PMT Division, Ametek, Inc., Feasterville, PA 19053 215-355-6900
Precise Sensors, Inc., Monrovia, CA 91016 818-358-4578
Pressure Systems, Inc., Hampton, VA 23666 804-865-1243
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
# Sensor Products, Inc., New York, NY 10010 212-675-0201
Sensotec, Inc., Columbus, OH 43212 614-486-7723
† Sensym, Inc., Sunnyvale, CA 94089 408-744-1500
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400

§ SOR, Inc., Lenexa, KS 66215 913-888-2630
Stoelting Co., Wood Dale, IL 60191 708-860-9700
§† Teledyne Taber, Teledyne Inc., N. Ton., NY 14120 ..... 716-694-4000;800-333-5300
§ Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
§† Trans Metrics, Inc., Solon, OH 44139 216-248-2229
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
Viatran Corporation, Grand Isl. 14072 716-773-1700
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
§ Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397
§ Weed Instrument Co., Inc., Round Rock, TX 78680-0300 512-255-7043

Transducers, Proximity-5500

§ Contaq Technologies Corp., Bristol, VT 05443, 802-453-3332 ..... B•1889
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1903
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1904-1905
§† Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1916-1917
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1783
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1947
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
A M Sensors, Inc., Salem, NH 03079 603-898-1543
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728 915-592-3253
§ Eaton Corp. Durant Products, Watertown, WI 53094 ..... 414-261-4070;800-289-3866
FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ..... 708-932-9380;800-468-6009
General Numeric Corporation, Elk Grove Village, IL 60007 708-640-1595
† GIC Thermodynamics, Royal Oak, MI 48073 313-280-1648
§ Global Components & Controls, Eatontown, NJ 07724 201-389-1470
§ Gordon Products, Brookfield, CT 06804 203-775-4501
§ HBM, Inc., Marlboro, MA 01752 508-624-4500
Hecon Corp., Eatontown, NJ 07724 908-542-9200
§ Industrial Computer Designs, Inc., Westlake Village, CA 91361 ..... 818-889-3179; 800-423-3179
Kaman Instrumentation, Colo Springs, CO 80907 1-719-599-1892
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
Metrix Instrument Co., Houston, TX 77043 713-461-2131
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390; 800-999-3390
Motion Sensors, Inc., Cranford, NJ 07701 908-709-0025
MULTISENS Inc. Laval, Que., CANADA H7S 2E8 514-629-5646
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 708-824-1133
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§ Redington Counters, Windsor, CT 06095 203-688-6205
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Sentech, Inc., Cheltenham, PA 19012 215-663-0422
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265 .. 515-225-6933
§ Tenor Company, New Berlin, WI 53151 414-782-3800
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300
Wabash Magnetics, Wabash, IN 46992 219-563-2191

Transducers, Sonic-5500

Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000 ..... D•1029
† Blatek, Inc., State College, PA 16801, 814-231-2085;814-231-2086 ..... B•1885
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111 805-683-2575
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 708-824-1133
† Ocean Motions Co., Barrington, RI 02806 401-246-1394
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208

Transducers, Strain Gauge-5500

§ Data Instruments, Inc., Acton, MA 01720, 508-264-9550 ..... B•1891
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1916-1917
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1945-1946
Acurex Corp./Autodata Div., Mountain View, CA 94039 415-967-9100
A. L. Design, Inc., Buffalo, NY 14217 716-875-6240
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
BLH Electronics, Inc., Canton, MA 02021-9111 617-821-2000
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4410
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§† Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
DJ Instruments, Inc., N. Billerca, MA 01862 508-667-5301
§ Dynisco, Sharon, MA 02067 617-784-8400
† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342 818-362-7151
† Entran Devices, Fairfield, NJ 07004 ..... 201-227-1002;800-635-0650
GP:50 New York, Grand Island, NY 14072 716-773-9300
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
HBM, Inc., Marlboro, MA 01752 508-624-4500
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
§ Interface, Inc., Scottsdale, AZ 85260 602-948-5555
§† Kistler-Morse, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
Lebow Products, Eaton Corp., Troy, MI 48084 313-643-0220
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
NMB Technologies, Chatsworth, CA 91311 818-341-3355
† Paine Corporation, Seattle, WA 98144 ..... 206-329-8600;800-426-0366
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
Precise Sensors, Inc., Monrovia, CA 91016 818-358-4578
Sensotec, Inc., Columbus, OH 43212 614-486-7723
§† Teledyne Taber, Teledyne Inc., N. Ton., NY 14120 ..... 716-694-4000;800-333-5300
Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
§† Trans Metrics, Inc., Solon, OH 44139 216-248-2229
Viatran Corporation, Grand Isl. 14072 716-773-1700
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Temperature-5500

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 ..... B•1878
Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 ..... B•1834-1837
§ Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... B•1839-1841
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 ..... B•1892
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1849-1851
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1916-1917
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1945-1946
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1338
Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... B•1859
ABB Kent-Taylor Inc., ASea Brown Boveri, Rochester, NY 14692 716-235-5000
Advanced Thermal Products, Inc., St. Marys, PA 15857 814-834-1541
Alpha Thermistor, Inc., San Diego, CA 92121 ..... 619-549-4660;800-235-5445
§ Alpha Wire Corp., Elizabeth, NJ 07207-0711 908-925-8000
§† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 516-593-5600
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
ARi Industries, Inc., Addison, IL 60101 ..... 708-953-9100;800-237-6725
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
§† Bailey Controls Co., Wickliffe, OH 44092 216-585-8500
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Burling Instruments, Inc., Chatham, NJ 07928-0298 201-635-9481
Cambridge Aerollo, Inc., Shirley, MA 01464 508-45-2346
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Degussa Corp., Temperature Sensing Products, So. Plainfield, NJ 07080
DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
§ Dowty Custom Elctrns., Inc., Thermocontrol Div., Brandon, VT 05733 ... 802-247-6811
§ EDL, Inc., Danville, VA 24540 ..... 804-799-0807;1-800-DIAL EDL
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 800-422-4342
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983 203-848-9271
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
§† Fenwal Electronics, Inc./APD, Milford, MA 01757 508-478-6000
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
GP:50 New York, Grand Island, NY 14072 716-773-9300
§ Hades Manufacturing Corp., Farmingdale, NY 11735 516-249-4244
† Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
HBM, Inc., Marlboro, MA 01752 508-624-4500
† Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
§ Industrial Computer Designs, Inc., Westlake Village, CA 91361 ..... 818-889-3179; 800-423-3179
† Instrulab, Dayton, OH 45404 513-223-2241
International Resistive Company, Boone, NC 28607 704-264-8861
Ketema/Rodan Division, Anaheim, CA 92806 714-630-0081
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007 ..... 215-781-0700; 800-523-8989
Larson Instrument, Orangeburg, NY 10962 914-359-3800
§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
§ Martel Electronics, Salem, NH 03079 603-893-0886
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
† Minco Products, Minneapolis, MN 55432 612-571-3121
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
§ Newport Electronics, Santa Ana, CA 92704-4426 ..... 714-540-4914;800-NEWPORT
Ogden Manufacturing Co., Arlington Heights, IL 60005 708-593-8050
Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
PMT Division, Ametek, Inc., Feasterville, PA 19053 215-355-6900
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
Princo Instruments, Inc., Southampton, PA 18966
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054

RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
† Relco Products, Denver, CO 80237 303-756-1143
§ RFL Inds., Inc., (DBA) Dowty Elctrns. Co., Brandon, VT 05733 802-247-6811
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
§ S. F. Products Corporation, Chester, NJ 07930 201-271-4009
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
† Syscon Intl., Inc., So. Bend, IN 46601-3796 219-232-3900
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538 419-525-8450
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300
WARREN G-V, GENERAL SIGNAL CORP., WHIPPANY, NJ 07981 201-386-1200
§ Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397
§† Weed Instrument Co., Inc., Round Rock, TX 78680-0300 512-255-7043
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002
§ West Instrument, A Mark IV Company, Des Plaines, IL 60018-1919 708-390-7711

Transducers, Temperature, Digital Output-5500

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 ..... B•1878
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1337-1338
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007 ..... 215-781-0700; 800-523-8989
MetriCor, Inc., Woodinville, WA 98072 206-483-5577
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
§† Relco Products, Denver, CO 80237 303-756-1143
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
§ SOR, Inc., Lenexa, KS 66215 913-888-2630
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
† Williamson Corporation, Concord, MA 01742 508-369-9607

Transducers, Thermoelectric — See Transducers, Temperature (Vol. B)

Transducers, Tilt - Also see Inclinometers-5500

§† Dova Controls, Redmond, WA 98052-5165 206-881-7414
The Fredericks Company, Huntingdon Valley, PA 19006 215-947-2500
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
† Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600

Transducers, Torque-5500

Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1946
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2079
Acurex Corp./Autodata Div., Mountain View, CA 94039 415-967-9100
† A. L. Design, Inc., Buffalo, NY 14217 716-875-6240
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
HBM, Inc., Marlboro, MA 01752 508-624-4500
§ Interface, Inc., Scottsdale, AZ 85260 602-948-5555
§† Kistler Instruments Corp., Amherst, NY 14221-2171 716-691-5100
Lebow Products, Eaton Corp., Troy, MI 48084 313-643-0220
Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
§† Mag Dev Inc., Pittsfield, MA 01201 413-442-6368
Magnetoelastic Devices, Pittsfield, MA 01202 413-445-5608
Motortest, Inc., Columbus, OH 43229 614-882-7821
NMB Technologies, Chatsworth, CA 91311 818-341-3355
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
Sensor Developments Inc., Lake Orion, MI 48361 313-391-3000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Ultrasonic-5500

† Blatek, Inc., State College, PA 16801, 814-231-2085;814-231-2086 ..... B•1885
§ Contaq Technologies Corp., Bristol, VT 05443, 802-453-3332 ..... B•1889
EDO Corporation, Electro-Ceramic Division, Salt Lake City, UT 84115, 801-486-2115 ..... A•1357
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1916-1917
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. B•1922-1923
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1700
Accusonic Division, Ferranti O.R.E. Inc., Falmouth, MA 02541 508-548-5800
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
Anders, Inc., Simsbury, CT 06070 203-658-7666
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
† Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 708-584-2300
EDO Corp., Electro-Acoustic Div., Salt Lake City, UT 84115 801-486-7481
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
International Microelectronics, Arlington, TX 76003 817-561-2244
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111 805-683-2575
Kaman Instrumentation, Colo Springs, CO 80907 1-719-599-1892
§† Kay-Ray/Sensall, Inc., Mt. Prospect, IL 60056 708-803-5100
Kistler-Morse, Redmond, WA 98073 206-881-8000
Lundahl Instruments, Inc., Ezra C. Lundahl Inc., Logan, UT 84321 801-753-7300
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Ocean Motions Co., Barrington, RI 02806 401-246-1394
Panametrics, Waltham, MA 02154-3497 617-899-2740
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Sonicor Instrument Corp., Copiague, NY 11726 516-842-3344
§ Sonobond Ultrasonics Inc., Inductotherm Industries, West Chester, PA 19382 ..... 215-696-4710;800-323-1269
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Transonic Systems Inc., Ithaca, NY 14850 607-257-5300
§ TURCK Inc., Minneapolis, MN 55441-2656 ..... 612-553-9224;1-800-328-0580; 1-800-544-PROX
† Ultran Laboratories, State College, PA 16801 814-238-9083
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Transducers, Velocity-5500

BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600 ..... B•1879
BEI Motion Systems Company, Digital Products Div., Little Rock, AR 72203, 501-851-4000 ..... B•1879
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 ..... B•1879
BEI Motion Systems Company, Itek Encoder Div., Needham Hgts., MA 02194, 617-455-1414 ..... B•1879-1881
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... B•1879
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... D•2243
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1947
§ Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-8-SENS-IT .. B•1957
Airpax Sensor Div., A North American Philips Co., Cheshire, CT 06410 .. 203-271-6000
A M Sensors, Inc., Salem, NH 03079 603-898-1543
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Blatek, Inc., State College, PA 16801 ..... 814-231-2085;814-231-2086
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4410
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91304-5005 818-884-6860
† Computer Instruments Div., Hempstead, NY 11550 516-483-8200
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
† Electro Physics Co., Inc., Waukegan, IL 60085 708-249-5801
§ Fenwal Electronics, Inc./APD, Milford, MA 01757 508-478-6000
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
§ HBM, Inc., Marlboro, MA 01752 508-624-4500
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
§ Kavlico Corp., Moorpark, CA 93021 805-523-2000
Kinemetrics/Systems, Kinemetrics, Inc., Pasadena, CA 91107 818-795-2220
† Kurz Instruments Inc., Monterey, CA 93940 800-424-7356
† Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
Metrix Instrument Co., Houston, TX 77043 713-461-2131
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390; 800-999-3390
Motion Sensors, Inc., Cranford, NJ 07701 908-709-0025
† Sentech, Inc., Cheltenham, PA 19012 215-663-0422
§† Systron-Donner Inertial Div., Concord, CA 94518 415-671-6400
† Teledyne Gurley, Troy, NY 12181 ..... 518-272-6300;800-759-1844
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
Transicoil Inc., Robinson-Halpern Products, Trooper, PA 19403 215-539-4400
Trans-Tek, Ellington, CT 06029 203-872-8351
Unimeasure, Inc., Corvallis, OR 97330 503-757-3158
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
WARREN G-V, GENERAL SIGNAL CORP., WHIPPANY, NJ 07981 201-386-1200
† Wilcoxon Research, Rockville, MD 20850 301-330-8811

Transducers, Vibration-5500

Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200 .... D•1234
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 ..... B•1892
§ Projects Unlimited, Dayton, OH 45414, 513-890-1918 ..... D•1050
† Signal Systems International, Lavalette, NJ 08735, 201-793-4668 ..... B•1779
§ Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-8-SENS-IT .. B•1957
† Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... B•1959
Alpha-M Corp., Dallas, TX 75229 214-406-0424
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4410
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
§ Dova Controls, Redmond, WA 98052-5165 206-881-7414
† Electro Physics Co., Inc., Waukegan, IL 60085 708-249-5801
§ Endevco Corporation, Allied Signal Aerospace Co., San Juan Capistrano, CA 92675 714-493-8181
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
HBM, Inc., Marlboro, MA 01752 508-624-4500

§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
† HH Controls Co., Inc., Arlington, MA 01274 617-646-2626
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
Kelmet, Inc., San Dimas, CA 91773 714-599-0954
Kinemetrics/Systems, Kinemetrics, Inc., Pasadena, CA 91107 818-795-2220
§† Kistler Instruments Corp., Amherst, NY 14221-2171 716-691-5100
† Knowles Electronics, Inc., Itasca, IL 60143 708-250-5100
Metrix Instrument Co., Houston, TX 77043 713-461-2131
Motion Sensors, Inc., Cranford, NJ 07701 908-709-0025
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
PMC/BETA Ltd. Partnership, Natick, MA 01760 617-237-6920
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
Sensotec, Inc., Columbus, OH 43212 614-486-7723
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400
§† Systron-Donner Inertial Div., Concord, CA 94518 415-671-6400
Trans-Tek, Ellington, CT 06029 203-872-8351
Unholtz-Dickie Corp., Wallingford, CT 06492 203-265-3929
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Volt, Watt, Current VAR, Power Factor, Frequency-5500

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000 ..... D•1126
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1720
† **American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100** ..... B•1876-1877
Best Technology Inc., Seattle, WA 98109, 206-382-1300 ..... B•1833
Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... B•1883
§ **CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518** ..... A•2194
Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235, 614-889-6152 ..... A•2228
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711 ..... B•1912-1913, D•1289
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600** ..... B•1916-1917
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ..... B•1925-1928,1934-1937,1940-1944
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1387
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... B•1959
§† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 516-593-5600
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
Bell, F. W., Inc., Orlando, FL 32807 407-678-6900
† C & C Jetronic, Inc., Princeton, NJ 08540 609-921-8540
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 603-749-6434
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
Cross Electronics, Warrendale, PA 15086 412-776-1591
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
Dowty RFL Inds. Inc./Instrumentation Div., The Dowty Grp. PLC, Boonton, NJ 07005-0239 201-334-3100
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
EWC, Inc., Englishtown, NJ 07726 908-446-3110
§ Fenwal Electronics, Inc./APD, Milford, MA 01757 508-478-6000
§ Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204 614-275-0530
Kaman Instrumentation, Colo Springs, CO 80907 1-719-599-1892
Motortest, Inc., Columbus, OH 43229 614-882-7821
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1 604-652-5118
Rotek Instrument Corp., Waltham, MA 02254 617-899-4611
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854 908-572-9512
† Sundstrand Data Control Inc., Sundstrand Corporation, Redmond, WA 98073-9701 206-885-3711
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
Tokin America, Inc., San Jose, CA 95134 408-432-8020
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123

Transformers, Audio-5600 — ***See Vol. A***

Transformers, Autotransformer-5600 — ***See Vol. A***

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Transformers, Bridging — See Transformers, Matching (Vol. A)

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Transformers, Chopper-5600 — ***See Vol. A***

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Transformers, Decade-5600 — ***See Vol. A***

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Transformers, Pulse-5600 — ***See Vol. A***

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Transformers, Servo-5600 — ***See Vol. A***

Transformers, Split Bobbin-5600 — ***See Vol. A***

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Transformers, Surface Mount-5600 — ***See Vol. A***

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Transformers, Wall Plug-in — See Power Supplies, Plug-in (Vol. D)

Transformers, Wideband-5600 — *See Vol. A*

Transformers (MIL), Audio, Power, RF-2440

† **Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630** ..... A•2134
† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660** ..... A•2174
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ..... A•2182
Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2187, B•1883
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423, 716-538-4421 ..... A•2189
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... A•2190
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462/3487 ..... A•2201-2202,2204
Enegren Electronics, Inc., Olathe, KS 66062, 913-782-4720 ..... A•2210
† **EWC, Inc., Englishtown, NJ 07726, 908-446-3110** ..... A•2212,2225
Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2227
† **Hisonic, Inc., Olathe, KS 66061, 913-782-0012** ..... A•2234
† **Magnecomp, Inc., Pickens, SC 29671, 803-878-4700** ..... A•2252
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2253,2255,2257
† **Magnetico Inc., Holtsville, NY 11742, 516-654-1166** ..... A•2264-2265
§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ..... A•2280,2286-2290,2294-2298
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... A•2333
† **Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700** ..... A•2371
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2385-2389
† **Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790** ..... A•2427
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2439
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... A•2448-2451
† **Trans American Transformer, E. Setauket, NY 11733, 516-928-0762** ..... A•2452
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... A•2454-2457
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2458
† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 213-673-3245
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5246
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
† Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
Mouser Electronics, Mansfield, TX 76063 800-346-6873
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
PC Transformer Corp., West Babylon, NY 11704 516-491-3300
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
† Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§† Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 414-253-8200
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Voltampere Corp., Lynbrook, NY 11563 516-887-9443

Transformers (MIL), Data Bus Coupling-2440

Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423, 716-538-4421 ..... A•2189
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... A•2190
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2458
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
EWC, Inc., Englishtown, NJ 07726 908-446-3110
† JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960

Transformers (MIL), Interface & Coupling-2440

Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423, 716-538-4421 ..... A•2189
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... A•2190
† **Magnetico Inc., Holtsville, NY 11742, 516-654-1166** ..... A•2265
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2451
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
EWC, Inc., Englishtown, NJ 07726 908-446-3110
† JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960

Transformers (MIL), Pulse & Variable-2440

Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ..... A•2182
† **BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590** ..... A•2184-2185
† **Bicron Electronics, Canaan, CT 06018, 203-824-5125** ..... A•2186-2187, B•1883
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423, 716-538-4421 ..... A•2189
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... A•2190
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462/3487 ..... A•2203
Enegren Electronics, Inc., Olathe, KS 66062, 913-782-4720 ..... A•2210
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... A•2211
† **EWC, Inc., Englishtown, NJ 07726, 908-446-3110** ..... A•2212,2225
Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2227
Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
† **JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222** ..... A•2236
† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... A•2248
† **Magnecomp, Inc., Pickens, SC 29671, 803-878-4700** ..... A•2252
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2253,2255,2257
† **Magnetico Inc., Holtsville, NY 11742, 516-654-1166** ..... A•2265
† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ..... A•2280,2286-2290,2295-2296,2298
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... A•2333
† **Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700** ..... A•2371
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2385-2389
Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2439
† **Trans American Transformer, E. Setauket, NY 11733, 516-928-0762** ..... A•2452
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2458
§† **Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535** ..... A•2459
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Epco Products Inc., Wallkill, NY 12589 914-895-2033
† Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
† Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
† Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
† Technitrol, Philadelphia, PA 19134 215-426-9105
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Texas Transformer Corp., Plano, TX 75086 214-424-1581

§† Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

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Transistors, Photo (Incl. Arrays)-3700

§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1319
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1155
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1325-1326,1330-1331
§† Optek Technology Inc., Carrollton, TX 75006, 214-323-2200 ..... B•1333
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1345
I I Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1196,1199
A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1866
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Raytheon/TAG Semiconductors Ltd., Burlington, MA. 01803 ..... 617-272-3704 (3705)
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
§ Zetex, Inc., Zetex plc, Commack, NY 11725 516-543-7100

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† Continential Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§† Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
† International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† Powertech, Inc., Fairlawn, NJ 07410 201-791-5050
§† PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§† Siliconix, Inc., Santa Clara, CA 95054 408-988-8000
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500

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Transmission Line, Wire & Cable — See Cable, Transmission Line (Vol. C)

Transmission Lines (MIL), RF-2440

† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639

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Transmitters, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1217
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751 ..... B•1218-1221
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1225
† Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121 ..... B•1227-1228
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ... B•1230, D•1319
§ S.I. Tech, Batavia, IL 60510, 708-232-8640 ..... B•1231
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
§ Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
BT & D Technologies, Wilmington, DE 19803 302-479-0300
CATEL Telecommunications, Fremont, CA 94537 415-659-8988
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
Dymec Inc., Winchester, MA 01890 617-729-7870
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
§ Fuji Electric Corp. of America, Los Angeles, CA 90071 213-622-4490
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
IPAC Grp., Bethel Pk., PA 15102 412-831-9200
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014 413-592-9123
† Math Assocs., Westbury, NY 11590 516-334-6800
3M Photodyne Products, Dynatel Systerms Division, Camarillo, CA 93010 ..... 805-388-8378;800-426-8688
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Ortel Corp., Alhambra, CA 91803 818-281-3636
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
§† SpecTran Corp., Sturbridge, MA 01566 508-347-2261
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-5397

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Transmitters, Infrared remote control transmitters for satellite T.V. receivers-1900 — *See Vol. D*

Transmitters, Laser-3700

§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1225
§ American Laser Systems, Inc., Goleta, CA 93117 805-967-0423
Analog Modules, Inc., Longwood, FL 32750 407-339-4355
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
† Ortel Corp., Alhambra, CA 91803 818-281-3636
Tektronix, Inc., Beaverton, OR 97077 800-835-9433

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Transmitters, Process Control (Temperature, Pressure, Flow, etc.)-5500

§ Data Instruments, Inc., Acton, MA 01720, 508-264-9550 ..... B•1891
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT ..... D•1365
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... D•1142,1307
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1948-1949
§ ABB Kent-Taylor Inc., ASea Brown Boveri, Rochester, NY 14692 716-235-5000
Accutex Corporation, Taunton, MA 02780 508-880-3660
Accutech, Adaptive Instrs. Corp., Hudson, MA 01749 508-568-0500
§ Action Instruments, San Diego, CA 92123 619-279-5726
# A.P.C.S. America, Grand Rapids, MI 49548 616-247-1453
§ ASI Instruments, Inc., Houston, TX 77024 800-245-7056
§† Bailey Controls Co., Wickliffe, OH 44092 216-585-8500
§ Beckman Industrial Corp., An Affiliate of Emerson Elec. Co., San Diego, CA 92123-1898 619-495-3200
§ Bristol Babcock Inc., Watertown, CT 06795 ..... 203-575-3000;800-243-3576
Brooks Instrument Div., Emerson Elec. Co., Hatfield, PA 19440 215-362-3500
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91304-5005 818-884-6860
§ Chessell Corp., Newtown, PA 18940 215-968-0660
† Computer Instruments Div., Hempstead, NY 11550 516-483-8200
Controlex, Inc., New Boston, NH 03070 603-487-5512
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
Degussa Corp., Temperature Sensing Products, So. Plainfield, NJ 07080
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
DGH Corporation, Manchester, NH 03108 603-622-0452
§ Dieterich Standard, A Dover Industries Company, Boulder, CO 80301 ... 303-530-9600
† EG & G Flow Technology, Inc., Phoenix, AZ 85072 602-437-1315
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
Entran Devices, Fairfield, NJ 07004 ..... 201-227-1002;800-635-0650
E-T-A Circuit Breakers, Chicago, IL 60648 708-647-8303
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
§ Fuji Electric Corp. of America, Los Angeles, CA 90071 213-622-4490
§ Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
Kistler-Morse, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
Lucas Schaevitz, Pennsauken, NJ 08110-1489 609-662-8000
Martel Electronics, Salem, NH 03079 603-893-0886
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
Minco Products, Minneapolis, MN 55432 612-571-3121
§† MKS Instruments, Inc., Andover, MA 01810 508-975-2350
Moore Products Co., Spring House, PA 19477 215-646-7400
§ Pacer Industries, Inc., Chippewa Falls, WI 54729 715-723-1141
† Paine Corporation, Seattle, WA 98144 ..... 206-329-8600;800-426-0366
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
† PMT Division, Ametek, Inc., Feasterville, PA 19053 215-355-6900
Precise Sensors, Inc., Monrovia, CA 91016 818-358-4578
Princo Instruments, Inc., Southampton, PA 18966
† Relco Products, Denver, CO 80237 303-756-1143
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
Schlumberger Industries, Tranducers Div., Houston, TX 77082 713-558-2587
§† Seaboard Electronics, New Rochelle, NY 10805 914-235-8073
Sensotec, Inc., Columbus, OH 43212 614-486-7723
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
§† Trans Metrics, Inc., Solon, OH 44139 216-248-2229
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
Viatran Corporation, Grand Isl. 14072 716-773-1700

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Transmitters (MIL)-2440

Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827, D•1077
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 ..... 800-336-5917;703-953-4751
MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257

Transmitters (MIL), Fiber Optic-2440

Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121 ..... B•1228-1229

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Triggers, SCR — See Controls, SCR (Vol. D)

Trimmers, Capacitor — See Capacitors, Variable, Padders & Trimmers (Vol. A)

Trimmers, Potentiometer — See Potentiometers, Trimmer (Vol. A)

Trimmers, Surface Mount, Capacitor-1500 — *See Vol. A*

Trimmers, Surface Mount, Potentiometer-4750 — *See Vol. A*

Tube Heat Dissipators-2600 — *See Vol. C*

Tubes, Ballast — See Resistors, Ballast (Vol. A)

Tubes, Cathode Ray, General Purpose-2450

SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, La Mirada, CA 90638, 213-802-8425 ..... B•1114-1115
I I Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1196,1198-1199
A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1866
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
† EEV Inc., Elmsford, NY 10523 914-592-6050
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 ... 619-931-3000
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
† Litton Electron Devices, Litton Systems, Inc., Tempe, AZ 85281 602-968-4471
§† Mitsubishi Electronics, Torrance, CA 90502 213-515-3993
§† Rank Brimar Inc., Scotts Valley, CA 95066 408-438-6440
Rauland-Zenith Electronics Corp., Melrose Pk., IL 60160 708-450-8992
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
Thomas Electronics, Inc., Wayne, NJ 07470 201-696-5200
§ Video Display Corp., Tucker, GA 30084 404-938-2080,800241-5005
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Tubes, Cathode Ray, Special Purpose-2450

† EEV Inc., Elmsford, NY 10523 914-592-6050
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 ... 619-931-3000
† Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
† Litton Electron Devices, Litton Systems, Inc., Tempe, AZ 85281 602-968-4471
§† Mitsubishi Electronics, Torrance, CA 90502 213-515-3993
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Professional Components Grp, Slatersville, RI 02876 401-762-3800
§† Rank Brimar Inc., Scotts Valley, CA 95066 408-438-6440
Rauland-Zenith Electronics Corp., Melrose Pk., IL 60160 708-450-8992
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
Thomas Electronics, Inc., Wayne, NJ 07470 201-696-5200
Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
§ Video Display Corp., Tucker, GA 30084 404-938-2080,800241-5005
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Tubes, Counting-2200 — *See Vol. D*

Tubes, Flash-3700

† EEV Inc., Elmsford, NY 10523 914-592-6050
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Tubes, Ignitron-2200 — *See Vol. D*

Tubes, Image Converter-2450

§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
† EEV Inc., Elmsford, NY 10523 914-592-6050
ElectroPhysics Corp., Nutley, NJ 07110 201-667-0170
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
§ IR Scientific, Carlisle, MA 01741 508-667-7110
† Litton Electron Devices, Litton Systems, Inc., Tempe, AZ 85281 602-968-4471
Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000

Tubes, Indicator — See Tubes, Readout (Vol. B)

Tubes, Magnetron — See Tubes, Microwave (Vol. A)

Tubes, Microwave-3450 — *See Vol. A*

Tubes, Photomultiplier-3700

Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
Hamamatsu Corporation, Bridgewater, NJ 08807 201-231-0960
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Professional Components Grp, Slatersville, RI 02876 401-762-3800
§† Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586

Tubes, Readout (CRT, Cold-Cathode, Vacuum Fluorescent, Incandescent, etc.)-2450

EDI, Wood Dale, IL 60191, 708-860-5838 ..... B•1065
Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1017,1090
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1100
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
† Displays, Inc., Lewistown, PA 17044 717-242-2541
† EEV Inc., Elmsford, NY 10523 914-592-6050
† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731

§ Fujitsu Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
Life-On Inc., Milpitas, CA 95035 408-946-4577
Mitsubishi Electronics, Torrance, CA 90502 213-515-3993
Packard-Zenith Electronics Corp., Melrose Pk, IL 60160 708-450-8892
§ † Tektron, Inc., Birdsboro, PA 19508 215-582-8711

Tubes, Strobe — See Lamps, Stroboscopic Sources (Vol. D)

Tubes, TV Camera Pickup-2470
§ ATV Research Inc., Dakota City, NE 68731 402-987-3771
† EEV Inc., Elmsford, NY 10523 914-592-6050
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref., Japan 534-02-0121
† Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Professional Components Corp, Slatesville, RI 02876 401-762-3800
§ † Tektron, Inc., Birdsboro, PA 19508 215-582-8711
Thomson Electron Tubes & Devices Corp, Thomson CSF, Totowa, NJ 07511 201-812-9000
§ Videk Display Corp., Tucker, GA 30084 ..... 404-938-9000/800/241-8005

Tubes, Transmitting-1000 — *See Vol. D*

Tubes, X-ray-2200 — *See Vol. D*

Tubes (MIL), Indicator & Pickup-2440
† EEV Inc., Elmsford, NY 10523 914-592-6050
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Professional Components Corp, Slatesville, RI 02876 401-762-3800
§ † Tektron, Inc., Birdsboro, PA 19508 215-582-8711

Tubes (MIL), Microwave-2440
† EEV Inc., Elmsford, NY 10523 914-592-6050
Hughes Aircraft Co., Electron Optical Sys. Div., Orange, CA 92667 714-759-2222
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
Varian Associates, Electron Device Business, Palo Alto, CA 94303 ..... 415-493-4000 800-544-4088

Tubes (MIL), Power & Gas, Planar-2440
† EEV Inc., Elmsford, NY 10523 914-592-6050
Litton Electron Devices, San Carlos, CA 94070 415-591-8411
Varian Associates, Electron Device Business, Palo Alto, CA 94303 ..... 415-493-4000 800-544-4088

Tubes (MIL), Receiving, & Tube Shields-2440
Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ..... 708-459-1070 800-323-0198
† EEV Inc., Elmsford, NY 10523 914-592-6050
Elnorth America, New York, NY 10021 212-517-0422
Litton Electron Devices, San Carlos, CA 94070 415-591-8411

Tubing, Ceramic-2800 — See Ceramics (Vol. C)

Tubing, Expandable-2800 — See Vol. C

Tubing, Fiberglass-2800 — See Vol. C

Tubing, Glass-2800 — See Vol. C

Tubing, Heat Shrinkable-Also See Caps, Forms & Tapes, Heat Shrinkable-2500 — *See Vol. C*

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Tubing, Paper-2500 — *See Vol. C*

Tubing, Plastic-Also See Tubing, Spaghetti-2500 — See Vol. C

Tubing, Spaghetti-2500 — *See Vol. C*

Tubing, Spiral Wrap-2500 — *See Vol. C*

Tubing, Waveguide-3450 — *See Vol. A*

Tubing, Zipper-2500 — *See Vol. C*

Tuners, AM/FM-1300 — *See Vol. D*

Tuners, Microwave-3450 — *See Vol. A*

Tuning Forks-2300 — *See Vol. A*

Tweezers, Manual & Vacuum-5400 — *See Vol. C*

Ultrasonic Transceivers, High Resolution, Narrow Beam-5500
§ Contaq Technologies Corp., Bristol, VT 05443, 802-453-3332 ..... B•1689
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... B•1922-1923
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
† Ocean Motions Co., Barrington, RI 02806 401-246-1394

Ultraviolet Inspection Lighting-Also See Microscopes, Ultraviolet-4100 — *See Vol. D*

Urea Formaldehyde — See Plastic Raw Materials (Vol. C)

Valve Position Indicators / Transmitters-5440
§ Data Instruments, Inc., Acton, MA 01720, 508-263-9161 ..... B•1261
ITT Systems, Pointe Inst. Centers, Clearwater, CA 33521, 813-797-7711 ..... B•1260
Newbort Electronics, Inc., Westmont, IL 60559, 708-789-8990 ..... B•1634
§ Orbital Instruments, San Diego, CA 92140 619-279-5726
§ Ultra G. W. Co., Clifton Springs, NY 14432 315-462-2611
M. System Technology Inc., Irvine, CA 92718 800-544-8161
§ Norwich Eaton Valves, Norwich, NY 13815 607-334-2611
Transmagnetics, Farmingdale, NY 11735 516-293-3100
§ Weed Fiber Optics Inc., Weed Instrument Co., College Station, TX 77845 409-693-0307

Valve Positioners & Actuators-4750 — See Vol. A

Valves, Solenoid-4300
IET Systems, Polaris Instr. Engrs., Sacramento, CA 95834, 916-567-7700 ..... B•1260
Peerless Solenoid, Inc., Westmont, IL 60559, 708-789-8990 ..... B•1634-1635,1637
Aerospace Controls Corporation, Bohemia, NY 11779 516-737-1900
§ † Automatic Switch Co., Florham Park, NJ 07932 201-966-2000
§ † Barksdale Controls Div., Ipo Industries Inc., Los Angeles, CA 90058 213-589-6191
Cole-Parmer Instrument Company, Chicago, IL 60648 ..... 708/647-7600
§ Crouzet Corporation, Carrollton, TX 75006-2950 ..... 214-380-1647 1-800-527-5311
† STS of Canada, Ltd., Streetsville, ONTARIO, CAN, L5M 1T1 416-826-1141
§ Detroit Controls, Milwaukee, WI 53215 414-647-7890
† ECMCO, Dalton, Inc., Los Angeles, CA 90016 213-737-7890
† Electronic Specialty Corp., Vancouver, WA 98668 206-574-3000
Solenoid Protection Co., Inc., Animal Protection Group, Chicago, IL 60641 312-282-4700
§ Industrial Computer Designs, Inc., Westlake Village, CA 91361 805-495-0179
Lee Co., Westbrook, CT 06498 203-399-6281
Lee Co., Mt. Clair Springs, PA 19138 215-481-0571
Lee Co., Salem, NH 03079 603-893-9351
§ † Magnetrol Valve Corp., Hasbrouck Heights, NJ 07604 201-427-4341
Mallory Controls, Emerson Electric, Indianapolis, IN 46241 317-228-4010
§ † MKS Instruments, Inc., Andover, MA 01810 508-975-2350
Orbital, Clifton, CO 80120-1855 303-799-2611
Parker Hannifin Corp., Cleveland, OH 44112-1290 ..... 800-CPA-2211
Parker Hannifin Corp., Hydraulic Valve Division, Elyria, OH 44035 ..... 800-C-PARKER
Parker Hannifin Corp., Pneumatic Div., Richland, MI 49083 800-272-7537
Parker Hannifin Corp., Refrigeration Specialties Division, Broadview, IL 60153 708-681-5400
Parker Hannifin Corp., Schrader Bellows Division, Akron, OH 44309-0631 216-375-5200
§ † Sheffer/Alloy, Erie, PA 16505 814-833-6131
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
Vesco Instruments Inc., Plainview, NY 11803 516-349-3300

Valves, Vacuum-4100 — See Vol. C

Varactors — See Diodes, Varactor (Vol. D)

Varistors — See Resistors, Voltage Sensitive (Vol. D)

VCO — See Oscillators, Voltage Controlled Crystal

VHF Equipment — See Generators (Vol. D), Receivers (Vol. D), etc.

Vibration Surveys — See Services, Vibration Surveys (Vol. D)

Vibration Test Systems — See Testers, Vibration (Vol. D)

Vibrators-4050 — *See Vol. D*

Video Components & Equipment — See Specific Components: Amplifiers (Vol. D), Cameras (Vol. D), Networks (Vol. D), etc.

Video Links, Fiber Optic-2475
Optelecom, Inc., Gaithersburg, MD 20877, 301-840-1111 ..... B•1427
§ Advanced Video Products, Littleton, MA 01460 508-486-0024
§ Adtel Communications Corp., Hudson, MA 01749 508-562-2100
Lenfronics, Prism Systems Inc., Burnaby, B.C., CANADA V5A 1V7 604-421-8733
3M Private Network Products 3M, Austin, TX 78769-9960 ..... 512 984-1800 800-245-7459
§ † Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
Soltec Corp., San Fernando, CA 91340-1597 818-365-0000-800-423-9344

Viewers (MIL)-2440
ElectroPhysics Corp., Nutley, NJ 07110 201-667-0170
† IR Scientific, Carlisle, MA 01741 508-667-7110

Viewing Hoods, Cathode Ray Tube-2875 — *See Vol. D*

Vinyl Compounds — See Plastic Raw Materials (Vol. C)

Vises-5400 — *See Vol. C*

Visual Micro Inspection Systems-2900 — *See Vol. D*

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VME Bus Cards-2025 — *See Vol. D*

Voice Recognition Equipment – See Recognition Equipment, Speech (Vol. D)

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Voltage Sources-4000 – *See Vol. D*

Voltmeter, Electrostatic-2900 – *See Vol. D*

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VXIbus Enclosures-1400 – *See Vol. C*

VXIbus Modular Test Systems-2900 – *See Vol. D*

Wafer Fabrication, Semiconductor – See Semiconductor Wafer Fabrication (Vol. D)

Wall Plates – See Boxes, Junction, Outlet & Wall Plates (Vol. C)

Warning Systems, Lightning-4300

† Avex Electronics, Bensalem, PA 19020 ..... 215-638-1515;800-345-1295
U.S. Elco Inc., Santa Clara, CA 95054 ..... 1-800-888-ELCO

Warning Systems (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
† E-Systems, Greenville Div., Greenville, TX 75403-6056 903-455-3450
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† NAVAN Corporation, Media, PA 19063 215-543-8066
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400

Washers, Lock-2500 – *See Vol. C*

Washers, Plain-2500 – *See Vol. C*

Washers, Shoulder-2500 – *See Vol. C*

Waveguide-Coax Adapters-3450 – *See Vol. A*

Waveguides-3450 – *See Vol. A*

Waveguides (MIL)-2440

† Ark Elctrns. Corp., Southampton, PA 18966 215-322-6510
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
Litton Electron Devices, San Carlos, CA 94070 415-591-8411
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428

Wave Soldering Equipment – See Soldering Equip, Printed Circuit (Vol. C)

Wave Traps – See Filters, Antenna (Vol. A), Filters, Microwave (Vol. A), etc.

Welding Equipment & Accessories (Excl. Equipment for Semiconductor Devices)-5400 – *See Vol. C*

Welding Machines, Laser-4100 – *See Vol. D*

White Noise Generator Modules – See Generators, White Noise (Vol.), Diodes, Noise

White Printers-4200 – *See Vol. C*

Windows, Sapphire-2500 – *See Vol. C*

Windows, Shielded – See Shields, RF (Vol. C)

Wire & Cable Ties-2500 – *See Vol. C*

Wire, Airframe-2440

§† **Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886 ..... C•1716**
§† **Judd Wire Inc., Turners Falls, MA 01376, 413-863-4357 ... B•1020-1021, C•1764**
MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553 ..... C•1772
Weico Wire & Cable, Inc., Edgewood, NY 11717, 516-254-2970 ..... C•1833
† Brand-Rex, BICC, Willimantic, CT 06226-1128 203-456-8000
§† Cable USA, Inc., Naples, FL 33942-3560 813-643-6400
Champlain Cable Corp., Huber & Suhner(USA)Corp., Colchester, VT 05446 802-655-2121
§† Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 708-455-8830
§† Cooper Industries/Belden Div., Richmond, IN 47375 .... 317-983-5200;800-BELDEN-1
§ Custom Cable Corp., Westbury, NY 11590 516-334-3600
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647 201-768-5400
§† Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ..... 708-459-1000; 800-323-0198
† Electroweave, Inc., Worcester, MA 01604 508-752-8932
† General Wire Products, Inc., Worcester, MA 01604 617-752-8260
† W.L. Gore & Assocs., Newark, DE 19714 302-738-4880
† GSI Corp., Timonium, MD 21093 410-252-1768
† Harbour Ind. (Canada) Ltd., Farnham, Quebec, CANADA J2N 2X3 514-293-5304
Judd Wire Inc., San Marcos, CA 92069 619-744-7720
§† Olympic Wire & Cable, Fairfield, NJ 07006 201-227-7996
§† Philadelphia Insulated Wire Co. Inc., Moorestown, NJ 08057 ..... 800-257-8357; 609-235-6700
† Plastoid Corporation, Hamburg, NJ 07419 201-827-7141
§† Specialty Cable Corporation, Wallingford, CT 06492 ..... 800-456-SPEC
§† Standard Wire & Cable Co., Rancho Dominguez, CA 90220 ..... 213-609-1811; 800-326-0006
Storm Products Co., Hinsdale, IL 60521 708-323-9121
§† Tensolite Company, Subsidiary of Carlisle Corp., St. Augustine, FL 32092 904-829-5600
§† Thermax Wire Corp., Flushing, NY 11354-2897 718-939-8300
† United Wire & Cable Corp., Worcester, MA 01604 508-757-3872
† Victor Wire & Cable Corp., Los Angeles, CA 90016 213-870-9933

Wire, Antenna (All Types)-6000 – *See Vol. C*

Wire, Bare, Copper-6000 – *See Vol. C*

Wire, Bare, Nickel-6000 – *See Vol. C*

Wire, Bare, Nickel-Chrome-6000 – *See Vol. C*

Wire, Bonding-6000 – *See Vol. C*

Wire, Braid (Excluding Shielding)-6000 – *See Vol. C*

Wire, Braid (Shielding) – See Braid, Cable (Vol. C)

Wire, Ceramic Insulated-6000 – *See Vol. C*

Wire, Clad (All Types)-6000 – *See Vol. C*

Wire Cutting & Stripping – See Services, Wire Cutting & Stripping (Vol. D)

Wire, Enamel Insulated – See Wire, Hookup (All Types) (Vol. C)

Wire, Fiberglass Insulated – See Wire, Glass Insulated (Vol. C)

Wire, Flame Retardant-6000 – *See Vol. C*

Wire, Flat Strip-6000 – *See Vol. C*

Wire, Glass Insulated-6000 – *See Vol. C*

Wire, Gold-2500 – *See Vol. C*

Wire, Guy-6000 – *See Vol. C*

Wire, Heater – See Cable, Heater (Vol. C)

Wire, High Temperature (Over 125°C)-6000 – *See Vol. C*

Wire, High Voltage (1000 Volts & Over)-6000 – *See Vol. C*

Wire, Hookup (All Types)-6000 – *See Vol. C*

Wire, Irradiated-6000 – *See Vol. C*

Wire, Lead-in & Ground-6000 – *See Vol. C*

Wire, Litz-6000 – *See Vol. C*

Wire, Magnet-6000 – *See Vol. C*

Wire Markers (All Types)-Also See Strips Marker & Fanning-6000 – *See Vol. C*

Wire, Multiconductor – See Cable, Multiconductor (Vol. C)

Wire Nuts-2500 – *See Vol. C*

Wire, Plastic Insulated – See Wire, Hookup (All Types) (Vol. C)

Wire, Plated (All Types)-6000 – *See Vol. C*

Wire, Radiation Resistant-6000 – *See Vol. C*

Wire, Resistance-6000 – *See Vol. C*

Wire, Semiconductor Lead-6000 – *See Vol. C*

Wire, Shielded-6000 – *See Vol. C*

Wire Shielding-Also See Braid, Cable-4525 – *See Vol. C*

Wire, Stainless Steel-6000 – *See Vol. C*

Wire, Strain Gauge-6000 – *See Vol. C*

Wire Connectors-2100 – *See Vol. C*

Wire Strippers, Automatic-4100 – *See Vol. D*

Wire Strippers, Chemical – See Chemicals, Wire Stripping (Vol. C)

Wire Strippers, Manual-5400 – *See Vol. C*

Wire Calipers, Thermal-7000 — *See Vol. C*

Wire, Test Lead-4000 — *See Vol. C*

Wire, TFE Insulated-9000 — *See Vol. C*

Wire, Thermocouple-4000 — *See Vol. C*

Wire, Transmission — See Cable, Transmission (See Vol. C)

Wire, Tubular Pen — See Cable, Tubular Pen (See Vol. C)

Wire (MIL)-2440

Wire, Ultrasonic Generators-4000 — *See Vol. C*

Wire Wrap-1000 — *See Vol. C*

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Wiring Harness & Cable Assembly, Flex Circuit — See Flex Circuit Harness Assembly (See Vol. C)

Word Processor — See Optical Character Systems-4000 (See Vol. C)

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Work Stations, Computer-3000 — *See Vol. D*

Work Stations, Laminar Flow-4100 — *See Vol. D*

Work Stations, 3-D Vision Microscope-4100 — *See Vol. D*

Work Stations/Desks, Data Entry-1400 — *See Vol. C*

Wrenches-5400 — *See Vol. C*

X-ray Detector Arrays (For Industrial Inspections)-4100 — See Vol. D

X-ray Imaging Systems-4100 — See Vol. D

X-ray Inspection Equipment-4100 — See Vol. D

X-ray Testing — See Testing, X-ray (See Vol. D)

X-ray Diffraction, Powder-Area-4100 — See Vol. D

X-ray Inspection, Digital-4100 — See Vol. D

X-ray Machines, Medical Pre-Filter — See Vol. A

X-ray, Reflection, Oscillograph-1000 — See Vol. A

X-Ray, Tube Protection, Radial Pre-Filter — See Vol. A

Yokes, Deflection, TV Camera-1000 — See Vol. A

Zener Diodes — See Diodes, Zener

Zone Refine, Thermocouple — See Thermocouples, Elements & Assemblies (See Vol. C)

MAXIMUM CURRENT CAPACITY—CONDUCTORS

Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum			60°C	80°C		
	Single-wire	Wire-bundled	Single-wire	Wire-bundled					
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	....	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

MINIGLOSSARY
BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		Zone Punches
			9	9	9	9	9	9	9	9									Digit Punches
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							i	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB		¬	?	"									8-7
			12				12				12	12		12	12	12		12	
				11				11				11	11	11		11	11	11	Zone Punches
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0	⑬	0-1
②	12-11-9-8-1	⑥	12	⑩	11-0	⑭	11-0-9-1
③	11-0-9-8-1	⑦	11	⑪	0-8-2	⑮	12-11
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0		

Control Character Representations

ACK	Acknowledge	EOT	End of Transmission	PF	Punch Off
BEL	Bell	ESC	Escape	PN	Punch On
BS	Backspace	ETB	End of Transmission Block	RES	Restore
BYP	Bypass	ETX	End of Text	RS	Reader Stop
CAN	Cancel	FF	Form Feed	SI	Shift In
CC	Cursor Control	FS	Field Separator	SM	Set Mode
CR	Carriage Return	HT	Horizontal Tab	SMM	Start of Manual Message
CU1	Customer Use 1	IFS	Interchange File Separator	SO	Shift Out
CU2	Customer Use 2	IGS	Interchange Group Separator	SOH	Start of Heading
CU3	Customer Use 3	IL	Idle	SOS	Start of Significance
DC1	Device Control 1	IRS	Interchange Record Separator	SP	Space
DC2	Device Control 2	IUS	Interchange Unit Separator	STX	Start of Text
DC4	Device Control 4	LC	Lower Case	SUB	Substitute
DEL	Delete	LF	Line Feed	SYN	Synchronous Idle
DLE	Data Link Escape	NAK	Negative Acknowledge	TM	Tape Mark
DS	Digit Select	NL	New Line	UC	Upper Case
EM	End of Medium	NUL	Null	VT	Vertical Tab
ENQ	Enquiry				

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

MINIGLOSSARY SERVO COMPONENTS

SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

Impedance: Specified as R + jX, where R is the resistive component and X is the reactive component. Important impedances are: (a) Z_{oo} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with the secondary open; (b) Z_{so}, which is the impedance of the secondary winding with the primary open; and (c) Z_{ss}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

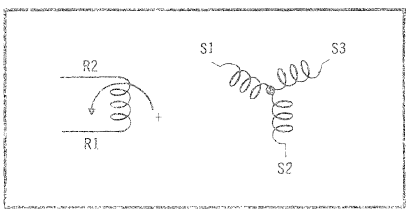
Accuracy: The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

Loads: For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

Operation Temperature: The ambient temperature range over which the unit performs its primary function.

FUNCTIONS

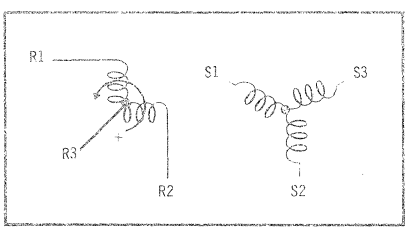
Transmitter: A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

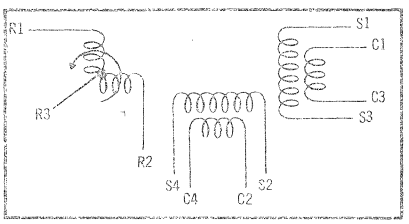
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to overrotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

WIRE GAUGES— DIAMETER, AREA AND COPPER WEIGHT

	Diameter at 20°C (68°F)		Area at 20°C (68°F)			Weight at 20°C (68°F), bare copper wire		
Size, AWG	mils	mm	mils	c mils	mm	lb/1,000 ft.	lb/mile	kg/km
4/0	460.0	11.68	166,200	211,600	107.2	640.5	3,382	953.2
3/0	409.6	10.40	131,800	167,800	85.01	507.8	2,681	755.7
2/0	364.8	9.266	104,500	133,100	67.43	402.8	2,127	599.5
1/0	324.9	8.252	82,891	105,600	53.49	319.5	1,687	477.6
1	289.3	7.348	65,730	83,690	42.41	253.3	1,338	337.0
2	257.6	6.543	52,120	66,360	33.62	200.9	1,061	298.9
3	229.4	5.827	41,330	52,620	26.67	159.3	841.1	237.1
4	204.3	5.189	32,780	41,740	21.15	126.3	667.1	188.0
5	181.9	4.620	25,990	33,090	16.77	100.2	528.8	149.0
6	162.0	4.115	20,610	26,240	13.30	79.44	419.4	118.2
7	144.3	3.665	16,350	20,820	10.55	63.03	332.8	93.80
8	128.5	3.264	12,970	16,510	8.367	49.98	263.9	74.38
9	114.4	2.906	10,280	13,090	6.631	39.61	209.1	58.95
10	101.9	2.588	8,155	10,380	5.261	31.43	166.0	46.77
11	90.7	2.304	6,460	8,230	4.17	24.90	131	37.1
12	80	2.05	5,130	6,530	3.310	19.8	104	29.4
13	72.0	1.83	4,070	5,180	2.63	15.7	82.9	23.4
14	64.1	1.63	3,230	4,110	2.08	12.4	65.7	18.5
15	57.1	1.45	2,560	3,260	1.650	9.87	52.1	14.7
16	50.8	1.29	2,030	2,580	1.31	7.81	41.2	11.6
17	45.3	1.150	1,610	2,050	1.040	6.21	32.8	9.24
18	40.3	1.02	1,280	1,620	0.823	4.92	26.0	7.32
19	35.9	0.912	1,010	1,290	0.653	3.90	20.6	5.81
20	32.0	0.813	804.0	1,020	0.519	3.10	16.4	4.61
21	28.5	0.724	636.0	812.0	0.412	2.46	13.0	3.66
22	25.3	0.643	503.0	640.0	0.324	1.94	10.2	2.88
23	22.6	0.574	401.0	511.0	0.259	1.55	8.16	2.30
24	20.1	0.511	317.0	404.0	0.205	1.22	6.46	1.82
25	17.9	0.455	252.0	320.0	0.162	0.970	5.12	1.44
26	15.9	0.404	199.0	253.0	0.128	0.765	4.04	1.14
27	14.2	0.361	158.0	202.0	0.102	0.610	3.22	0.908
28	12.6	0.320	125	159.0	0.0804	0.481	2.54	0.715
29	11.3	0.287	100.0	128.0	0.0647	0.387	2.04	0.575
30	10.0	0.254	78.50	100.0	0.0507	0.303	1.60	0.450
31	8.9	0.226	62.20	79.2	0.0401	0.240	1.27	0.357
32	8.0	0.203	50.30	64.0	0.0324	0.194	1.02	0.288
33	7.1	0.180	39.60	50.40	0.0255	0.153	0.806	0.227
34	6.3	0.160	31.20	39.7	0.0201	0.120	0.634	0.179
35	5.6	0.142	24.60	31.4	0.0159	0.0940	0.501	0.141
36	5.0	0.127	19.60	25.00	0.0127	0.0757	0.400	0.113
37	4.50	0.114	15.90	20.20	0.0103	0.0613	0.324	0.0912
38	4.0	0.102	12.60	16.0	0.00811	0.0484	0.256	0.0721
39	3.5	0.0889	9.62	12.2	0.00621	0.0371	0.196	0.0552
40	3.1	0.0787	7.55	9.61	0.00487	0.0291	0.154	0.0433
41	2.8	0.0711	6.16	7.84	0.00397	0.0237	0.125	0.0353
42	2.5	0.0635	4.91	6.25	0.00317	0.0189	0.0999	0.0282
43	2.2	0.0559	3.80	4.84	0.00245	0.0147	0.0774	0.0218
44	2.0	0.0508	3.14	4.00	0.00203	0.0121	0.0639	0.0180
45	1.8	0.0457	2.54	3.24	0.00164	0.00981	0.0519	0.0146
46	1.6	0.0406	2.01	2.56	0.00130	0.00775	0.0409	0.0115
47	1.4	0.0356	1.54	1.96	0.000993	0.00593	0.0313	0.00883
48	1.2	0.0305	1.13	1.44	0.000730	0.00436	0.0230	0.00649
49	1.1	0.0279	0.950	1.21	0.000613	0.00366	0.0193	0.00545
50	1.0	0.0254	0.785	1.00	0.000507	0.00303	0.0160	0.00450

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

MINIGLOSSARY
BASIC
ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

(CC) Communication Control
(FE) Format Effector
(IS) Information Separator

Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon
<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
_	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_c - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\,\pi\,fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\,\pi\,fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta\ (\text{loss angle}) = \frac{ESR}{X_c} = (2\,\pi\,fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\ \delta\ (\text{loss angle}) = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\ (Xc) = (DF)\ (\frac{1}{2}\,\pi\,fC)$

XII. Power Loss (watts)

Power loss = $(2\,\pi\,fCV^2)\ (DF)$

XIII. KVA (Kilowatts)

$KVA = 2\,\pi\,fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \left(\frac{T_t}{T_O}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \cdots + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \cdots + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

MINIGLOSSARY FIBER OPTICS

Acceptance Angle
The maximum angle within which light will be accepted by an element such as a detector or waveguide. In the latter, it is quantified as half the vertex angle of the cone within which optical power may be coupled into bound modes of a fiber.

Aligned Bundle
An assembly of fibers in which the coordinates of each fiber are the same at the two ends of the bundle, also called *Coherent Bundle*.

Bend Radius
The radius of curvature that an optical fiber can bend without breaking.

Bundle
Multiple optical fibers in a single housing used to transmit light or images.

Cladding
The low refractive index material that surrounds the core of the fiber to contain core light while protecting against surface contaminant scattering. In all-glass fibers, the cladding is glass.

Effective Numerical Aperture
The real numerical aperture of a fiber when the computed NA is not valid due to a change in the glass indices during the drawing and fusion process.

Fiber Bundle
A rigid, or flexible, concentrated assembly of glass or plastic fibers used to transmit optical images or light.

Fiber Optic Light Guide
A bundle of optical fibers arranged randomly for the purpose of transmitting energy, not images.

Fiber Optic Probe
A flexible optical probe having a bundle of glass fiber arranged to transmit an image

Gap Loss
The optical power loss caused by space between axially aligned fibers.

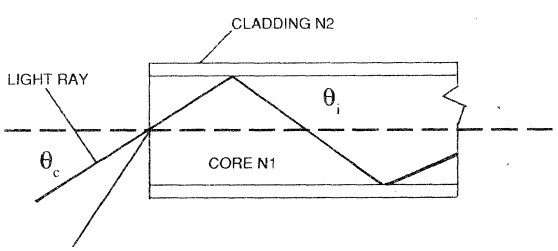
Image Transducer
Any arrangement of a bundle of optical fibers that alters the shape of the image. For example, by a systematic regulation of the spacing of the fibers from the entrance end to the exit end, a distortion of the image can occur that may be used to neutralize or compensate for the distortion introduced by the lens, prism or mirror components in an optical system.

Large-Core Fiber
Optical fiber with a large core, often a step-index fiber. "Large" is sometimes defined as greater than 85 µm.

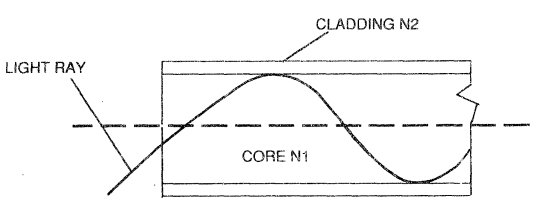
Multifibers
An array of optically distinct fibers that are fused into one strand. They are used to keep the resolution efficiency of the smaller single fibers and eliminate difficulty in handling. Their specific usage is determined by their flexibility or rigidity.

Packing Fraction
The ratio of the active core area of the fiber bundle to the total area at its light emitting or receiving end.

Plastic Fiber
Fiber in which both the core and cladding are made of plastic.



(a) Light propagation in a step index fiber.



(b) Path of light rays in a graded index fiber.

EEM MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination*. This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float*. Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof*. May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card*. The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement*.

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage*. Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage*. The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

91
92 Manufacturers and Sales Offices Directory

Each manufacturer is listed alphabetically with complete address and telephone number of main offices. The names of those with data pages in this edition of EEM are shown in **boldface**

Many manufacturers also show FAX, TWX and Telex numbers, FSC (Federal Supply Code), other pertinent company data, their sales and/or local distributor offices and phones. The page numbers of their data pages in this edition are shown in all volumes.

AAK CORPORATION

FAX: 508-373-8881

AAK CORP, 747 River St., Haverhill, MA 01832, Tel: 508-373-3769, 800-886-2225, TELEX: 04 26 3109-1; FSC No.: 04 26 3109-1; Empl.: 20; *Sls. Mgr.:* Marie Credit ..... **D•1507-1510**

Local Sales Offices & Reps

CA Los Angeles, Power Partners 213-215-0800
IN Indianapolis, Loren Green Assocs. 317-293-9827
MN Minneapolis, Hei-Lite Sls. 612-861-6051
OH Cleveland, Tiby Co. 216-371-5335
PA Cheltenham, Stein Instr. Corp. 215-379-1990

AALPHA PRECISION, Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, FAX: 818-345-1507; FSC No.: 06416; *Sls. Mgr.:* Douglas Trewhitt ..... **A•1837**

Local Sales Offices & Reps

CA San Jose, Comtech Mktg. 408-294-5448

Local Distributors

CA San Jose, Comtech Mktg. 408-294-5448

A & D ELEC. INSTRS., 73-07 88th St., Glendale, NY 11385, Tel: 718-275-6516, FAX: 718-275-6516; FSC No.: 01914; Empl.: 7

A & J MANUFACTURING CO., 14131 Franklin Ave., Tustin, CA 92680, Tel: 714-544-9570, FAX: 714-544-4215; FSC No.: 08060; Empl.: 70; *Sls. Mgr.:* Wayne L. Seeley

AAVID ENGINEERING, INC., One Kool Path, P.O. Box 400, Laconia, NH 03247-0400, Tel: 603-528-3400, TWX: 510-298-1127, FAX: 603-528-1478; FSC No.: 30161; Empl.: 450; *Sls. Mgr.:* Charles Nelson; *Dist. Mgr.:* David Mendel ..... **C•1604**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean, Inc. 205-830-1540
AZ Phoenix, Jarko Assocs. Inc. 602-243-4387
CA Brea, Masco Elctrns. 714-529-0866
CA Santa Clara, WestRep 408-988-8833
CO Broomfield, SummitWest Mktg. 303-460-9600
FL Apopka, Cartwright & Bean, Inc. 407-889-9100
FL Deerfield Bch., Cartwright & Bean, Inc. 305-429-3400
GA Norcross, Cartwright & Bean, Inc. 404-368-0160
IL Itasca, Beta Technlg. Sls., Inc. 708-250-9586
IN Carmel, Kahsar Sls. Inc. 317-844-9353
IA Des Moines, S P S Assocs. 515-225-0607
KS Olathe, S P S Assocs. 913-764-4460
LA Covington, Cartwright & Bean, Inc. 504-892-1780
MD Hunt Valley, Marktron, Inc. 301-628-1111
MD Rockville, Marktron, Inc. 301-251-8990
MA Millis, Selmark Assocs., Inc. 508-376-2914
MI Ann Arbor, Kahsar Sls. Inc. 313-769-0131
MN Brainerd, Mitchell Johnson 218-829-8180
MS Jackson, Cartwright & Bean, Inc. 601-981-1170
MO Earth City, S P S Assocs. 314-291-0520
NE Panama, S P S Assocs. 913-764-4460
NJ Berkeley Hgts., Cambridge-Allen & Assocs. 908-464-0203
NJ Medford, Jack McCoy, Inc. 609-953-0770
NM Albuquerque, Ron-Tek, Inc. 505-299-4124
NY Endwell, Reagan/Compar Binghamton 607-754-2171,607-754-8946
NY Fairport, Reagan/Compar Corp. 716-271-2230
NY New Hartford, Reagan/Compar Syracuse/Utica 315-732-3775,315-735-9831
NC Charlotte, Cartwright & Bean, Inc. 704-536-0303
NC Raleigh, Cartwright & Bean, Inc. 919-876-4130
OH Cincinnati, Kahsar Sls. Inc. 513-922-3133
OH Columbus, Kahsar Sls. Inc. 614-252-4009
OH Mentor, Kahsar Sls. Inc. 216-946-7659
OR Portland, S P S Elctrns. 503-297-6919
PA Exton, Jack McCoy, Inc. 215-363-0350
TN Knoxville, Cartwright & Bean, Inc. 615-693-7450
TN Memphis, Cartwright & Bean, Inc. 901-362-8345
TX Austin, Mil-Rep Assocs., Inc. 512-346-6331
TX Houston, Mil-Rep Assocs., Inc. 713-444-2557
TX Richardson, Mil-Rep Assocs., Inc. 214-644-6731
UT Salt Lake City, Butterworth Mktg. 801-969-5566
WA Snohomish, S P S Elctrns. 206-794-0154
WI Milwaukee, Beta Technlg. Sls., Inc. 414-543-6609
PR Guaynabo, ISLA Caribe Electro Sls. ... 809-720-4430
Can Markham, Ont., Avotronics, Ltd. 416-475-2024
Can Ottawa, Ont., Avotronics, Ltd. 613-233-5527
Can Pointe Claire, Que., Avotronics, Ltd. ... 514-697-2135

Local Distributors

AL Huntsville, Century Fasteners Corp. ... 205-883-5344
AL Huntsville, Hammond Elctrns. Inc. 205-830-4764
AZ Phoenix, Aero-Space Southwest Inc. .. 602-582-2779
AZ Tempe, Acacia/Deanco 602-894-2874
AZ Tempe, D C Elctrns. Supp. 602-438-1234
AR Ft. Smith, Carlton-Bates Co., Inc. 501-646-8201
AR Little Rock, Carlton-Bates Co. Inc. 501-562-9100
AR Pine Bluff, Carlton-Bates Co. Inc. 501-535-1355
AR Springdale, Carlton-Bates Co. Inc. 501-756-5012
CA Fountain Valley, Comps. Cen. Inc. 714-979-0433
CA Fullerton, Pyramid Elctrns. 213-691-0561
CA Garden Grove, Allied Elctrns. 714-554-0731
CA Hayward, Allied Elctrns. 415-487-5250
CA Irvine, Acacia/Deanco 714-660-0834
CA Mtn. View, Energy Sls. Inc. 415-969-0800
CA Rancho Cordova, Acacia/Deanco 916-638-1861
CA San Diego, Acacia/Deanco 619-565-4365
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Jose, Allied Elctrns. 408-727-1690
CA San Jose, Future Elctrns. Inc. 408-435-9100
CA Santa Clara, Comps. Cen. 408-988-3751
CA Santa Clara, D C Elctrns. Supp. 408-980-1199
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Santa Monica, Master Distrs. 213-452-1229
CA Sunnyvale, Acacia/Deanco 408-745-7200
CA Tustin, Added Value Elctrn. 714-259-8258
CO Englewood, N E P Elctrns. Inc. 303-799-9898
CO Lakewood, Acacia/Deanco 303-232-2882
CO Westminster, Future Elctrns. Inc. 303-650-0123
CT Danbury, Future Elctrns. Inc. 203-743-9594
CT Wallingford, Cronin Elctrns., Inc. 800-982-4449
FL Clearwater, Elctrn. Precepts of FL 813-530-9781
FL Clearwater, Future Elctrns. Inc. 813-441-4771
FL Ft. Lauderdale, Allied Elctrns. 305-486-0500
FL Ft. Lauderdale, Hammond Elctrns. Inc. 305-973-7103
FL Lake Mary, Elctrn./Fasteners 407-321-4000
FL Largo, Bell Inds. 813-541-4434
FL Orlando, Hammond Elctrns. Inc. 407-849-6060
FL Tampa, Century Fasteners Corp. 813-886-5770
GA Decatur, Allied Elctrns. 404-377-3555
GA Norcross, Atlanta Hardware Special ... 404-449-3000
GA Norcross, Future Elctrns. Inc. 404-441-7675
GA Norcross, Hammond Elctrns. Inc. 404-449-1996
IL Chicago, N E P Elctrns. Inc. 708-625-8400
IL Elgin, Allied Elctrns. 312-697-8200
IL Lisle, Comps. Inc. 708-852-7707
IL Rosemont, Advent Elctrns. Inc. 708-297-6200
IL Schaumburg, Future Elctrns. Inc. 312-882-1255
IN Indianapolis, Bell Inds. 317-634-8202
IN Indianapolis, Bell Inds.;Jit Div. 317-299-5487
IN Indianapolis, Mar Elctrns. Inc. 317-633-6699
IA Cedar Rapids, Advent Elctrns. Inc. 319-363-0221
MD Columbia, Future Elctrns. Inc. 301-995-1222
MD Jessup, Treeko Sls. Inc. 301-470-3300
MD Marlow Hgts., Allied Elctrns. 301-423-0161
MA Bolton, Future Elctrns. Inc. 508-366-2400
MA Marlborough, Hardware Specialty Co. Inc. 718-481-8622
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MA Woburn, Macbearing Co. 617-933-2110
MI Farmington Hills, Advent Elctrns. Inc. .. 313-477-1650
MN Bloomington, Bergquist Co. 612-835-2322
MN Minneapolis, Aero-Space Computer Supp. 612-884-4725

MN St. Paul, Chris Elctrns. 612-631-2647
MO St. Charles, Finnigan Elctrns. 314-946-6201
MO St. Louis, Ric-Tronics 314-576-9816
NH Salem, Cronin Elctrns., Inc. 603-898-4440
NJ Mt. Laurel, Future Elctrns. Inc. 609-778-7600
NJ Springfield, Route Elctrns. 201-379-7710
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Buffalo, Summit Distrs. inc. 716-887-2800
NY Elmhurst, Century Fasteners Corp. 718-446-5000
NY Holtsville, Tower Fasteners 516-289-8800
NY Liverpool, Future Elctrns. Inc. 315-451-2371
NY Mineola, Allied Elctrns. 516-248-2360
NY Mt. Vernon, Q A R Indl. Elec. 914-699-2224
NY Rochester, Masline Elctrns. Inc. 716-546-5373
NY Rochester, Summit Elctrns. Inc. 716-334-8110
NC Charlotte, Century Fasteners Corp. ... 704-554-0444
NC Greensboro, Golden Elctrns. 919-294-4653
NC Greensboro, Hammond Elctrns. Inc. ... 919-275-6391
NC Raleigh, Century Elctrn. Comps. 919-782-2116
NC Raleigh, Century Fasteners Corp. 919-787-1800
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cincinnati, Schuster Elctrns. 513-489-1400
OH Twinsburg, Schuster Elctrns. 216-425-8134
OH Warren, REM Elctrns. 216-373-1300
OK Tulsa, Carlton-Bates Co. Inc. 918-250-1626
OR Beaverton, Acacia/Deanco 503-646-3377
OR Beaverton, Comp. Resources 503-641-8488
OR Beaverton, Future Elctrns. Inc. 503-626-2977
OR Beaverton, Murphy Elctrns. 503-642-2001
OR Portland, Dynn Elctrns. 503-285-0214
PA Carisle, Cumberland Elctrns. 717-243-8006
PA Erie, REM Elctrns. 814-453-5626
PA Harrisburg, Cumberland Elctrns. 717-232-5999
PA Lancaster, Cumberland Elctrns. 717-393-8304
PA Lewistown, Cumberland Elctrns. 717-249-9631
PA Norristown, Century Elctrn. Comp. 215-631-5400
PA Philadelphia, P E I-Genesis 800-523-0727
PA Philadelphia, Shap Elctrns. 215-969-3300
PA York, Cumberland Elctrns. 717-845-8791
SC Greenville, Hammond Elctrns. Inc. 803-233-4121
SC W. Columbia, Century Fasteners Corp. 803-791-1800
TN Memphis, Carlton-Bates Co. Inc. 901-365-3539
TN Nashville, Carlton-Bates Co. Inc. 615-244-3562
TX Austin, Wofford Elctrns., Inc. 512-339-1131
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Wofford Elctrns., Inc. 713-847-3583
TX Texarkana, Carlton-Bates Co. Inc. 214-792-6923
UT Salt Lake City, Future Elctrns. Inc. 801-972-8489
VA Richmond, Century Fasteners Corp. .. 804-262-8671
WA Bellevue, Future Elctrns. Inc. 206-881-8199
WA Kent, Pyramid Elctrns. 206-872-5800
WA Redmond, Comp. Resources 800-547-6523
WA Redmond, Energy Sls. Inc. 206-883-2342
WA Redmond, Murphy Elctrns. 206-881-1234
WA Seattle, Allied Elctrns. 206-547-2827
WI New Berlin, N E P Elctrns. Inc. 414-785-9100
Can Calgary, Alberta, Future Elctrns. Inc. ... 403-259-6408
Can Downview, Ont., Future Elctrns. Inc. ... 416-638-4771
Can Edmonton, Alberta, Future Elctrns. Inc. 403-438-2858
Can Mississauga, Ont., Rush Elctrns. 416-677-7280
Can Nepean, Ont., Carsten Elctrns. Ltd. 613-726-9250
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. Inc. 514-694-7710
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can St. Laurent, Que., Carsten Elctrns. 514-334-8321
Can Vancouver, BC, Future Elctrns. Inc. ... 604-294-1166
Can Victoria, BC, Queale Elctrns. Ltd. 604-388-6111
Can Winnipeg, Manitoba, Future Elctrns. Inc. 204-339-0554



FAX: 908-526-6866

ABACUS CONTROLS INC., 89 Readington Rd., Somerville, NJ 08876, Tel: 908-526-6010; FSC No.: 54241; Empl.: 45; *Sls. Mgr.:* P. Milone ..... **D•2149-2151**

Local Sales Offices & Reps

AL Gurly, Saber Assocs. 800-327-0853
CA Los Angeles, Power Partners 800-468-5400
CA San Diego, Power Partners 800-468-5400
CA Sunnyvale, N-S Westronics 408-745-1102
CT New London, Elctrn. Sls. of New England 203-443-2646
FL Apopka, Saber Assocs. 800-432-6288
FL Melbourne, Saber Assocs. 800-432-6288
FL Plantation, Saber Assocs. 800-432-6288
FL Tampa, Saber Assocs. 800-432-6288
GA Dacula, Saber Assocs. 800-327-0853
MD Landover, Sel-Tronics 301-341-2700
MA Wareham, Elctrn. Sls. of New England 508-295-7634
NC Clayton, Saber Assocs. 800-327-0853
TX Dallas, True Technlg. 214-691-7870
VA Hampton, Sel-Tronics 301-341-2700
VA Herdon, Sel-Tronics 301-341-2700
WA Bellevue, Al Smith Co. 206-746-6770
WA Vancouver, Al Smith Co. 206-892-9912

ABALON PRECISION MFG., 1040 Home Street, Bronx, NY 10459, Tel: 212-589-5682, 1-800-888-ABALON, FAX: 212-589-0300; Empl.: 25; *Sls. Mgr.:* Harold Miller

ABB KENT-TAYLOR INC., ASea Brown Boveri, P.O. Box 110, 95 Ames St, Rochester, NY 14692, Tel: 716-235-5000, TELEX: 978412, FAX: 716-235-7131; Empl.: 600; *Dist. Mgr.:* Michael Spoonhower

ABB METRAWATT, 2150 W. 6th Ave. Unit J, Broomfield, CO 80020, Tel: 303-469-5231, 800-821-6327, TELEX: 4970869, FAX: 303-469-4256; Empl.: 20; *Sls. Mgr.:* Erik Pfanku

ABB SEMICONDUCTOR, See IXYS Corporation

abbott

FAX: 213-836-1027

ABBOTT ELECTRONICS, 2727 S. La Cienega Blvd., Los Angeles, CA 90034, Tel: 213-202-8820, TELEX: 69-1398; FSC No.: 6130, 5999, 15755; Empl.: 200; *Sls. Mgr.:* Brooke Hartman ..... **D•1523-1543**

Local Sales Offices & Reps

NJ Ft. Lee, Abbott Elctrns. 201-461-4411
TX Richardson, Abbott Elctrns. 214-437-0697
UT Bountiful, Anderson & Assocs. 801-292-8991
AZ Scottsdale, Aztech-CPS Assocs. 602-991-6300
Can Ottawa, Subtec Ltd. 613-738-1470

ABBOTT TECHNOLOGIES, INC, Transformer Division, 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-504-0644, 1-800-367-8200, 818-841-3630, TELEX: 75-2972, FAX: 818-768-0395,69-6282; FSC No.: 58910; Empl.: 62; *Sls. Mgr.:* Suresh Soni ..... **A•2134-2149; D•2152-2153**

Local Sales Offices & Reps

CA Mission Viejo, Abbott Technlgs., Inc. .. 714-454-1361
CA Sun Valley, Abbott Technlgs., Inc. 818-504-0644
NJ Palisades Pk, Abbott Technlgs., Inc. .. 201-461-4005

ABBOTT TECHNOLOGIES, INC. POWER SUPPLIES DIVISION, 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-504-0644,1-800-367-8200,818-841-3630, TELEX: 75-2972, FAX: 818-768-0395; Empl.: 62; *Sls. Mgr.:* Suresh Soni ..... **D•1511-1521, 2152-2153**

Local Sales Offices & Reps

CA Mission Viejo, Abbott Technlgs., Inc. .. 714-454-1361
CA Sun Valley, Abbott Technlgs; Inc. 818-504-0644
NJ Palisades Pk, Abbott Technlgs., Inc. .. 201-461-4005

ABBOTT TRANSISTOR LABS, Power Supplies, See Abbott Electronics, Power Supplies

ABL ELECTRONICS SUPPLY, INC., 1736 Front St, Yorktown Hgts., NY 10598, Tel: 914-962-2253, FAX: 914-962-2296; Empl.: 18; *Sls. Mgr.:* George Wiesel ..... **C•1155, 1710-1713**

ABLESTIK LABORATORIES, 20021 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-764-4600, FAX: 213-764-2545; FSC No.: 21109; Empl.: 150; *Sls. Mgr.:* J. Gausepohl

ABORN ELECTRONICS INC., 2108 D Bering Dr., San Jose, CA 95131, Tel: 408-436-5444, FAX: 408-436-0969; FSC No.: 8Z441; Empl.: K. Bomin; *Sls. Mgr.:* V. Lumba

ABRAMS INSTRUMENT CORP., 2859 W. Jolly Rd., Okemos, MI 48864, Tel: 517-332-6405, FAX: 517-332-8270; FSC No.: 00048; *Sls. Mgr.:* Merlyn Gates

ACC ELECTRONICS COMPANY, Echlin Inc., 1300 W. Oak, Independence, KS 67301, Tel: 316-331-1000, FAX: 316-331-1422; Empl.: 1000; *Sls. Mgr.:* Leon Allen

ACCEL INDUSTRIAL HEAT SINK CORP., 3709 Medford St, Los Angeles, CA 90063, Tel: 213-261-5156, FAX: 213-261-5159; FSC No.: 26701; *Sls. Mgr.:* Ron Ruby

ACCEL TECHNOLOGIES, INC., 6825 Flanders Dr., San Diego, CA 92121, Tel: 619-554-1000, TELEX: 201-582 ATI UR, FAX: 619-554-1019; Empl.: 26; *Sls. Mgr.:* Ray Schnorr

ACCESSORIES FOR ELECTRONICS, INC., 800 Merrick Rd., Baldwin, NY 11510-3593, Tel: 516-546-1751, FAX: 516-867-1922; FSC No.: 54355; Empl.: 27; *Sls. Mgr.:* Bill Harris

ACCU DATA, INC., 1220 Spring Creek Place, Springville, UT 84663-0963, Tel: 801-377-9156, FAX: 801-377-9158; Empl.: 10; *Sls. Mgr.:* Ralph D. Bradley; *Dist. Mgr.:* Ralph D. Bradley

ACCUDYNE CORP., P.O. Box 1429, Janesville, WI 53547, Tel: 608-752-4053, FAX: 608-752-9706; FSC No.: 18356; Empl.: 540; *Sls. Mgr.:* R. E. Mowris; *Dist. Mgr.:* R. E. Mowris

ACCULEX CORPORATION, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3660, TELEX: 503989, FAX: 508-880-0179; *Sls. Mgr.:* Richard A. Mullen

ACCULIN, INC., 214 N. Main St, Suite 204, Natick, MA 01760, Tel: 508-650-1012, FAX: 508-650-1457; Empl.: 3; *Sls. Mgr.:* Barry Hilton

ACCUMET ENGINEERING, 518 Main St, Hudson, MA 01749, Tel: 508-568-8311, FAX: 508-562-4384; *Sls. Mgr.:* C. T. Haering

ACCUPROBE, INC., 1 Harrison Ave, Box 1044, Salem, MA 01970, Tel: 508-745-7878, FAX: 508-745-7922; Empl.: 22; *Sls. Mgr.:* Thomas H. Murphy; *Dist. Mgr.:* T. H. Murphy

ACCURATE ELECTRONICS CORP., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036, Tel: 216-366-6330, 1-800-325-8979, FAX: 216-366-0522; FSC No.: 11375; Empl.: 35; *Sls. Mgr.:* J. F. Seybold

Local Sales Offices & Reps

FL Niceville, Adams Sls. Co. 904-897-4958
OH Worthington, Padgett Sls. Co. 614-885-5908

ACCURIDE, 12311 Shoemaker, Santa Fe Springs, CA 90670, Tel: 213-903-0373, TWX: 910-586-1632, FAX: 213-903-0208; *Sls. Mgr.:* Jackie Pinto

ACCUSONIC DIVISION, Ferranti O.R.E. Inc., Box 709, Falmouth, MA 02541, Tel: 508-548-5800, TELEX: 6817399 OREFAL UW, FAX: 508-540-3835; Empl.: 125; *Sls. Mgr.:* Robert Beede

ACCUSONIC SYSTEMS CORP., A DSG Company, 2101 Jericho Turnpike, New Hyde Park, NY 11040, Tel: 516-328-3300, FAX: 516-326-8827; Empl.: 116; *Sls. Mgr.:* Michael D'Agostino

ACCUTECH, Adaptive Instrs. Corp., 15 Bunazzoli Ave., Riverside Indl. Park, Hudson, MA 01749, Tel: 508-568-0500, FAX: 508-568-9085; *Sls. Mgr.:* Cliff Lewis

ACCUTECH BENCHMARK SERVICES, P.O. Box 252, Brick, NJ 08723, Tel: 1-908-206-0026, FAX: 908-206-0280 ..... **D•1024-1026**

ACCUTRONICS/CONNOR-WINFIELD, See Connor-Winfield

acdc electronics
A DIVISION OF ASTEC AMERICA INC

ACDC ELECTRONICS, DIV. OF ASTEC AMERICA, See Astec America

ACD-ELCOR PRODUCTS, P.O. Box 244, Bethel, CT 06801, Tel: 203-743-3510; Empl.: 3

ACHESON COLLOIDS, Div. of Acheson Industries, Inc., P.O. Box 611747, Port Huron, MI 48061-1747, Tel: 313-984-5581, FAX: 313-984-1446; Empl.: 200

A.C. INTERFACE INC., 22391 Gilberto, Rancho Santa Margarita, CA 92688, Tel: 714-858-1866, FAX: 714-858-1073; FSC No.: OAP 78; Empl.: 23; *Sls. Mgr.:* Bill Roth; *Dist. Mgr.:* Al Kile

ACL INC., 1960 E. Devon Ave., Elk Grove, IL 60007, Tel: 708-981-9212, 1-800-782-8420, FAX: 708-981-9212; Empl.: 12; *Sls. Mgr.:* Ralph D. Considine; *Dist. Mgr.:* Tony Banks



FAX: 716-968-3948

ACME ELECTRIC CORPORATION, 20 Water Street, Cuba, NY 14727, *Tel:* 716-968-2400; *Sls. Mgr.:* Dale Guilford; *Dist. Mgr.:* Bill Bengle ..... D•1544-1547, 2154-2155

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, O'Donnell Assocs. S.W.	602-944-9542
CA	San Jose, O'Donnell Assocs., North	408-432-1940
CO	Littleton, Harthun Assocs.	303-795-5545
FL	Apopka, Cartwright & Bean	407-422-4531
FL	Deerfield Bch., Cartwright & Bean	305-429-3400
GA	Norcross, Cartwright & Bean	404-368-0160
ID	Boise, Jas. J. Backer Co.	208-343-9831
IL	Des Plaines, Electron Mktg.	312-298-2330
IN	Ft. Wayne, Needler Sls. Co., Inc.	219-447-2123
IN	Indianapolis, Luebbe Sls.	317-845-7389
IN	Indianapolis, Needler Sls. Co., Inc.	317-255-8056
KS	Shawnee Mission, Lowell Kangas & Assocs.	913-631-3515
LA	Covington, Cartwright & Bean	504-892-1780
MD	Gaithersburg, Naudain Assocs.	301-258-5040
MA	Framingham, Marathon Sls.	508-875-3566
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MS	Jackson, Cartwright & Bean	601-981-1170
MN	Minneapolis, Boerger & Assocs.	612-560-3435
MO	St. Louis, Lowell Kangas & Assocs.	314-821-4050
NM	Albuquerque, O'Donnell Assocs. S.W.	505-889-4522
NY	Clark Mills, KLM Garner	315-853-6126
CA	Torrance, O'Donnell Assocs. S. W.	213-539-9664
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Lumberton, Acme Elec. Corp.	919-738-9202
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Cleveland, Marlow Assocs.	216-831-8232
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Luebbe Sls.	513-294-0426
OH	Dayton, Marlow Assocs.	513-274-9666
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
PA	Pittsburgh, Luebbe Sls.	412-364-0490
PA	Pittsburgh, Marlow Assocs.	412-343-5050
TN	Knoxville, Cartwright & Bean	615-693-4750
TN	Memphis, Cartwright & Bean	901-362-8345
UT	Salt Lake City, Acme Elec. Corp.	801-539-0227
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Sullivan, Electron Mktg.	414-593-2981

Local Distributors

AL	Birmingham, American Elctrns. Supp.	205-942-4656
AL	Birmingham, Forbes Distrbg.	205-251-3941
AL	Decatur, Forbes Distbg.	205-353-4762
AL	Huntsville, Allied Elctrns.	205-721-3500
AL	Huntsville, Forbes Distbg.	205-837-1579
AL	Huntsville, Future Elctrns.	205-882-3190
AL	Mobile, Allied Elctrns.	205-476-1875
AL	Mobile, Forbes Distbg.	205-479-4535
AL	Mobile, Spectronics	205-344-0450
AL	Montgomery, Forbes Distrbg.	205-263-2083
AZ	Phoenix, Allied Elctrns.	602-437-9080
AZ	Phoenix, Future	602-968-7140
AZ	Tempe, L Comp	602-730-1633
AZ	Tempe, P&A Entprs.	602-894-1519
AR	Little Rock, Carlton Bates	501-562-9100
AR	N. Little Rock, Allied Elctrns.	501-376-0233
CA	Chatsworth, Allied Elctrns.	818-882-6981
CA	Chatsworth, Future Elctrns.	818-722-6240
CA	Fremont, Allied Elctrns.	415-770-0590
CA	Irvine, Allied Elctrns.	714-727-3010
CA	Irvine, Future Elctrns.	714-250-4141
CA	Irvine, ITT Multicomp.	714-727-3001
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Rockland, Allied Elctrns.	916-632-3014
CA	S. San Francisco, Allied Elctrns.	415-952-9599
CA	San Diego, Allied Elctrns.	619-279-2550
CA	San Diego, Future Elctrns.	619-278-5020
CA	San Jose, Capstone	408-453-9804
CA	San Jose, Future Elctrns.	408-434-1122
CA	San Jose, ITT Multicomp.	408-453-1404
CA	San Jose, Rose Elctrns.	408-943-0255
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Torrance, Allied Elctrns.	213-373-8828
CA	Tustin, Capstone	714-730-0349
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Denver, Consolidated Parts	303-623-5313
CO	Englewood, Allied Elctrns.	303-790-1664
CO	Englewood, NEP Elctrns.	303-799-9898
CO	Westminster, ITT Multicomps.	303-451-8740
CT	Bethel, Future Elctrns.	203-743-9594
CT	Cheshire, Allied Elctrns.	203-272-7730
CT	Wallingford, Sager	203-265-7741
FL	Altamonte Springs, Future Elctrns.	407-767-8414
FL	Casselberry, Allied Elctrns.	407-831-3331
FL	Clearwater, Future Elctrns.	813-578-2770
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Jacksonville, Allied Elctrns.	904-346-0741
FL	Jacksonville, Hammond/EMSCO	904-356-4851
FL	Largo, Allied Elctrns.	813-541-4660
FL	Orlando, EMSCO	407-849-6362
FL	Orlando, Hammond Elctrns.	407-849-6060
FL	Pompano Bch., Allied Elctrns.	305-978-3008
FL	Riviera Bch., K & M Elctrl.	407-842-4911
GA	Doraville, Voltex Batteries	404-448-6021
GA	Norcross, Bell Inds.	404-662-0923
GA	Norcross, Future Elctrns.	404-441-7676
GA	Norcross, Hammond Elctrns.	404-449-1996
IL	Addison, LComp Elctrns.	312-628-1400
IL	Itasca, Capstone	708-250-3000
IL	Libertyville, Allied Elctrns.	708-918-0250
IL	Oak Forest, Allied Elctrns.	708-535-0038
IL	Wood Dale, Allied Elctrns.	708-860-0007
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Ft. Wayne, Bell Inds.	219-742-4346
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Allied Elctrns.	317-875-0448
IN	Indianapolis, Bell Inds.	317-634-8202
IN	Indianapolis, Meunier Elctrns.	317-635-3511
IN	Indianapolis, R S Elctrns.	513-793-2450
ID	Boise, Radar Elec.	208-336-2227
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	W. Des Moines, Allied Elctrns.	515-223-6488
KS	Lenexa, Allied Elctrns.	913-599-6227
KS	Overland Park, Olive Elctrns.	312-297-6200
IL	Schaumberg, Future Elctrns.	312-882-1255
KY	Florence, URI Elctrns.	606-371-4423
KY	Lexington, Radio Elctrn.	606-255-6661
KY	Louisville, Allied Elctrns.	502-452-2293
KY	Louisville, Peerless Elctrns.	502-637-7674
LA	Baton Rouge, Menard Elctrns.	504-355-0323
LA	Metairie, Allied Elctrns.	504-885-1195
LA	New Orleans, Menard Elctrns.	504-734-8445
LA	New Orleans, Radio Parts	504-581-5959
MD	Baltimore, Resco/Baltimore	301-931-8200
MA	Billerica, Allied Elctrns.	508-667-7921
MD	Columbia, Allied Elctrns.	301-381-1560
MD	Columbia, Future Elctrns.	301-290-0600
MD	Columbia, Sager	301-995-6580
MD	Jessup, Treeko Elctrns.	301-470-3300
MD	W. Friendship, Cerberus Sys.	301-489-7198
MA	Hingham, Sager Elctrl.	617-749-6700
MA	Norwood, Allied Elctrns.	617-255-0361
MA	Wilmington, Capstone	508-657-5874
MA	Wilmington, North Star Elctrns.	508-657-5155
MI	Battle Creek, Gt. Lakes Elctrns.	616-963-6282
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Haven, Fitzpatrick Elec.	616-846-5591
MI	Grand Rapids, Allied Elctrns.	616-949-8200
MI	Grand Rapids, Fitzpatrick Elec.	800-968-9880
MI	Grand Rapids, R S Elctrns.	616-241-3483
MI	Holland, Fitzpatrick Elec.	800-968-4625
MI	Lansing, Battery Exchange(Dynalite)	517-694-0411
MI	Livonia, Allied Elctrns.	313-462-0190
MI	Livonia, Future Elctrns.	313-261-5270
MI	Livonia, R S Elctrns.	313-525-1155
MI	Muskegon, Fitzpatrick Elec.	800-968-6621
MI	Traverse City, Fitzpatrick Elec.	800-968-7262
MN	Eden Prairie, Allied Elctrns.	612-829-7554
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, ISI-Instrmn. Svc.	612-544-8916
MS	Jackson, Ellington Elec.	601-355-0561
MO	Earth City, Allied Elctrns.	314-291-7031
MO	Kansas City, LComp Elctrns.	816-221-2400
MO	Maryland Hgts., LComp Elctrns.	314-291-6200
MO	Maryland Hgts., Olive Elctrns.	314-997-7709
MO	St Louis, ISL Corp.	314-535-5760
MO	St. Louis, Future Elctrns.	314-469-6805
MO	St. Louis, Vansickle Elctrns.	314-621-5000
NE	Omaha, Allied Elctrns.	402-697-0038
NH	Nashua, Allied Elctrns.	603-883-3008
NJ	Edison, Allied Elctrns.	908-572-9600
NJ	Fairfield, Future Elctrns.	201-227-4346
NJ	Green Brook, Apparatus Elec.	201-752-8400
NJ	Lodi, TRC	201-779-8282
NJ	Mt. Laurel, Capstone	609-727-7800
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Parsippany, Allied Elctrns.	201-428-3350
NM	Albuquerque, International Elctrns.	505-291-9951
NJ	Mt. Laurel, Future Elctrns.	609-778-7600
NY	Buffalo, Summit Inds.	716-887-2800
NY	Cen. Islip, Circuit Sls.	516-348-7670
NY	E. Rochester, Rome Elctrns.	716-248-0160
NY	Fairport, Allied Elctrns.	716-425-3850
NY	Hauppauge, Future Elctrns.	516-234-4000
NY	Hauppauge, Sager Elctrl.	516-348-1300
NY	Lagrangeville, Allied Elctrns.	914-452-1470
NY	Liverpool, Future Elctrns.	315-451-2371
NY	Melville, Capstone	516-391-1300
NY	Mineola, Allied Elctrns.	516-248-2360
NY	Mt. Vernon, OAR Elctrns.	914-699-2224
NY	Mt. Vernon, QAR Elctrns.	914-699-2224
NY	Rochester, CAM/RPC Elctrns.	716-427-9999
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Simcona	716-328-3230
NY	Rochester, Summit Inds.	716-334-8110
NY	Rockville Centre, Group 516 Inc.	516-678-7360
NY	Rome, Rome Elctrns.	315-337-5400
NC	Asheville, Southeastern Elctrns.	704-253-1446
NC	Charlotte, Future Elctrns.	704-529-5500
NC	Charlotte, Southeastern Elctrns.	704-523-1122
NC	Fayetteville, Southeastern Elctrns.	919-483-0371
NC	Greensboro, Hammond/EMSCO	919-275-6391
NC	Greensboro, Southeastern Elctrns.	919-273-8675
NC	Hickory, Southeastern Elctrns.	704-322-9493
NC	Jacksonville, Southeastern Elctrns.	919-353-4171
NC	Kingston, Southeastern Elctrns.	919-523-5113
NC	Lumberton, The Computer Store	919-738-3755
NC	Raleigh, Allied Elctrns.	919-876-5845
NC	Raleigh, Capstone	919-954-0600
NC	Raleigh, Sager Elctrns.	919-850-9550
NC	Raleigh, Southeastern Elctrns.	919-828-2311
NC	Wilmington, Southeastern Elctrns.	919-791-7365
OH	Cincinnati, Allied Elctrns.	513-771-6990
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Cleveland, Acorn Inds.	216-289-2531
OH	Cleveland, CAM/RPC Elctrns.	216-461-4700
OH	Columbus, Foster Battery (Dynalite)	614-351-1500
OH	Dayton, Bell Inds.	513-435-8660
OH	Dayton, Duellman Elec.	513-461-8000
OH	Maumee, R S Elctrns.	419-893-0721
OH	Millbury, Dynalite Battery	419-837-6837
OH	Solon, Allied Elctrns.	216-248-4200
OH	Warren, REM Elctrns.	216-373-1300
OH	Worthington, Allied Elctrns.	614-785-1270
OK	Oklahoma City, Radio, Inc.	405-789-0741
OK	Tulsa, Allied Elctrns.	918-664-0844
OK	Tulsa, Altair Co.	918-252-9123
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Future Elctrns.	503-645-9454
OR	Beaverton, Rose Elctrns.	503-629-9288
OR	Portland, Radar Elec.	503-232-3404
PA	Allentown, Yates Battery	215-437-6700
PA	Bristol, Aim Elctrns.	215-785-3500
PA	Camp Hill, Allied Elctrns	717-975-3570
PA	Drexel Hill, Kass Elctrns.	215-449-2300
PA	Erie, REM Elctrns.	814-453-5626
PA	Essington, Tri-Com	215-521-3080
PA	Mars, Sager Elctrns.	412-772-2233
PA	N. Huntingdon, REM Elctrns.	412-864-7423
PA	Pittsburgh, Allied Elctrns.	412-367-4124
PA	Pittsburgh, CAM/RPC Elctrns.	412-782-3770
PA	Reading, Yates Battery	215-670-2515
SC	Charleston, Cameron & Barkley	803-554-9550
SC	Florence, Cameron & Barkley	803-664-0600
SC	Greenville, Allied Elctrns.	803-288-8835
TN	Clarksville, Randolph, Hale & Matthews	615-647-2325
TN	Columbia, Randolph & Williams	615-388-7566
TN	Memphis, Allied Elctrns.	901-367-2895
TN	Nashville, Randolph & Rice	615-255-5601
TN	Tullahoma, Randolph & Vandergaff	615-455-4531
TX	Austin, Allied Elctrns.	512-389-3771
TX	Austin, Altair Co.	512-837-4970
TX	Carrollton, Capstone	214-380-9049
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
TX	Dallas, Allied Elctrns.	214-553-4370
TX	El Paso, Allied Elctrns.	915-779-6294
TX	Ft. Worth, Allied Elctrns. Exp.	817-595-3500
TX	Houston, Altair Co.	713-462-3029
TX	Houston, Future Elctrns.	713-556-8696
TX	Humble, Allied Elctrns.	713-446-8005
TX	Irving, Allied Elctrns.	214-570-5196
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Bell Inds.	214-744-2510
TX	Richardson, Future Elctrns.	214-437-2437
UT	Salt Lake City, Allied Elctrns.	801-261-5244
UT	Salt Lake City, Future Elctrns.	801-972-8489
VA	Alexanderia, Allied elctrns.	703-750-0206
VA	Roanoke, Southeastern Elctrns.	703-344-6611
VA	Virginia Bch., Allied Elctrns.	804-363-8662
WA	Bellevue, Syntek	206-488-0394
WA	Redmond, Future Elctrns.	206-881-8199
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Allied Elctrns.	206-547-2827
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Mequon, Taylor Elctrns.	414-241-4321
WI	New Berlin, Allied Elctrns.	414-796-1280
WI	Sullivan, The Bergquist Co.	414-593-2020
WI	Waukesha, Future Elctrns.	414-786-1884
WI	Everett, Pringle Elctrns.	206-258-6161
PR	San Juan, Clary Corp.of P.R.	809-760-5845
Can	Calagary, Future Elctrns.	403-250-5550
Can	Downsview, Future Elctrns.	416-638-4771
Can	Edmonton, Future Elctrns.	403-438-2858
Can	Ottawa, Future Elctrns.	613-820-8313
Can	Ottawa, Ont., Wackid Radio	613-728-1821
Can	Pt. Claire, Que., Future Elctrns.	514-694-7710
Can	St. Foy, Future Elctrns.	418-682-8092
Can	Van Couver, Future Elctrns.	604-294-1166
Can	Winnipeg, Future Elctrns.	204-786-7711

Can Winnipeg, Westrock Battery 204-786-6034
Can Yellowknife, Yukon, Northern Comm .. 403-873-3953

ACME MODEL ENGINEERING CO., 654 Bergen Blvd., Ridgefield, NJ 07657, Tel: 201-943-7650; Empl.: 29

ACME TRANSFORMER, Acme Electric Corporation, 4815 West 5th St, Lumberton, NC 28358, Tel: 919-738-1121, FAX: 919-739-0024; *Sls. Mgr.:* Don Chesner

ACME-URDC, INC., 7915 South 1530 West, Box 10, West Jordan, UT 84084, Tel: 801-561-9385, FAX: 801-562-9004; *Sls. Mgr.:* Leland Coleman

ACON, INC., 15c Plymouth Dr., South Easton, MA 02375, Tel: 508-230-8022, FAX: 508-230-2371; Empl.: 10

ACOPIAN TECHNICAL COMPANY, Box 638, Easton, PA 18044, Tel: 215-258-5441, FAX: 215-258-2842; FSC No.: 14749; *Sls. Mgr.:* T. Skopal ..... **D•1549-1578**

Local Sales Offices & Reps
FL Melbourne, Acopian 407-727-1172
MD Jessup, Doss Elctrns. 301-880-3262

ACRODYNE CONTROLS, See Accudyne Corp.

ACROMAG INC., 30765 Wixom Rd., P.O. Box 437, Wixom, MI 48393-7037, Tel: 313-624-1541, FAX: 313-624-9234; Empl.: 100; *Sls. Mgr.:* C. Mitchell

ACROSYSTEMS CORP., 66 Cherry Hill Dr., Beverly, MA 01915, Tel: 508-927-8880; Empl.: 30; *Sls. Mgr.:* Herbert Tobey

ACR SYSTEMS INC., 8561-132nd St, Surrey,B.C., Canada V3W 4N8, Tel: 604-591-1128, FAX: 604-591-2252; Empl.: 5; *Sls. Mgr.:* Rick Schellenberg; *Dist. Mgr.:* Rick Schellenberg

ACTEL CORPORATION, 955 E. Arques Ave., Sunnyvale, CA 94086, Tel: 408-739-1010, FAX: 408-739-1540; Empl.: 86; *Sls. Mgr.:* Bob Duyn

ACTION INSTRUMENTS, 8601 Aero Dr., San Diego, CA 92123, Tel: 619-279-5726, FAX: 619-279-6290; Empl.: 230; *Sls. Mgr.:* Frank Williams, Sls. VP

ACTIVE CONTROL INSTRUMENTATION, P.O. Box 243-Wildwood Circle, Key Largo, FL 33037, Tel: 305-451-1000, FAX: 305-451-3232; FSC No.: 55116; Empl.: 6 ..... **D•1126**

ACTOWN-ELECTROCOIL, INC., 2414 Highview, Spring Grove, IL 60081, Tel: 815-675-6641, FAX: 815-675-2050; Empl.: 200; *Sls. Mgr.:* Les Friedman

AC TRANSFORMER, 89 Madison St., Newark, NJ 07105, Tel: 201-589-8574, FAX: 201-589-3155; FSC No.: 3677; Empl.: 13; *Sls. Mgr.:* George Giangrande, Sls. Consit.

ACUREX CORP./AUTODATA DIV., 555 Clyde Ave., P.O. Box 7042, Mountain View, CA 94039, Tel: 415-967-9100, TELEX: 34-6391, TWX: 910-379-6593, FAX: 415-967-7727; Empl.: 40; *Sls. Mgr.:* David Swartz; *Dist. Mgr.:* David Swartz

ADALET-PLM/DIV. OF SCOTT & FETZER CO., 4801 W. 150th St., Cleveland, OH 44135, Tel: 216-267-9000, TELEX: 98-5349, FAX: 216-267-1681; FSC No.: 73389; Empl.: 177

ADAMS-MAXWELL DIVISION, Coast Magnetics, 1207 North La Brea Ave., Inglewood, CA 90302-1284, Tel: 213-673-3245, TELEX: 686103AMISPACEASA, FAX: 213-673-8828; FSC No.: 22558; Empl.: 60; *Sls. Mgr.:* Allen Adams

ADAMS RITE PRODUCTS, INC., 540 W. Chevy Chase Dr., Glendale, CA 91204, Tel: 818-241-5121, TWX: 910-497-2276, FAX: 818-500-7239; Empl.: 150; *Sls. Mgr.:* Jonas Williams

ADAMS-RUSSELL, INC., DIV. OF M/A COM, INC., 110 Haverhill Rd., Amesbury, MA 01913, Tel: 508-388-5210, TWX: 710-347-6360, FAX: 508-388-9758; FSC No.: 11556; Empl.: 400; *Sls. Mgr.:* H. Adjemian

ADAPTEC, INC., 691 South Milpitas Blvd., Milpitas, CA 95035, Tel: 408-945-8600, TELEX: 910-338-0060, FAX: 408-262-2533; Empl.: 6000; *Sls. Mgr.:* Wayne Gartin; *Dist. Mgr.:* Roy Safire

ADAPTIVE NETWORKS, P.O. Box 1020 Kendall Sq., Cambridge, MA 02142, Tel: 617-497-5150; Empl.: 20; *Sls. Mgr.:* Sumin Tchen

ADATEK, INC., 700 Airport Way, Sandpoint, ID 83864, Tel: 208-263-1471, 800-323-3343, TELEX: 62903932, FAX: 208-263-6596; Empl.: 18; *Sls. Mgr.:* Jeff Siebert; *Dist. Mgr.:* Suzy Hook

ADCOUR, INC., 18 Billings St., PO Box 277, Sharon, MA 02067, Tel: 617-784-8123, FAX: 617-784-5563; Empl.: 29; *Sls. Mgr.:* William O'Connell; *Dist. Mgr.:* William O'Connell

ADC TELECOMMUNICATIONS, INC., 4900 W. 78th St, Minneapolis, MN 55435, Tel: 612-835-6800, TELEX: 290321, FAX: 612-893-3292; Empl.: 2200; *Sls. Mgr.:* Mark Lonergan, VP. Sls. ..... **C•1157-1159**

ADDACON GREENSBORO, 3702-C Alliance Dr., Greensboro, NC 27407, Tel: 919-852-6200, FAX: 919-852-6256; *Sls. Mgr.:* Lynn Cummings

A.D. DATA SYSTEMS CORP., Photographic Sciences Corp., 770 Basket Rd., Webster, NY 14580-0748, Tel: 716-265-1600, FAX: 716-265-1689; FSC No.: 23389; Empl.: 12; *Sls. Mgr.:* J. Cessna, J. Butters

Local Sales Offices & Reps
CA Torrance, AMASCO-South 213-781-9494
FL Melbourne, Saber Assocs. 800-327-0853
KS Lenexa, Midtec Assocs. 913-541-0505
MD Landover, Sel-Tronics 301-341-2700
MA Westford, ICS Assocs. 508-692-3545
NM Albuquerque, Trembly Assocs. 505-266-8616
OH Westlake, TMS, Inc. 216-327-3527
PA N. Wales, Scientific Devs. 215-699-7707
TX Richardson, Scientific Devs. (SW) 214-231-8106
WA Seattle, Datacom Assocs. 206-285-2525
EXP Leport Marly, France, Euromeasure, SA ... 395-84863
EXP Warwickshire, England, Measurement LTD 926-35411
Can Scarborough, Ont., Multitest Elctrns. 416-609-8396

ADDITIVE CIRCUITS, AMP-AKZO Corp., P.O. Box 700, West La., Aquebogue, NY 11931, Tel: 516-722-4100, FAX: 516-722-4154; Empl.: 500; *Sls. Mgr.:* Lenny Smookler, Nat. Sls. Mgr.

ADE, INC., 1430 E. 130th St., Chicago, IL 60633, Tel: 312-646-3400, FAX: 312-646-3919; FSC No.: 62049; *Sls. Mgr.:* Fred Tenzer

ADIRONDACK WIRE & CABLE, ACS Industries Inc., 160 Hamlet Ave., Woonsocket, RI 02895, Tel: 1-401-769-1600, FAX: 1-401-769-1607; Empl.: 650; *Sls. Mgr.:* Julian Caduto



FAX: 714-634-0802

ADTECH POWER INC., 1620 S. Sunkist St., Anaheim, CA 92806, Tel: 714-634-9211; FSC No.: 56410; Empl.: 55; *Sls. Mgr.:* Royston A. Allman; *Dist. Mgr.:* Royston A. Allman ..... **D•1580-1583**

Local Sales Offices & Reps
CA Campbell, Sedillo Co. 408-374-5220
FL Deerfield Beach, Jack Krutek & Assoc. 305-427-4202
IL Elk Grove Vl, Carlson Elect. Sls. 312-956-8240
MA Natick, Wayland Eng. Sls. 508-655-6080
MI Troy, C.B. Jensen & Assoc. 313-643-0506
NY New York, Morgan Elctrn. Sls. 516-549-5180
OR Beaverton, Quest Mktg. 503-641-7377
TX Dallas, Spectra Sls. Corp. 214-234-3600
WA Bellevue, Quest Mktg. 206-747-9424

Local Distributors
AL Birmingham, Industrial Elec. Supp. 205-956-8504
CA Palo Alto, Zack Elctrns. 415-326-5432
CA San Francisco, Zack Elctrns. 415-626-1444
IL Chicago, Newark Elctrns. 1-312-784-5100
LA Lafayette, Ralph's of Lafayette 318-233-0105
MD Gaithersburg, M S Elctrns. 301-921-0200
MA Woburn, Mac Bearing 617-933-2110
PA Philadelphia, Philadelphia Elctrns. 215-673-0400
TX Ft. Worth, Allied Elctrns. 1-800-433-5700

ADTRON CORPORATION, 128 W. Boxelder Ste. 102, Chandler, AZ 85224, Tel: 602-926-9324, FAX: 602-926-9359; Empl.: 4; *Sls. Mgr.:* Shiela Fitzgerald

ADVACOM, INC., 5620 West Rd., McKean, PA 16426, Tel: 1-800-458-0512, 814-476-7774

ADVANCE, A Unit of Zero Corporation, 6900 Beck Avenue, N. Hollywood, CA 91605, Tel: 818-983-0333; *Sls. Mgr.:* Kevin Quinn

ADVANCE CONVERSION DEVICES CO.UNIT OF TRANSITOR DVCS., INC., 85 Horsehill Rd., Cedar Knolls, NJ 07927, Tel: 201-267-1900, FAX: 201-267-2047; FSC No.: 52298; Empl.: 24; *Sls. Mgr.:* Ron Zeman ..... **D•2156-2159**

Local Sales Offices & Reps
AL Huntsville, Reynolds & Assocs., Inc. ... 205-539-1485
AZ Scottsdale, Dave Menegay & Assocs. 602-994-9519
AR El Dorado, Kemp Instrs. Co., Inc. 501-862-5869
CA Bakersfield, FLW, Inc. 805-398-0720
CA Campbell, SMA 408-370-6900
CA Canoga Park, FLW, Inc. 818-719-0037
CA Carlsbad, FLW, Inc. 619-434-5251
CA Costa Mesa, FLW Inc. 714-751-7513
CA Costa Mesa, FLW, Inc. 714-751-7512
CO Denver, Elcom, Inc. 303-337-2300
CT Watertown, May Technlg. 203-274-3777
FL Ft. Lauderdale, Reynolds & Assocs., Inc. 305-344-4536
FL Melbourne, Reynolds & Assocs., Inc. .. 407-259-7000
FL Tampa, Reynolds & Assocs., Inc. 818-372-8369
GA Duluth, Reynolds & Assocs. 404-476-4992
IL Wheeling, Ed Joyner & Co. 708-520-1200
KS Overland Pk., WEB Assocs., Inc. 913-381-7986
MD Hunt Valley, Elctrn. Resources, Inc. ... 301-584-8157
MA Lexington, E.F. Delfino,Inc. 617-862-1118
MI Ann Arbor, Ashby Assocs., Inc. 313-995-4082
MN St. Louis Pk., Elctrn. Innovation, Inc. ... 612-922-2945
MO Florissant, WEB Assocs./Elctrns. Inc. 314-921-5720
NY Endicott, Advanced Comp. Corp. 607-785-3191
NY Kingston, Advanced Comp. Corp. 914-339-1730
NY N. Syracuse, Advance Comps. 315-699-2671
NY Rochester, Advanced Comps. Corp. ... 716-544-7017
NY Scottsville, Advanced Comps. Corp. ... 716-889-1429
NC Raleigh, Reynolds & Assocs., Inc. 919-876-0282
OH Arcanum, Ashby Assocs., Inc. 513-692-8713
OH Cleveland, Ashby Assocs., Inc. 216-461-0826
OK Tulsa, Kemp Instrs.,Inc. 918-663-4501
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Pittsburgh, Ashby Assocs., Inc. 412-343-5105
PA Southampton, Campbell Assocs. 215-322-6630
PA West Chester, Elctrn. Resources, Inc. 215-431-0198
SC Greenville, Reynolds & Assocs., Inc. .. 803-288-8701
TX Lewisville, J. Hughes Co. ..... 214—221-1536, 214-221-1538
UT Murray, Elcom 801-262-2400,801-262-2472
VA Alexandria, Dyna-Rep Co. 703-354-1222
VA Harrisburg, Elctrn. Resources, Inc. 703-289-5571
VA Norfolk, Elctrn. Resources, Inc. 804-583-4859
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
EXP NY/New York, Robum Agencies, Inc. 914-968-1016
Can Weston, Ont., Duncan Instrs., Canada Ltd. 416-742-4448

ADVANCED ANALOG, Intech, 2270 Martin Ave., Santa Clara, CA 95050, Tel: 408-988-2702, FAX: 408-988-2702; FSC No.: 52467; Empl.: 200; *Sls. Mgr.:* Michael Sullivan ..... **D•1548**

Local Sales Offices & Reps
AL Huntsville, Sides Assoc. 205-859-9395
AZ Tempe, Thor Engrg. 602-438-8494
CA La Jolla, Thorson 619-292-8525
CA Newport Bch., Leading Concept 714-851-0654
CA Sunnyvale, Pass Assoc. 408-735-9040
CT North Haven, Kitchen & Kutchin 203-239-0212
IL Berkeley, ESA Tech. Mktg. 708-544-0120
IN Indianapolis, CC Electro Sls. 317-921-5000
IA Cedar Rapids, Delltron 319-393-0075
KS Wichita, Miller Aerospace 316-689-8292
MD Randallstown, Beacon North 703-478-2480
MA Burlington, Kitchen & Kutchin 617-229-2660
MI Madison Hgts., Pine Sls. 313-589-0350
MN Eden Prairie, Electro Mark 612-944-5850
MO Hazelwood, Acorn 314-731-2002
MO St. Louis, Acorn 314-421-1751
NY Huntington, Compar 516-423-5660
NY Rochester, Foster & Wager 716-385-7744
OH Cincinnati, Makin 513-871-2424
OH Dayton, Del Steffen 513-293-3145
OR Beaverton, Micro Sls. 503-645-2841
PA Collegeville, HB Sys. 215-489-3256
TX Dallas, MGR 214-238-5246
UT Ogden, Taylor Mktg. 801-546-9570
VA Sterling, Beacon North 703-478-2480
WA Bellevue, Micro Sls. 206-451-0568
Can Quebec, Kaytronics 514-745-5000

ADVANCED CIRCUIT TECHNOLOGY, 118 Northeastern Blvd., Nashua, NH 03062, Tel: 603-880-6000, 800-234-FLEX, TWX: 710-228-8961, FAX: 603-880-1785; FSC No.: 57034; Empl.: 185; *Sls. Mgr.:* David Bouley, Dir. of Sls.

ADVANCED COMPONENTS INDUSTRIES, INC.

FAX: 310-328-0062

ADVANCED COMPONENTS INDS., INC., Spitznagel GmbH, 1308 Sartori Ave., No. 105, Torrance, CA 90501, Tel: 213-328-0060, 310-328-0060; *Sls. Mgr.:* Irma Spreitzer ..... **A•2150-2151; B•1492**

Local Sales Offices & Reps

CT	Hopkinton, Berkshire Elctrns.	508-435-9356
IL	Schaumburg, Terry McNulty & Assocs.	708-894-2529
MA	Hopkinton, Berkshire Elctrns.	508-435-9356

ADVANCED CONNECTOR TECHNOLOGY, 326 Oakwood St., Ventura, CA 93001, Tel: 805-653-5753, FAX: 805-653-0940; Empl.: 5; *Sls. Mgr.:* Karin Kalli

ADVANCED CONTROL SYS., 10 Old Mine Rock Way, Hingham, MA 02043, Tel: 617-740-0223, FAX: 617-740-4227; Empl.: 13; *Sls. Mgr.:* Leopold Bric ..... **D•1127**

ADVANCED CONVERSION TECH., 2001 Fulling Mill Rd. P.O.B. 70, Middletown, PA 17057, Tel: 717-939-2300, FAX: 717-939-7170; FSC No.: 60642; Empl.: 100; *Sls. Mgr.:* L.M. Reis

ADVANCED ELECTRONIC PACKAGING, 21562 Surveyor Circle, Huntington Beach, CA 92646, Tel: 714-969-1150, FAX: 714-536-0936; Empl.: 12; *Sls. Mgr.:* Douglas A. Hill ..... **A•1719**

Local Sales Offices & Reps

Can	Mississauga, Ont., Vitel Elctrns.	416-676-9720

ADVANCED FILTER DEVICES, INC., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009, Tel: 619-438-2074, FAX: 619-438-5937; FSC No.: 56620; Empl.: 45; *Sls. Mgr.:* Herbert Johnson

ADVANCED HARDWARE ARCHITECTURES, INC., P. O. Box 9669, Moscow, ID 83843, Tel: 208-883-8000, FAX: 208-883-8001; Empl.: 50; *Sls. Mgr.:* Jack Maynard

ADVANCED HARDWARE MANUFACTURING, INC., 925 Horan Drive, Fenton, MO 63026, Tel: 314-343-3850, FAX: 314-343-3937; Empl.: 11

ADVANCED HIGH VOLTAGE CO. INC., P.O. Box 32408, Tucson, AZ 85751, Tel: 818-997-7222, 602-721-2424; *Sls. Mgr.:* John Richardson ..... **D•1579**

ADVANCED INPUT DEVICES, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814, Tel: 208-765-8000, TWX: 510-776-0584; FSC No.: 95666; Empl.: 300; *Sls. Mgr.:* Jim Bennett ..... **B•1795**

Local Sales Offices & Reps

CO	Aurora, Electrodyne	303-695-8903
CT	Wallingford, Apex Assocs.	203-269-8401
FL	Casselbury, Southern Elctrn. Sls.	407-332-4718
ID	Coeur'd Alene, Advanced Input Dvcs.	208-765-8000
IL	N. Arlington Hgts., Coombs Assocs. Inc.	312-439-9810
MD	Gaithersburg, Carwither Assocs. Inc.	301-912-9545
MA	Westwood, Apex Assocs.	617-326-5042
MN	Minneapolis, Debeck-Hays	612-835-3610
NJ	Matawan, Shepard & Assocs.	201-566-0095
NJ	Matawau, Shepard	201-566-0095
NY	Victor, Net Sls.	716-924-1844
PA	Prospect Park, Elf Sls.	215-534-3340
PA	Warrendale, Baehr-Greenleaf & Assocs.	412-934-3088
FL	Casselberry, S.E.M.I.	305-962-2255
OH	Westlake, Baehr-Greenleaf	216-892-1770
UT	Salt Lake City, Electrodyne	801-264-8050
WI	Milwaukee, Coombs Assocs. Inc.	414-351-6123
Can	Hamilton, Ont., Cartwright Southall Assoc., Inc.	416-528-0294

ADVANCED INTERCONNECTIONS CORP., P.O. Box 1019, West Warwick, RI 02893, Tel: 401-823-5200, TWX: 910-240-3454, FAX: 401 823-8723; FSC No.: 05-0394638; *Sls. Mgr.:* Max E. Rice

ADVANCED LINEAR DEVICES, INC., 1180F Miraloma Way, Sunnyvale, CA 94086-4606, Tel: 408-720-8737, FAX: 408-720-8297; Empl.: 10; *Sls. Mgr.:* G. M. O'Neal; *Dist. Mgr.:* G. M. O'Neal

ADVANCED MATERIALS SYSTEMS, See Handy & Harman Electronic Materials Corp.

ADVANCED MICRO SYSTEMS, INC., 31 Flagstone Drive, Hudson, NH 03051-4920, Tel: 603-882-1447, FAX: 603-881-7600; Empl.: 50

ADVANCED POWER PRODUCTS, 1510 Garden St. Ste. 17, Santa Barbara, CA 93101, Tel: 805-965-0042, FAX: 805-684-4400

ADVANCED SYSTEMS CONCEPTS, INC., 2333 N. Lake Ave., Altadena, CA 91001, Tel: 818-791-0983, TELEX: 701 215 ASCI, FAX: 818-791-8347; FSC No.: 6U785; Empl.: 15; *Sls. Mgr.:* Maria Reddix; *Dist. Mgr.:* B. Lee ..... **D•1144**

Local Sales Offices & Reps

IA	Des Moines, Beams Co.	515-255-1148
MN	Edina, Integrated Peripheral Sys.	612-831-0349
OH	Dayton, Ashby Assocs.	513-252-5627
VA	Vienna, Advanced Technlg. Assocs.	703-556-0500

FAX: 619-727-4436

ADVANCED TECHNOLOGY COMPANY, 2142 F Industrial Ct., Vista, CA 92083, Tel: 619-727-7430; Empl.: 10; *Sls. Mgr.:* Bill Linko ... **B•1235-1237; C•1605-1608**

ADVANCED THERMAL PRODUCTS, INC., P.O. Box 249, St. Marys, PA 15857, Tel: 814-834-1541, FAX: 814-834-1556; Empl.: 15; *Sls. Mgr.:* John M. Sidoni

Local Sales Offices & Reps

GA	Atlanta, DHR Mktg.	404-564-0529
MA	Andover, Crawford & Assoc.	508-470-2122
NY	Syracuse, John R. Costello	315-472-0322
NC	Raleigh, DHR Mktg.	919-829-1970
TX	Dallas, Eatman Engineering	214-771-1903
WI	New Berlin, Thomas Labant	414-425-7157

ADVANCED VIDEO PRODUCTS, P.O. 1450/543 Great Rd., Littleton, MA 01460, Tel: 508-486-0024, FAX: 508-486-8488; Empl.: 65; *Sls. Mgr.:* Christopher Mohen

AD-VANCE MAGNETICS, INC., 625 Monroe St., Rochester, IN 46975, Tel: 219-223-3158, TWX: 810-290-0294, FAX: 219-223-2524; FSC No.: 50788; Empl.: 31; *Sls. Mgr.:* Kay Nixon ..... **C•1686**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp	205-539-8476
CA	El Cajon, ATronix Technlg.	619-444-1501
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Solvang, ATronix Technlg.	805-686-4366
CO	Arvada, Arrowhead	303-423-5556
CA	Mission Viejo, ATronix Technlg., Inc.	714-858-9009
CT	Branford, Abbott-Allison	203-481-0405
FL	Miramar, DAN-Tech Sls., Inc.	305-963-6142
IL	Wheaton, EMTronics, Inc.	708-665-6222
NJ	Flanders, K & R Engrg. Sls. Corp.	201-584-5235, 800-631-9362
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	W. Conshohocken, Eastern Comps.	215-825-8610
MD	Baltimore, Eastern Comps. Sls. Corp.	301-788-7050
TX	Dallas, J.M. Spell Co. Inc.	214-620-0040
UT	Midvale, Arrowhead	801-561-5688
Can	Nepean, Ont., Subtec Ltd.	613-723-7720
WA	Bellevue, Caruso & Assocs.	206-455-8811

ADVANCE POWER SUPPLIES, INC., See Farnell Advance Power, Inc.

ADVANCE WIRE & CABLE, The Advance Group, 1661 Industrial Way, Belmont, CA 94002, Tel: 415-592-4550, TELEX: 334475, FAX: 415-593-8859; FSC No.: 57775; Empl.: 158; *Sls. Mgr.:* Ed Mittelbusher; *Dist. Mgr.:* Ed Mittelbusher

Local Sales Offices & Reps

AZ	Phoenix, The Advance Grp.	602-437-1334
CA	Anaheim, The Advance Grp.	714-870-0300
CA	Belmont, The Advance Grp.	415-592-4550
CT	Torrington, Phoenix Sls.	203-496-7709
CO	Lakewood, CDT	303-989-6563
MI	Livonia, JFCO Inc.	513-421-7590
FL	Orlando, Gillum Sls.	305-857-2110
FL	Tampa, Gillum Sls.	813-531-2248
GA	Duluth, DTM Inc.	404-381-5592
IL	Deerfield, Flaherty-Haines, Inc.	312-948-7800
MD	Ellicott City, Tech. Sls. Inc.	301-461-2400
MN	Minneapolis, TecTeam Sls. Inc.	612-854-6616
NY	Glen Cove, Dynorep	516-676-1598
OH	Cleveland, JFCO Inc.	216-398-6300
OH	Vandalia, JFCO Inc.	513-890-8322
SC	Greer, Advance Wire & Cable	803-877-9600
TX	Richardson, Promark	214-644-0467
WA	Redmond, The Advance Grp.	206-867-0416

ADVANTEST®
Advantest America, Inc.

FAX: 708-634-2610

ADVANTEST AMERICA, INC., 300 Knightsbridge Parkway, Lincolnshire, IL 60069, Tel: 708-634-2552, FAX: 708-634-2610; Empl.: 233; *Sls. Mgr.:* John Heitman ..... **D•1214-1215**

Instruments

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs.	205-534-6020
AZ	Phoenix, Advantest America, Inc.	602-840-9470
AZ	Phoenix, Tech. Mktg. Svc.	602-678-4940
CA	Cypress, Ward Davis	213-402-2458
CA	Redondo Bch., Ward Davis	213-643-6977
CA	Santa Clara, Advantest America, Inc.	408-970-9922
CA	Santa Clara, Ward Davis	408-245-3700
CA	Santa Monica, Advantest America, Inc.	213-392-0088
CA	Westlake Village, Advantest America,Inc.	805-496-2523
CO	Englewood, Tech. Mktg. Svc.	303-781-8819
CT	Wallingford, Pat Jenks Assocs.	203-265-9939
FL	Longwood, Southern Mktg. Assocs.	407-682-7317
FL	Orlando, Advantest America, Inc.	407-859-0722
GA	Marietta, Southern Mktg. Assocs.	404-565-0603
IL	Arlington, Dytec/Midwest	708-255-3200
IL	Lincolnshire, Advantest America, Inc.	708-634-2552
IL	Park Ridge, Aegis	708-823-1587
IN	Indianapolis, Dytec/Midwest	317-849-9898
KS	Lenexa, Dytec/Midwest	913-888-0215
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MD	Rockville, Creative Mktg. Assocs.	301-880-4161
MA	Beverly, Pat Jenks Assocs.	508-921-4600
MA	Marlboro, Advantest America, Inc.	508-481-1141
MA	Reading, Aegis	617-944-0974
MN	Edina, Dytec Instrs.	612-831-7169
MO	Maryland Hgts., Dytec/South	314-739-0665
NJ	Fort Lee, Advantest America, Inc.	201-886-0300
NJ	Teaneck, Scientific Dvcs.	201-837-1004
NM	Albuquerque, Tech. Mktg. Svc.	505-884-3444
NC	Greensboro, Southern Mktg. Assocs., Inc.	919-479-6034
OH	Dayton, WKM Associates, Inc.	513-434-7500
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
OR	Portland, Advantest America, Inc.	503-255-8985
OR	Wilsonville, SYNTEK	503-682-2750
PA	Allentown, Advantest America, Inc.	215-264-7680
PA	Coopersburg, Aegis	215-965-6840
PA	Northampton, AEGIS	215-837-8400
PA	Southampton, Eastern Instrmn. of PA	215-355-7700
PA	Stroudsburg, AEGIS	717-421-8660
TX	Austin, Advantest America, Inc.	512-451-3936
TX	Austin, Aegis	512-451-6188
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Farmers Branch, Advantest America, Inc.	214-239-7834
UT	Salt Lake City, Tech. Mktg. Svc.	801-596-8803
VT	Williston, Advantest America, Inc.	802-879-8974
WA	Bellevue, SYNTEK	206-462-7700
Can	Mississauga, Ont., Allan Crawford Assocs., Ltd.	416-890-2010
Can	N. Vancouver, B.C., Allan Crawford Assocs., Ltd.	604-988-2195
Can	Ottawa, Ont., Allan Crawford Assocs., Ltd.	613-596-9300
AL	Huntsville, Southern Mktg. Assoc.	205-534-6020
CA	Camarillo, Advantest America, Inc.	808-987-6415
CT	Wallingford, Pat Jenks	203-265-9939
FL	Longwood, Southern Mktg.Assoc.	407-682-7317
GA	Marietta, Southern Mktg. Assoc.	404-565-0603
MD	Frederick, Advantest America, Inc.	301-662-1696
MA	Beverly, Pat Jenks Assocs.	508-921-4600
MI	Madison Heights, WKM Assocs.	313-588-2300
NM	Albuquerque, Barnhill Assocs.	505-299-7658

NY	Canastota, New York Hytek Assocs.	315-697-8415
NC	Greensboro, Southern Mktg. Assoc.	919-854-5588
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Wilsonville, Syntek	503-682-2750
PA	Pittsburgh, WKM Assocs.	412-892-2953
PA	Southampton, Eastern Instrs. of PA	215-355-7700
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-954-5023
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
VA	Sterling, Advantest America, Inc.	703-444-3372
WA	Bellevue, Syntek	206-462-7700
WI	Hartland, Dytec/Midwest	414-367-4550
Can	Calgary,AL, Allan Crawford Assocs.	403-295-0822
Can	Mississauga, Ont., Allan Crawford Assocs.	416-890-2010
Can	N. Vancouver, B.C., Allan Crawford Assocs.	604-988-2195
Can	Ottawa, Ont., Allan Crawford Assocs.	613-596-9300
Can	St. Laurent, QE, Allan Crawford Assocs.	514-747-7878

ADVANTEST CORPORATION, NS Bldg. 2-4-1, Nishi-Shinjuku, Tokyo 163, Japan, Tel: 03-3342-7500, TELEX: 232-4914 ADVAN; Empl.: 1444; *Sls. Mgr.:* Shinpei Takeshita

ADVANZ TECHNOLOGIES, INC., 455 Industrial Drive, Warwick, RI 02887, Tel: 800-669-9987/401-737-1050, FAX: 401-732-0240; Empl.: 80; *Sls. Mgr.:* Richard J. DeGiacomo, Jr.; *Dist. Mgr.:* Richard J. DeGiacomo, Jr.

ADVOTECH, INC., 670 Mercer Rd., Butler, PA 16001, Tel: 412-283-4497, FAX: 412-283-4713

A E G CORPORATION, 3140 Rte. 22, P.O. Box 3800, Somerville, NJ 08876-1269, Tel: 908-231-8491, FAX: 908-231-8353; Empl.: 200; *Dist. Mgr.:* Graham Wells

A E G CORPORATION, Telefunken Semiconductors Div., 3140 Route 22, Somerville, NJ 08876-1269, Tel: 201-231-8300, FAX: 201-231-8353; *Sls. Mgr.:* John Szafranski

AEG TELEFUNKEN, SEMICONDUCTOR GRP., See AEG Corp.

AEL DEFENSE CORP., 305 Richardson Rd., Lansdale, PA 19446, Tel: 215-822-2929; FSC No.: 93346; Empl.: 1,600; *Sls. Mgr.:* Denis Ritchie

AEMC CORPORATION, 99 Chauncy Street, Boston, MA 02111, Tel: 617-451-0227, 800-343-1391, TELEX: 95-1073, FAX: 617-423-2952; *Sls. Mgr.:* George Wood

AEROCOM, 3090 S.W. 37th Ave., Miami, FL 33133, Tel: 305-448-6503, TELEX: 6812020, FAX: 305-448-6916; FSC No.: 81535; Empl.: 55; *Sls. Mgr.:* Thomas A. Coleman

AERODYNE CONTROLS CORPORATION, 30 Haynes Court, Ronkonkoma, NY 11779, Tel: 516-737-1900, FAX: 516-737-1912; FSC No.: 14923; Empl.: 80; *Sls. Mgr.:* Anthony R. Pipitone

AEROFLEX

FAX: 516-694-6771

AEROFLEX LABORATORIES INC., ARX, Inc., 35 South Service Road, Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417; FSC No.: 88379; Empl.: 490 ..... **A•1720-1721**

Local Sales Offices & Reps

AL	Huntsville, EMA	205-830-4030
AL	Huntsville, South Design and Mktg.	205-880-3623
AZ	Phoenix, JBS Assocs.	602-893-2382
CA	Camarillo, RD & D Sls. Engrg.	805-388-8220
CA	Long Beach, RD & D Sls. Engrg.	213-988-1116
CA	Los Altos Hills, HB Mktg.	415-941-4080
CA	Mt. View, Bay Area Sls.	415-969-7959
CA	Woodland Hills, Peterson Engrg. Co.	818-346-1201
CO	Englewood, Delltron Co.	303-741-2122
CO	Lakewood, Tech. Mktg.	303-989-3611
CT	Southbury, Dynamic Technigs.	203-262-6220
CT	Thomaston, Tygren Co.	203-283-8722
FL	Altamonte Sp., EMA	407-339-2604
FL	Pinellas Park, P & M Tech Sls.	813-546-4175
FL	Tampa, APM Assocs.	813-886-2457
FL	Winterpark, Max Tech	407-679-1220
GA	Roswell, EMA	404-992-7240
IL	Northfield, Feller Assocs., Inc.	312-446-8065
IL	West Dundee, American Specialties Prods.	708-428-2100
IA	Cedar Rapids, Richardson Assocs. Grp.	319-364-2003
MD	Columbia, Autek Assocs.	301-740-5100
MA	N. Andover, Russett Assoc.	508-794-4995
MA	Needham Hghts., Kanan Assoc.	617-449-7400
MN	Minneapolis, International Elctrns., Inc.	612-571-0000
MO	St. Louis, Rush & West Assoc., Inc.	314-965-3322
NJ	Ft. Lee, Nexus Technlg. Sls., Inc.	201-947-0151
NY	Buffalo, Vibratech, Inc.	716-895-8000
NY	East Syracuse, Fountain, Young & Co.	315-437-7733
NY	Great Neck, F & F Metro, Inc.	516-482-4080
NY	Oswego, Fountain, Young & Co., Inc.	607-687-3373,FAX:607-687-7511
NC	Burlington, EMA	919-227-1832
NC	Charlotte, EMA	704-365-0547
NC	Raleigh, EMA	919-846-6888
AZ	Phoenix, Hartland Sls. Inc.	602-492-0012
PA	Horsham, Nexus Technlg. Sls., Inc.	215-675-9600
PA	Nottingham, Excel Tech	717-529-6059
TX	Austin, Tesco Inc.	512-834-8374
TX	Dallas, Tesco Inc.	214-553-1200
TX	Houston, Tesco, Inc.	713-370-8117
VA	Alexandria, Dyna Rep.	703-354-1222
NY	Mendon, Tech Mark	716-624-3840
WA	Mercer Island, Eagle Entprs., Inc.	206-232-7401
MA	N. Andover, Russet Assoc.	508-794-4995
Can	Dorval, PQ., Korfund Sampson, Ltd.	514-631-3565
Can	Laval, Que., Elcom GMB Inc.	514-668-3361
Can	St. Eustache, Que., Elcom GMB Inc.	514-623-4766

AEROSPACE OPTICS, INC., 3201 Sandy La., Fort Worth, TX 76112, Tel: 817-451-1141, FAX: 817-654-3405; Empl.: 60; *Sls. Mgr.:* Ben L. Fryrear

AEROSPACE WIRE & CABLE INC., 129-09 18 Ave., College Point, NY 11356, Tel: 718-358-2345, FAX: 718-358-2522; Empl.: 15

AEROTECH, INC., 101 Zeta Dr., Pittsburgh, PA 15238, Tel: 412-963-7470, TWX: 710-795-3125, FAX: 412-963-7459; Empl.: 156; *Sls. Mgr.:* K. Wyman; *Dist. Mgr.:* K. Ross

AEROVOX INC., 370 Faunce Corner Rd., North Dartmouth, MA 02747-1217, Tel: 508-995-8000; FSC No.: 4K459; Empl.: 700; *Sls. Mgr.:* Jack Chmura .... **A•1618**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999
AZ	Scottsdale, Interstate Mktg.	602-244-9050
CA	Los Gatos, Luscombe Engrg. Co.	408-370-2020
CA	Woodland Hills, Interstate Mktg.	818-883-7606
CO	Franktown, M.R.C.	303-660-8750
CT	North Haven, J.E. Boeing Co.	203-265-7378
DE	Greenville, H. Anderson	302-655-2917
FL	Orlando, E.P.M. Corp.	407-425-6149
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Elk Grove Village, Carlson Elctrn. Sls.	708-956-8240
IN	Ft. Wayne, F.J. Campisano Co.	219-486-6443
IN	Indianapolis, F.J. Campisano Co.	317-577-0319
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-379-1450
MD	Baltimore, Burgin-Kreh Assoc., Inc.	301-265-8500
MA	Chelmsford, J.E. Boeing Co.	508-256-5800
MA	Marion, Raymond F. Swoish Co.	508-748-2536
MI	Farmington Hills, Carrier & Gable	313-477-8700
MN	Minneapolis, Comstrand	612-788-9234
KS	Overland Park, Beneke & McCaul	816-765-2998
NJ	Moorestown, TAI Corp.	609-778-5353
NM	Albuquerque, Hewitt & Assocs.	505-299-7746
NY	Ithaca, B. Dean	607-257-1111
NY	Melville, Comtronic Assocs.	516-249-0505
NY	Wappingers Falls, Bob Dean	914-297-6406
NC	Raleigh, 20th Century Marketing	919-790-9389
OH	Cincinnati, F.J. Campisano Co.	513-574-7111
OH	Dayton, Schmidt & Assocs.	513-293-6652
OH	Mentor, F.J. Campisano Co.	216-975-9300
OK	Tulsa, Ammom & Rizos Co.	918-749-6116
PA	Coraopolis, F.J. Campisano Co.	412-264-5151
TN	Knoxville, 20th Century Mktg., Inc.	615-966-2099
TX	Austin, Ammon & Rizos	512-454-5131
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos	214-644-5591
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790
EXP	Santurce, PR, J.E. Boeing Co.	809-753-9805
CA	San Diego, Bestronics, Inc.	619-693-1111

AERTECH INDS., See TRW Microwave

AES CORP., 285 Newbury St., Peabody, MA 01960, Tel: 508-535-7310, TELEX: 387852 AES CORP INTL, FAX: 508-535-7313; Empl.: 25; *Sls. Mgr.:* Brian Rockett

AETNA ENGINEERING, P.O. Box 7749, Van Nuys, CA 91409-7749, Tel: 818-341-9409, FAX: 818-882-5131; Empl.: 6; *Sls. Mgr.:* T. W. Collins

AFE DISPLAYS INC., 3046A Berkmar Dr., Charlottesville, VA 22901, Tel: 804-974-7801, FAX: 804-974-7803; Empl.: 3(USA) 75(UK); *Sls. Mgr.:* Mike Humpherson; *Dist. Mgr.:* Mike Humpherson

AFI/DATATROL, See Datatrol, Div. of Data Card Corp.

AHAMTOR INC., 999 Inc., 27901 Front St., Temecula, CA 92390, Tel: 714-676-4151, FAX: 714-676-3031; *Sls. Mgr.:* John Markley

AIL, DIV. CUTLER-HAMMER, See Eaton Corp. AIL Div.

AIL SYSTEMS, INC., Eaton Corp., Commack Rd., Deer Park, NY 11729, Tel: 516-595-3094, TWX: 510-227-6073; FSC No.: 00752; Empl.: 2400; *Sls. Mgr.:* J.B. Migliaccio

AILTEC DIV. CUTLER-HAMMER, See Eaton Corp., Elctrn. Instrmn. Div.

AIMSCO INC., Cheler Corp., 5707 Airport Way So., Seattle, WA 98108, Tel: 206-762-8014, 800-426-0244, TWX: 910-444-1333, FAX: 206-762-8394; FSC No.: 3D536; Empl.: 30; *Sls. Mgr.:* C. Ernst; *Dist. Mgr.:* Carl Teichman

AIPHONE, 1700 130th Ave. NE, Bellevue, WA 98005, Tel: 206-455-0510, FAX: 206-455-0071; Empl.: 44; *Sls. Mgr.:* John Mosebar

AirBorn

FAX: 214-931-9305

AIRBORN, INC., 4321 AirBorn Dr., Addison, TX 75001-0519, Tel: 214-931-3200; FSC No.: 10400;Multiple; Empl.: 412; *Sls. Mgr.:* W.A. Clark, Sls. Mgr.; *Dist. Mgr.:* Jerry Jameson ..... **C•1160**

Local Sales Offices & Reps

AL	Huntsville, South Design & Mktg.	205-880-3623
AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	Downey, Buffa Co., Inc.	213-923-4618
CA	Sunnyvale, Advanced Tech. Sls.	408-746-0800
CT	Torrington, Phoenix Sls. Co.	203-496-7709
FL	Ft. Lauderdale, Southland Comps.	305-491-6110
IL	Des Plaines, ESCO Assoc.	708-298-5310
IA	Cedar Rapids, Dytronix	319-377-8275
KS	Wichita, Dytronix	316-838-0884
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MO	Bridgeton, Dytronix	314-291-4777
KS	Leawood, Dytronix	913-339-6333
NH	Nashua, Solla - Tronics	603-882-7146
NY	Glen Cove, Dynorep	516-676-1598
NM	Albuquerque, Piper Sls. Co.	505-883-9090
NY	Penfield, Upstate Comps.	716-381-6070
NC	Raleigh, GWC	919-790-7879
OH	Kettering, Electro-Com	513-299-0864
WA	Bellevue, Eltech Inc.	206-643-4330
Can	Mississauga, Ont., Source Elctrns. Ltd.	416-676-0830
Can	Ottawa, Ont., Source Elctrns. Ltd.	613-737-7580

Local Distributors

NY	Elmsford, Gemini Elect	914-592-5252
TX	Dallas, Hall Mark Elctrns.	214-343-5000
CA	Monrovia, Erik-A-Elect	818-574-1020
AZ	Scottsdale, Spirit Elctrns.	602-998-1533

Distributor

FAX: 818-988-4746

AIR ELECTRO INC., 7700 Gloria Ave., Van Nuys, CA 91406, Tel: 213-873-6400, 818-988-4400, TELEX: 66-2459, TWX: 910-495-1794 ..... **C•1280**

AIR FILTRATION PRODUCTS, INC., 707 No. Main Ave., Tuscon, AZ 85705, Tel: 602-624-2272, FAX: 602-624-2279; Empl.: 10; *Sls. Mgr.:* Ike Campos

AIR/FLEX INDS. INC., 2422 Merced Ave., S. El Monte, CA 91733, Tel: 818-579-7060, FAX: 1-818-579-7063; FSC No.: 22782; *Sls. Mgr.:* Brett Hoffman



FAX: 201-436-6024

AIRFLYTE ELCTRNS. CO., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, Tel: 201-436-2230; Empl.: 85; *Sls. Mgr.:* John Piret ..... **B•1238-1243**

Local Sales Offices & Reps

CA	Los Altos, Poltronics	415-941-3020
CA	Signal Hill, Thorson Co.	213-595-0361
CT	No. Haven, Kitchen & Kutchin	203-239-0212
FL	Naples, Techtron Sls. Corp.	813-566-3800
IL	Park Ridge, Probe Elctrns.	312-698-2044
MA	Lexington, Kitchen & Kutchin	617-862-8230
NJ	Kinnelon, Avionics Equip.	201-838-8105
NY	Rochester, Milton C. Matthews Co.	716-271-1910
PA	Downingtown, Budd Elctrns. Corp.	215-458-8258
TX	Austin, Electra Reps., Inc.	512-339-1163
TX	Dallas, Electra Reps., Inc.	214-248-3852

AIR MAZE CORP., 25000 Miles Rd., Cleveland, OH 44146, Tel: 216-292-6800, TELEX: 98-5413, FAX: 216-292-6812; Empl.: 300; *Sls. Mgr.:* J.B. Ernster

AIR-O-TRONICS, Trush, Inc., 2747 Rt 20 E., P.O. Box 326, Cazenovia, NY 13035, Tel: 315-655-2387, TWX: 710-541-1530, FAX: 315-655-3862; FSC No.: 16663; Empl.: 15

AIRPAX-CAMBRIDGE DIVISION, A North American Philips Co., Woods Rd., Cambridge, MD 21613, Tel: 301-228-4600, TELEX: 6849138, TWX: 710-865-9655, FAX: 301-228-8910; FSC No.: 81541; Empl.: 1100; *Sls. Mgr.:* Sandy Monaghan ..... **B•1348**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
FL	Pompano Bch., Airpax	305-978-9019
GA	Chamblee, BCI	404-455-0405
ID	Boise, Lange Sls., Inc.	208-345-8207
IL	Lake Zurich, Somers-Stanton, Inc.	708-438-2999
IN	Indianapolis, Airpax	317-573-9911
IA	Marion, Rep Assocs.	319-373-0152
MD	Frederick, Airpax	301-243-3133
MA	Northboro, Airpax	508-393-1919
MI	Farmington Hills, Airpax	313-553-6030
MN	Eagan, Airpax	612-683-9007
NY	Rochester, Airpax	716-654-7470
NY	Syosset, Airpax	516-364-1217
OH	Dayton, Baehr, Greenleaf	513-439-0724
OH	Westlake, Baehr, Greenleaf	216-892-1770
OH	Worthington, Baehr, Greenleaf	614-847-0220
OR	Beaverton, Airpax	503-641-6130
PA	Pittsburgh, Russell F. Clark	412-242-9500
TX	Dallas, Airpax	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX-CHESHIRE DIVISION, A North American Philips Co., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, Tel: 203-271-6000, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 800; *Sls. Mgr.:* Jerry Gabbard ..... **B•1875; D•1128**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
FL	Pompano Bch., Airpax Co.	305-978-9019
GA	Chamblee, B.C.I.	404-455-0405
ID	Boise, Lang Sls., Inc.	208-345-8207
IL	Lake Zurich, Somers-Stanton, Inc.	708-438-2999
IN	Indianapolis, Airpax	317-573-9911
IA	Marion, Rep Assocs.	319-373-0152
MD	Frederick, Airpax	301-243-3133
MA	Northboro, Airpax	508-393-1919
MI	Farmington Hills, Airpax	313-553-6030
MN	Eagan, Airpax	612-683-9007
NY	Rochester, Airpax	716-654-7470
NY	Syosset, Airpax	516-364-1217
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Airpax	503-641-6130
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Dallas, Airpax	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX-FREDERICK DIVISION, A North American Philips Co., Husky Park P.O. Box 500, Frederick, MD 21701, Tel: 301-663-5141, FAX: 301-698-0624; Empl.: 600; *Sls. Mgr.:* Dennis Karr, Prod. Mgr.; *Dist. Mgr.:* Mike Zusi, Mktg. Mgr. ..... **B•1832**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
FL	Pompano Bch., Airpax	305-978-9019
GA	Chamblee, B.C.I.	404-455-0405
ID	Boise, Lange Sls., Inc.	208-345-8207
IL	Lake Zurich, Somers-Stanton Inc.	708-438-2999
IN	Indianapolis, Airpax	317-573-9911
IA	Marion, Rep Assocs., Inc.	319-373-0152
MD	Frederick, Airpax	301-243-3133
MA	Northboro, Airpax	508-393-1919
MI	Farmington Hills, Airpax	313-553-6030
MN	Eagan, Airpax	612-683-9007
NY	Rochester, Airpax	716-654-7470
NY	Syosset, Airpax	516-364-1217
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Airpax	503-641-6130
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Dallas, Airpax	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX-INTERNATIONAL DIVISION, A North American Philips Co., West Johnson Ave., Cheshire, CT 06410, Tel: 203-271-6000, FAX: 203-271-6400; Empl.: 350; *Sls. Mgr.:* Art Catano ..... **B•1875; D•1128**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westerep	619-566-6580
CA	Santa Clara, Airpax	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
FL	Pompano Bch., Airpax	305-978-9019
GA	Chamblee, B.C.I.	404-455-0405
ID	Boise, Lang Sls., Inc.	208-345-8207
IL	Lake Zurich, Somers-Stanton, Inc.	708-438-2999
IN	Indianapolis, Airpax	317-573-9911
IA	Marion, Rep Assocs.	319-373-0152
MD	Frederick, Airpax	301-243-3133
MA	Northboro, Airpax	508-393-1919
MI	Farmington Hills, Airpax	313-553-6030
MN	Eagan, Airpax	612-683-9007
NY	Rochester, Airpax	716-654-7470
NY	Syosset, Airpax	516-364-1217
OH	Dayton, Behr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Behr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Behr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Airpax	503-641-6130
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Dallas, Airpax	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX SENSOR DIV., A North American Philips Co., Cheshire Industrial Park, Cheshire, CT 06410, Tel: 203-271-6000, TELEX: 962421, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 200; *Sls. Mgr.:* Jim Rochford ..... **B•1875; D•1128**

Local Sales Offices & Reps

AL	Birmingham, Dwight W. Prouty Co., Inc.	205-988-8110
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax	408-980-0410
CO	Littleton, Lange Sls., Inc.	303-795-3600
FL	Pompano Bch., Airpax	305-978-9019
GA	Marietta, Control Equip. Co.	404-427-8776
ID	Boise, Lange Sls, Inc.	208-345-8207
IL	Lake Zurich, Somers-Stanton Inc.	708-438-2999
IN	Indianapolis, Airpax	317-573-9911
IA	Cedar Rapids, Rep Assocs.	319-373-0152
LA	Kenner, D & W System Sls.	504-466-1692
MA	Northboro, Airpax	508-393-1919
MI	Farmington Hills, Airpax	313-553-6030
MN	Eagan, Airpax	612-683-9007
MS	Jackson, D & W Sys. Sls.	601-956-9292
NY	Rochester, Airpax	716-654-7470
NY	Syosset, Airpax	516-364-1217
NC	Charlotte, MacGuire & Crawford Inc.	704-366-3454
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf, & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Airpax	503-641-6130
PA	Warrendale, Baehr, Greenleaf & Assocs.	412-934-3088
TX	Dallas, Airpax	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
VA	Salem, Process Specialities	703-562-0707
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

AL	Birmingham, Dwight D. Prouty	205-988-8110
AL	Mobile, Dwight D. Prouty	205-476-5056
AZ	Mesa, FLW, Inc.	602-641-9157
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Santa Clara, MANCO	408-496-6611
CT	Milford, Motors & Drivers Inc.	203-877-6509
FL	Ft. Lauderdale, Indl. Instrs.	305-971-0209
FL	Tampa, Wacco Inc.	813-621-6441
GA	Marietta, Control Equip. Co.	404-427-8776
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Countryside, Chicago Chain & Transmission	708-482-9000
IN	Mishawaka, Power Comps. of Midwest	219-256-6630
IA	Des Moines, Kim Controls	515-274-9194
KY	Louisville, Automatic Controls	502-426-4666
LA	Baton Rouge, D & W Sys. Sls.	504-753-0992
LA	Kenner, D & W. Sys. Sls.	504-466-1692
MA	Hingham, Hingham Bay Corp.	617-740-1900
MI	Detroit, Automatic Controls	315-533-8890
MN	Minneapolis, Kim Controls	612-780-2991
MO	Fenton, Hi-Tech Elec.	314-343-6060
NY	Johnson City, Help Elctrns.	607-729-3528
NY	N. Tonawanda, N.E. Controls of Buffalo	716-691-0081
NY	New Hyde Park, 1/0 Corp.	516-355-0130
NY	Thompson Ridge, Vespo Mktg.	914-361-2800
NC	Charlotte, McGuire & Crawford	704-366-3454
OH	Brunswick, Automatic Controls	216-273-1117
OH	Cleves, ATR Distrs.	513-353-1800
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
PA	Conshohocken, I/O Corp.	215-825-4610
PA	Pittsburgh, Friday Engrg.	412-341-1444
TX	Dallas, Automatic Sys.	214-688-1810
TX	Houston, The Haltom Co.	713-782-5625
VA	Salem, Process Specialties	703-563-0707
WA	Richland, Radar Elec, Co., Inc.	509-943-6790
WA	Seattle, Radar Elec, Co., Inc.	206-282-2511
WA	Spokane, Radar Elec, Co., Inc.	509-747-3053
WI	New Berlin, Electric Sales & Engrg.	414-782-2400

AIRTRON, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950, Tel: 201-539-5500, TWX: 710-986-7473, FAX: 201-539-0357; FSC No.: 80006; Empl.: 500; *Sls. Mgr.:* M. R. Grosso, Natl. Sls. Mgr.

AIR-VAC ENGRG., 100 Gulf St., Milford, CT 06460, Tel: 203-874-2541, FAX: 203-783-1383; Empl.: 40

AJAX MAGNETHERMIC CORP., 1745 Overland Ave., N.E., Warren, OH 44482, Tel: 216-372-8511, TELEX: 098-2482, FAX: 216-372-8644; Empl.: 500

A.J.'S POWER SOURCE, 214A Cox Drive, Land-O-Lakes, FL 34639, Tel: 800-933-7725, FAX: 813-996-5037; Empl.: 10; *Sls. Mgr.:* Allen L. Johnson Jr. ..... **D•1584**

Local Sales Offices & Reps

FL	Land-O-Lakes, AJ's Power Source	813-996-2583
GA	Duluth, AJ's Power Source	404-441-7927
NC	Raleigh, Overton Assocs.	919-781-7004
SC	Walhalla, Overton Assocs.	803-638-7101
TN	New Tazewell, Overton Assocs.	615-626-6009

AKG ACOUSTICS, INC., 1525 Aluardo St., San Leandro, CA 94577, Tel: 415-351-3500, FAX: 415-351-0500; Empl.: 100; *Sls. Mgr.:* David Angress

AKRO-MILS, Myers Industries, 1293 S. Main St., Akron, OH 44301, Tel: 216-253-5593, TELEX: 98-6321, FAX: 216-253-9801; Empl.: 200; *Sls. Mgr.:* W. J. Tonachio; *Dist. Mgr.:* D. Martin

ALADDIN ELCTRNS., See AIE Div. of Vernitron

ALAN INDUSTRIES INC., P.O. Box 1203, Columbus, IN 47202, Tel: 812-372-8869, FAX: 812-372-5909; FSC No.: 52750; Empl.: 36; *Sls. Mgr.:* Blayde A. Kennedy

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	Calabasas, Pamcor, Inc.	818-348-8701
CA	Palo Alto, RF Assocs.	415-494-3331
FL	Apopka, Saber Assocs.	800-432-6288
FL	Melbourne, Saber Assoc.	800-432-6288
FL	Tampa, Saber Assocs.	800-432-6288
GA	Lawrenceville, Saber Assocs.	800-327-0853
IN	Fort Wayne, TX Sls.	219-489-4447
KS	Roeland Park, Abrams & Assocs.	913-432-2303
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Topsfield, Liberty Electro Mktg.	508-887-6655
MO	St. Louis, Abrams & Assocs.	314-569-0447
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NY	Syracuse, T-Squared Elctrns.	315-463-8592
NC	Clayton, Saber Assocs.	800-327-0853
OH	Dayton, Frederic L. Ohmer	513-434-1454
OR	Portland, Caruso & Assocs.	503-246-5439
PA	Glenside, Koebert Assocs.	215-887-2310
TX	Addison, Robert R. Thomas Co.	214-233-8235
WA	Bellevue, Caruso & Assocs.	206-455-8811
WV	Inwood, Koebert Assocs.	304-229-8401
EXP	CT, Stamford, Dage Corp.	203-324-3123
Can	Ottawa, Ont., Giga-Tron	613-225-4090,

ALARM CONTROLS CORPORATION, P.O. Box 280, Deer Park, NY 11729, Tel: 516-586-4220, FAX: 516-586-6500; FSC No.: 55042; Empl.: 50; *Sls. Mgr.:* John Benedetto

ALASCO RUBBER & PLASTICS CORP., 617 Mountain View Ave.67, Belmont, CA 94002, Tel: 415-595-4100, FAX: 415-595-0298; FSC No.: 13862; Empl.: 25

ALBAR, INC., 19013 36th Ave. W., Lynnwood, WA 98036, Tel: 206-771-4006, 800-822-5227, FAX: 206-771-2163; Empl.: 50; *Sls. Mgr.:* David C. Stiffler **A•2152**

Local Sales Offices & Reps

CA	Granada Hills, Crown Elctrns.	818-368-7475
GA	Marietta, B-C Elctrns. Sls.	404-565-2088
PA	Newtown, Indl. Sls. Assocs.	215-860-2076

ALBEROX CORPORATION, New Bedford Ind'l. Pk., New Bedford, MA 02745, Tel: 508-995-1725, FAX: 508-995-6954; Empl.: 180

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ALBION INDUSTRIES, 800 N. Clark St., Albion, MI 49224, Tel: 517-629-9441

ALDEC, INC., 3525 Old Conejo Rd., , Newbury Park, CA 91320, Tel: 805-499-6867, TELEX: 239-447, FAX: 805-498-7945; Empl.: 57; *Sls. Mgr.:* Harry Tosado

ALDEN COMPUTER SYSTEMS, One Salem Green, Ste. 420, Salem, MA 01970, Tel: 508-744-1314; *Sls. Mgr.:* Donald O'Brien

ALDEN ELECTRONICS, INC., 40 Washington Street, Westboro, MA 01581, Tel: 508-366-8851, TELEX: 94-8404, FAX: 508-898-2427; Empl.: 125; *Sls. Mgr.:* L. A. Farrington

ALDEN PRODUCTS CO., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, Tel: 508-583-0160, FAX: 508-583-0164; FSC No.: 01009; Empl.: 150; *Sls. Mgr.:* Donald J. Paul **C•1161-1163**

ALDEN SYSTEMS, Alden Products Co., 262 N. Main St., P.O. Box 860, Brockton, MA 02403-0860, Tel: 508-583-0160, TELEX: 287 793 ALDN UR, FAX: 508-583-0164; Empl.: 150; *Sls. Mgr.:* D. Paul

A. L. DESIGN, INC., 1411 Military Rd., Buffalo, NY 14217, Tel: 716-875-6240, FAX: 716-875-2404; Empl.: 25

ALEPH INTERNATIONAL CORP., Nippon Aleph Corp., 1026 Griswold, San Fernando, CA 91340, Tel: 818-365-9856, 800-423-5622, FAX: 818-365-7274; Empl.: 17; *Sls. Mgr.:* Frank Mastrolonardo

A.L.E. SYS., INC., 150 Homer Ave., Ashland, MA 01721, Tel: 508-881-5252, FAX: 617-235-6588; Empl.: 70; *Sls. Mgr.:* John Boyd/Ken Duval; *Dist. Mgr.:* John Boyd/Ken Duval **D•1604**

ALEXANDER BATTERIES, New Product/OEM Divison, P.O. Box 28880, San Diego, CA 92198, Tel: 619-480-4445, TELEX: 371-9855, FAX: 619-480-1351; Empl.: 390; *Sls. Mgr.:* Dave Zeman **D•1430**

Local Sales Offices & Reps

CA	San Diego, Alexander Batteries;New Prod./OEM Div.	619-480-4445-619-480-1351

ALEXANDER MANUFACTURING COMPANY, P.O. Box 1508, Mason City, IA 50401, Tel: 800-247-1821, 515-423-8955, TELEX: 3719855, FAX: 515-423-1644; Empl.: 270; *Sls. Mgr.:* Bill Sapp **D•1430**

ALEXANDRIA EXTRUSION CO., P.O. Box 847 Cty. Rd. 22 North, Alexandria, MN 56308, Tel: 612-763-6537, FAX: 612-763-6530; Empl.: 140; *Sls. Mgr.:* Brian L. Bloedorn

ALFA ELECTRONICS, INC., P. O. Box 8089, Princeton, NJ 08543-8089, Tel: 609-275-0220, FAX: 609-275-9536; Empl.: 9; *Sls. Mgr.:* Jeff Kao

ALGO, INC., 1237 Queen Anne Avenue, ODENTON, MD 21113, Tel: 301-672-1544, TELEX: FAX: (301) 672-1456; Empl.: 12; *Sls. Mgr.:* G. J. O'Mara

ALINABAL, 28 Woodmont Rd., Milford, CT 06460, Tel: 203-877-3241, TWX: 710-462-1178, FAX: 203-877-3241 (ext. 360); Empl.: 255

ALLEGRO MICROSYSTEMS, INC., formerly Sprague Semiconductor Grp., 363 Plantation St., Worcester, MA 01605, Tel: 508-795-1300, FAX: 508-792-9024; FSC No.: 31019,0CVK3,2D532; Empl.: 2000; *Sls. Mgr.:* D. Ax; *Dist. Mgr.:* J. Nardone

ALLEN AVIONICS, INC., 224 E. 2nd St., Mineola, NY 11501, Tel: 516-248-8080, FAX: 516-747-6724; Empl.: 300; *Sls. Mgr.:* Jeffrey Buchman **A•1494, 1653**

Local Sales Offices & Reps

AZ	Phoenix, J. F. Hurlbut Co.	602-952-2079
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Palo Alto, Adtek Assocs.	415-323-5414
CA	San Diego, Van Gott & Assocs.	619-308-0667
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Melbourne, Reynolds & Assocs., Inc.	407-259-7000
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
MA	Scituate, D&M Tech. Sls.	617-545-9369
MO	St. Louis, The Beams Co.	314-434-8448
NY	Plainview, Eastern Metro Assocs.	516-931-1414
NC	Raleigh, Reynolds Assocs.	407-259-7000
PA	W. Conshohocken, Eastern Comp. Sls. Inc.	215-825-8610
TX	Dallas, Bradenco Corp.	214-352-3554
VA	Alexandria, Vanguard Engrg. Sls.	703-768-1660
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160

ALLEN BRADLEY CO., ELECTRONIC COMPONENTS DIV., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, Tel: 915-592-4888, 800-592-4888, TELEX: 749-400, FAX: 915-594-8922; Empl.: 6500; *Sls. Mgr.:* George Hackstadt; *Dist. Mgr.:* George Hackstadt

ALLEN- BRADLEY CO., Div. of Industrial Control Grp., 1201 S. Second St., Milwaukee, WI 53201, Tel: 414-382-2000, TELEX: 26699, TWX: 4311016, FAX: 414-382-4444; Empl.: 1600; *Dist. Mgr.:* Dick Zajork



FAX: 818-765-2387

ALLEN CO., INC., ROBERT G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300, 800-999-3711; Empl.: 35; *Sls. Mgr.:* Bob Keltz **A•1008-1009, 1839-1842**

Local Sales Offices & Reps

CA	Sunnyvale, Robert G. Allen Co., Inc.	408-243-7007
CT	Windsor, Janeco	203-688-4513
IL	Chicago, Rendell Sls.	312-967-1513
NJ	Palisades Park, Janco Technig. Inc.	201-941-4008
NM	Albuquerque, Nelco Elctrns.	503-293-1399
NC	Kernsville, Wallace Elctrns.	919-996-2742
MN	Oakdale, Complete Sls.	612-731-2923
TX	Irving, Kite Elctrns.	214-986-0321
WA	Redmond, Interstate Elctrns.	206-885-5257
EXP	Dublin, Ireland, Standard Comps. Ltd.	375-25025

Local Distributors

CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Oakland, Brill Elctrns.	405-834-5888
CA	Redwood City, H D B	415-368-1388
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Diego, Mock III	619-560-0515
CA	San Leandro, Gateway Elctrns.	415-632-4500
CT	Greenwich, Wise Comps.	203-531-4880
CT	Stratford, C-Tronics, Inc.	800-243-9967
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Itasca, Voyager Elctrns. Corp.	312-773-4900
MA	Wilmington, Heiland Elctrns., Inc.	617-657-4870
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
NJ	Garfield, B & R Elctrns.	201-470-0700
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
UT	Provo, Central Utah Elctrn. Supp.	801-373-7522
WA	Richland, Radar Elec. Co., Inc.	509-943-8336
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec. Co., Inc.	509-747-3053

ALLEN DATAGRAPH, INC., 2 Industrial Way, Salem, NH 03079, Tel: 603-893-1983, FAX: 603-893-9042; *Sls. Mgr.:* Tom Allen

ALLEN SYSTEMS, 2346 Brandon Rd., Columbus, OH 43221, Tel: 614-488-7122; Empl.: 10

ALLEN TECHNOLOGY, PO Box 575, Sutton, NE 68979, Tel: 402-773-5285

ALLIED CONTROLS INCORPORATED, 562 Captain Neville Dr., Waterbury, CT 06705-3827, Tel: 203-757-4200, FAX: 203-757-4204; FSC No.: 5945; *Sls. Mgr.:* John T. Kryjak, VP Sls. & Mktg. **B•1400-1403**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs. Inc.	205-533-9108
CA	Irvine, Component Mktg. Assocs., Inc.	714-727-0688
CA	Tarzana, Component Mktg. Assocs., Inc.	818-708-8058
CT	Clinton, Selmark Assocs., Inc.	203-573-9088
FL	Orlando, Trimark Assocs., Inc.	407-859-5504
GA	Norcross, Hughes Assocs. Inc.	404-662-1587
IL	Skokie, Industrial Reps., Inc.	708-967-8430
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
MD	Burtonsville, Chesapeake Technig. Inc.	301-236-0530
MA	Millis, Selmark Assocs., Inc.	508-376-2914
MN	Bloomington, Indl. Reps., Inc.	612-854-8027
MS	Corinth, Hughes Assocs. Inc.	601-287-2915
NH	Hopkinton, Selmark Assocs., Inc.	603-746-3299
NJ	Englewood, Gray Assocs., Inc.	201-894-0894
NJ	Kenvil, Gray Assocs. Inc.	201-927-6662
NC	Cary, Hughes Assocs. Inc.	919-467-7029
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
AZ	Phoenix, BLS Comms.	602-841-6613
PA	Pittsburgh, Process Engrg. Co.	412-561-5050
TN	Knoxville, Hughes Assocs. Inc.	615-558-0283

TX Austin, Comp. Technlg. 512-250-2450
TX Dallas, Comp. Technlg. 214-783-8831
TX El Paso, Alexander Entprs. 915-591-3142
TX Houston, Component Technlg. 713-961-1262
WI Brookfield, Industrial Reps., Inc. 414-789-9393

Local Distributors

CA Los Angeles, Master Distrs. 213-452-1229
CA Santa Ana, El-Com, Inc. 714-432-6633
CA Santa Ana, Norstan Elctrns. Inc. 213-924-7651
FL Ft. Lauderdale, Peerless Radio 305-973-4141
IL Chicago, Newark Elctrns. 312-784-5100
IN Indianapolis, Bell Inds. 317-875-8200
MA Newton, Greene-Shaw 617-969-8900
MN Minneapolis, Control Design 612-721-1628
NJ Oakland, Relay Specialties 201-337-1000
NY Buffalo, Summit Distrbg. 716-887-2800
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Plainview, ACI 516-293-6630
NY Rome, Rome Elctrns. 315-337-5400
OH Willoughby, Gateway Megatech 216-953-0333
OK Oklahoma City, Electro Entprs. 405-427-6591
PA Philadelphia, P. E. I. Genesis 215-673-0400
PA Philadelphia, Shap Elctrns. 215-969-3300
Can Pointe Claire, Que., Future Elctrns. 514-694-7710

ALLIED ELCTRNS., SUBSIDIARY OF HALL-MARK, 7410 Pebble, Fort Worth, TX 76118, Tel: 800-433-5700, FAX: 817-595-6470; Empl.: 250; *Sls. Mgr.:* Ed Bridges

ALLIED-SIGNAL AEROSPACE CO., Bendix Communications Div., 1300 E. Joppa Rd., Towson, MD 21204, Tel: 410-583-4000, TWX: 710-232-1823, FAX: 410-337-7485; FSC No.: 06845; Empl.: 1500; *Sls. Mgr.:* Jack L. Shagena

ALLIGATOR TECHNOLOGIES, P.O. Box 9706, Fountain Valley, CA 92708, Tel: 714-850-9984, FAX: 714-850-9987; Empl.: 10; *Sls. Mgr.:* Bertil Wanner; *Dist. Mgr.:* Robert Galter

ALL-STATES, INC., 1801 W. Foster Ave., Chicago, IL 60640, Tel: 312-728-0525, TELEX: 317027, FAX: 312-728-6410; FSC No.: 26863

ALMOND INSTRUMENTS, See EG & G Almond Instruments

ALPHA COMPONENTS, 1106 E. Simpson Rd., Mechanicsburg, PA 17055, Tel: 717-697-8595, FAX: 717-697-8608; FSC No.: 52748; *Sls. Mgr.:* Jerry Buckwalter

ALPHA-CORE INC., 915 Pembroke St., Bridgeport, CT 06608, Tel: 203-335-6805, FAX: 203-384-8120; Empl.: 15; *Sls. Mgr.:* Sandu Pescaru

ALPHA DIST. CORP., 3554 Brecksville Rd., Richfield, OH 44286, Tel: 216-659-7100, 1-800-628-0841, FAX: 216-659-3435

ALPHA INDUSTRIES, INC., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, TELEX: 949436, TWX: 710-393-1236; FSC No.: 17540; Empl.: 1400; *Sls. Mgr.:* David Barker

ALPHA-M CORP., 11518 Reeder Rd S.W., 115, Dallas, TX 75229, Tel: 214-406-0424; Empl.: 8; *Sls. Mgr.:* W. L. Cowley

ALPHA METALS, 600 Rte 440, Jersey City, NJ 07304, Tel: 201-434-6778, FAX: 201-434-7508; Empl.: 350; *Sls. Mgr.:* Dave Zerfoss, VP Assembly Prods.

ALPHA OMEGA COMPUTER SYSTEMS, 33815 Eastgate Circle, Corvallis, OR 97333, Tel: 503-754-1911, FAX: 503-757-7415; Empl.: 5; *Sls. Mgr.:* Gary Oliver; *Dist. Mgr.:* Gary Oliver

ALPHA PRODUCTS, INC., 5740 Corsa Ave. 6104, Westlake Village, CA 91362, Tel: 818-889-9304, TELEX: 65-9210, FAX: 818-706-8986

ALPHA-TECH INC., P.O. Box 209, Riverdale, NJ 07457, Tel: 201-831-1222; Empl.: 8; *Sls. Mgr.:* M. Rice

ALPHA THERMISTOR, INC., 7181 Construction Ct., San Diego, CA 92121, Tel: 619-549-4660, 800-235-5445, FAX: 619-549-4791; Empl.: 30; *Sls. Mgr.:* Dan McGillicuddy

ALPHA WIRE CORP., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711, Tel: 908-925-8000, TELEX: 6853017, TWX: 710-996-5895, FAX: 908-925-7938; Empl.: 376; *Sls. Mgr.:* Linda Smith

ALPS ELECTRIC (USA), INC., 3553 N. First St., San Jose, CA 95134, Tel: 408-432-6000, FAX: 408-432-6035(37); Empl.: 700; *Sls. Mgr.:* Mattie Alesi,

ALTAIR

FAX: 818-701-5508

ALTAIR EXCHANGE CORPORATION, 19201 Parthenia St. No.E, Northridge, CA 91324, Tel: 818-701-6977, 800-824-5620 ..... **B•1034-1036**

ALTECH CORP., 120 Old Camplain Rd., Somerville, NJ 08876, Tel: 908-707-8484, FAX: 908-707-4455; Empl.: 35; *Sls. Mgr.:* Steve Stahovic, V.P.; *Dist. Mgr.:* Mort Gelfand, V.P. ... **B•1349, 1643; C•1006-1007, 1148, 1164-1171**

ALTEK CO., P.O. Box 1128, Torrington, CT 06790, Tel: 203-482-7626, FAX: 203-496-7113; FSC No.: 53939; Empl.: 65; *Sls. Mgr.:* Stephen Altschuler

ALTEK CORPORATION, 12210 Plum Orchard Dr., Silver Springs, MD 20904-7802, Tel: 301-572-2555, TWX: 710-825-0422, FAX: 301-572-2510; FSC No.: 7D336; Empl.: 80; *Sls. Mgr.:* Thomas A. Rainone; *Dist. Mgr.:* Thomas A. Rainone

ALTERNATIVE MANUFACTURING, INC., 8 Summer St., P.O. Box 200, Winthrop, ME 04364-200, Tel: 207-377-9377, FAX: 207-377-9379; Empl.: 20

ALTRON, INC., 6700 Industry Ave., N.W., Anoka, MN 55303, Tel: 612-427-7735, FAX: 612-427-3980; Empl.: 185; *Sls. Mgr.:* Waldo W. Hasse

ALUMINUM FILTER, 1000 Cindy Lane, Carpinteria, CA 93013, Tel: 805-684-7651, TELEX: 6713624, FAX: 805-684-3654; FSC No.: 17504; Empl.: 120; *Sls. Mgr.:* B. L. Baker

ALUSETT U.S.A., INC., 3 Cecilia Lane, Pleasantville, NY 10570, Tel: 914-737-0120, FAX: 914-737-8697; Empl.: 35

AMADOR CORPORATION, Taylors Falls, MN 55084-0270, Tel: 612-631-2487, TELEX: 5106007012, ESYLNK: 62911738, FAX: 612-465-3073; Empl.: 31; *Sls. Mgr.:* Gene A. Panger

AMATOM ELECTRONIC HARDWARE, 446 Blake St., New Haven, CT 06515, Tel: 203-397-3311, TELEX: 963-419, FAX: 203-387-4101; FSC No.: 06540; Empl.: 125; *Sls. Mgr.:* James Marshall

Local Sales Offices & Reps

AL Huntsville, Advanced Comps. Mktg. ... 205-881-5493
AZ Phoenix, Carlberg & Assoc. 602-468-0750
CA Moor Park, Interconn 805-529-4276
CA San Diego, Coastal Elctrns. 619-922-5525
CA Sunnyvale, Logan Sls. 408-732-6020
CO Highland Ranch, Valcomp 303-791-0330
CT Bethany, Reps. Corp. 203-393-0024
FL Longwood, R.O. Whitsell & Assoc. 407-682-6662
IL Elk Grove Village, Control Sls. 708-595-2110
IN Ft. Wayne, Outman Sls. 219-489-7699
IA Marion, M.S.B. Assocs. 319-377-6261
KS Roeland Pk, M.S.B. Assocs. 913-432-2131
MD Walkersville, Jadelectronics 301-845-6036
MA Wellesley, Reps. Corp. 617-237-6476
MI Dearborn, Pitcher-Poulin 313-582-5450
MN Edina, Jay Borman Sls. 612-922-5525
MO St. Charles, M.S.B. Assocs. 314-946-5577
NM Albuquerque, Carlberg & Assoc. 505-899-2155
NY New Rochelle, R D I Assocs. 914-632-2828
NY Syracuse, Lenard Co. 315-479-9191
NC Raleigh, Tingen Tech. Sls. 919-870-6670
OH Cleveland, J. Olsen Co. 216-838-0510
OR Beaverton, Luscombe Eng./NW 503-636-6664
PA Birchrunville, Jadelectronics Assocs. .. 215-296-3800
TX Dallas, Nesbitt 214-696-8700
WA Bellevue, Luscombe Eng./NW 206-223-1541
WI Brookville, Control Sls. 414-797-9500
EXP NY Edgewood, Kaytech Ind. 516-242-6606
Can Rexdale, Truenorth Technlgs. 416-744-2233

AMBER ELECTRIC DESIGN, 6969 Trans-Canada Hwy., St. Laurent, PQ,, Canada H4T 1V8, Tel: 514-333-8748, 800-361-3697, TELEX: 514-333-1388; FSC No.: 38047; Empl.: 40; *Sls. Mgr.:* Wayne Jones

AMBER INDS., INC., 14902 Preston Rd. Ste. 212, Dallas, TX 75379, Tel: 214-490-9801, FAX: 214-980-0329; *Sls. Mgr.:* R. Bacon ..... **B•1351**

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AZ Scottsdale, ESCO Elctrns. 602-948-4404
CA Redlands, ESCO Sls. 714-335-1444
CA San Carlos, Electronic Engrg. Assoc. .. 415-593-2189
FL Indian Rocks Beach, PAR Assocs. 813-596-8841
GA Atlanta, PAR Assocs. 404-391-9117
IL Park Ridge, G. McL. Cole Co. 312-692-0665
IN Jasper, E & K Elec., Inc. 812-482-3161
KS Lenexa, Dytec/South (west) 913-888-0215
KS Wichita, Dytec/South 316-263-7090
MD Westminster, Chesapeake Technlgs. .. 301-875-0004
MA Reading, May Technlg. 617-942-7135
MI Southfield, Comtel Instruments 313-358-2505
MN Crystal, Abtech 612-537-3384
MO Maryland Hgts., Dytec/South (east) ... 314-739-0665
NJ Medford, McCoy Grp. 609-953-0770
NM Albuquerque, ESCO Elctrns. 505-243-3470
NC Charlotte, PAR Assocs. 704-535-9858
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OH Dayton, Comtel Instruments 513-426-5310
OR Portland, SPS Elctrns. 206-323-4140
PA Exton, McCoy Grp. (east) 215-363-0350
PA Pittsburgh, Comtel Instrs. (west) 412-922-5720
TX Dallas, Seaton Corp. 214-980-9860
TX Houston, Seaton Corp. 713-731-2649
WA Edmonds, Power Sources Unlimited .. 206-743-6641
WA Redmond, SPS Elctrns. 206-323-4140

Local Distributors

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IL Park Ridge, G. McL. Cole Co. 312-692-6040
NC Charlotte, PAR Assocs. 704-366-6516

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AMBI-TECH INDS., 319 Knickerbocker Ave., Hillsdale, NJ 07642, Tel: 201-666-0504, FAX: 201-666-0597; Empl.: 20; *Sls. Mgr.:* Al Nagler; *Dist. Mgr.:* Al Nagler

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AL Huntsville, Kemp Instrs. 205-837-4304
AZ Phoenix, C. T. Carlberg 602-468-0750
CA Los Angeles, Knight Co. 213-670-2833
CA Orange County, Knight Co. 714-833-8250
CA Rancho, The Knight Co. 619-452-7196
CA Santa Clara, Interconnect Sls. Grp. 408-980-1166
CO Englewood, FG Mktg. Co. 303-795-9176
CT Bethel, Instr. Dynamics 203-743-5045
FL Tampa, Temco Sls. Inc. 813-855-7566, 800-282-6815
GA Atlanta, Kemp Instrs. 404-452-8050
IL Bensenville, R. L. Lang & Assocs. 708-766-3667
IN Ft. Wayne, Walter W. Biebrich 219-432-2537
IN New Albany, Walter W. Biebrich, Inc. .. 812-945-3187
IA Davenport, Rush & West 319-388-9494
KS Olathe, Rush & West 913-764-2700
LA Lafayette, Kemp Instruments 318-269-9452

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MO St. Louis, Rush & West 314-965-3322
NM Albuquerque, C. T. Carlberg Assocs. .. 505-836-1448
NY Endwell, Reagan/Compar Albany 607-754-2171
NY Great Neck, F & F Metro, Inc. 516-482-4080
NY Rochester, Reagan/Compar, Albany .. 716-271-2230
NC Raleigh, L. G. White & Co. 919-872-6049
NC Winston Salem, L. G. White & Co. 919-725-3612
OH Chesterland, Electro Sls. Assocs. 216-729-0190
OH Dayton, Electro Sls. Assocs. 513-426-5551
OK Tulsa, Kemp Engr. 918-663-4501
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Edgemont, White/Whiddett Co. 215-353-6343
PA Pittsburgh, Electro Sls. Assocs. 412-322-9000
SC Greenville, L. G. White & Co. 803-271-0630
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TX Austin, Kemp Engrg. 512-263-3322
TX Houston, Kemp Engrg. 713-466-1465
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WA Redmond, Eclipse Mktg. Grp. 206-885-6991
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EXP NJ, Mahwah, Intl. Sls. Div. 201-825-0473

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AME CORPORATION, 33 Jacksonville Rd., P.O. Box 195, Towaco, NJ 07082-0195, Tel: 201-263-1700, FAX: 201-263-8199; Empl.: 20; *Sls. Mgr.:* Edward Dimitry ..... **B•1644**

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AMERICAN AEROSPACE CONTROLS, 570 Smith St., Farmingdale, NY 11735, Tel: 516-694-5100, FAX: 516-694-6739; Empl.: 48; *Sls. Mgr.:* Gregory D'Abramo ..... **B•1876-1877**

AMERICAN ALUMINUM, 230 Sheffield St., Dept. EEM, Mountainside, NJ 07092, Tel: 908-233-3500, FAX: 908-233-3241; Empl.: 125; *Sls. Mgr.:* Ronald R. King

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FAX: 714-731-6344

AMERICAN ARIUM, Formerly American Automation & Arium, 14281 Chambers Rd., Tustin, CA 92680-7207, Tel: 714-731-1661; Empl.: 39; *Sls. Mgr.:* Suzanne Apitz ..... **D•1217**

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CA Placentia, Access Technlgs., Lee Dyal 714-996-3917

AMERICAN CAPACITOR CORPORATION, 5367 Third St., Irwindale, CA 91706, Tel: 818-814-4444, ESYLNK: 910-333-9810, FAX: 818-814-4434; FSC No.: 59366; Empl.: 65; *Sls. Mgr.:* Joseph Latourelle; *Dist. Mgr.:* Joseph Latourelle

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AMERICAN CONTROL PRODUCTS, Div. of Precision Timer Co., Inc., 47 Westbrook Ind'l Pk, Westbrook, CT 06498, Tel: 203-399-6253, FAX: 203-399-5619; Empl.: 35; *Sls. Mgr.:* J. H. Hunicke

AMERICAN CONTROL TECHNOLOGY, INC., 825 Village Quarter Rd., West Dundee, IL 60118-2100, Tel: 708-426-6780, FAX: 708-426-1057; *Sls. Mgr.:* Al Shrock ..... **B•1645**

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AMERICAN ELECTRONICS, 1600 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-3020, TWX: 910-592-1256; FSC No.: 89321; Empl.: 200; *Sls. Mgr.:* Bill Holland

AMERICAN ETCHING & MFG., 13730 Desmond St., Pacoima, CA 91331-2796, Tel: 818-896-1187, FAX: 818-896-0095; Empl.: 75

AMERICAN HOFMANN CORP., P.O. Box 10369, 3700 Cohen Pl., Lynchburg, VA 24506, Tel: 804-522-0300, ESYLNK: 5106000480, FAX: 804-846-1340; Empl.: 180; *Sls. Mgr.:* H.H. Wilmer

AMERICAN INSULATED WIRE CORP., Leviton Mfg. Co., 36 Freeman St., Pawtucket, RI 02862, Tel: 401-726-0700, TWX: 710-384-0150, FAX: 401-723-1420; Empl.: 1300; *Sls. Mgr.:* Gabe Stephen; *Dist. Mgr.:* John Pimental

AMERICAN LASER SYSTEMS, INC., 751 S. Kellogg Ave., Goleta, CA 93117, Tel: 805-967-0423, FAX: 805-683-4382; FSC No.: 5850; Empl.: 4

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FAX: 213-834-0685

AMERICAN MAGNETICS CORPORATION, Group 4, 740 Watsoncenter Rd., Carson, CA 90745, Tel: 213-775-8651, TWX: 910-345-6258; Empl.: 250; *Sls. Mgr.:* Charlotte Williams ..... **D•1079**

AMERICAN MAGNETICS, P.O. Box 49, Carterville, IL 62918, Tel: 618-985-4838, FAX: 618-985-4106; Empl.: 120

AMERICAN MAGNETICS, P.O. Box 2509, Oak Ridge, TN 37831-2509, Tel: 615-482-1056, TELEX: 557-592, FAX: 615-482-5472; Empl.: 30; *Sls. Mgr.:* E. T. Henson

AMERICAN MICROSEMICONDUCTOR, INC., 133 Kings Rd., Madison, NJ 07940, Tel: 201-377-9566, FAX: 201-377-3078; Empl.: 15; *Sls. Mgr.:* W. M. Foley; *Dist. Mgr.:* D. B. Wilson ..... **A•2083**

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AMERICAN MICROWAVE TECHNOLOGY, INC., 3080 Enterprise Street, Suite A, Brea, CA 92621, Tel: 714-993-0802, FAX: 714-993-1619; Empl.: 34; *Sls. Mgr.:* Lowell A. Beezley

AMERICAN MONARCH, 2801-37th Ave., N.E., Minneapolis, MN 55421, Tel: 612-788-9161, FAX: 612-788-2057; FSC No.: 11146; Empl.: 120; *Sls. Mgr.:* Kathleen Varga; *Dist. Mgr.:* Leon Anderson

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American Relays, Inc.

FAX: 213-944-0590

AMERICAN RELAYS, INC., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, Tel: 213-944-0447; FSC No.: 1HY41; Empl.: 45; *Sls. Mgr.:* Richard Lenning ..... **B•1404-1408**

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CA Irvine, Vale Elctrn. Assocs. 714-551-4004
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FL Pompano Bch., Bolton Assocs. 305-975-7245
NY Jericho, J-Square Mktg., Inc. 516-935-3200
OH Cleveland, Components, Inc. 216-243-9200
OH Dayton, Components, Inc. 513-436-0255
OR Tigard, Eltech, Inc. 503-684-3458
WA Bellevue, Eltech, Inc. 206-643-0525

Local Distributors
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FL Ft. Lauderdale, Brothers Elctrns. 305-561-6700
MN Minneapolis, The Bergquist Co. 612-835-2322
NJ East Brunswick, Brothers Elctrns. 201-238-2200

AMERICAN RESEARCH & ENGINEERING, 1500 Executive Dr., Elgin, IL 60123, Tel: 708-888-7245, FAX: 708-888-7094; *Dist. Mgr.:* Nancy Crenshaw

AMERICAN SKYNET ELECTRONIC CO., 1474 Gladding Ct., Milpitas, CA 95035, Tel: 408-945-6355, FAX: 408-945-6357; Empl.: 25

AMERICAN SWITCH CORP., See Mors Components, Inc.

AMERICAN TRANS-COIL CORPORATION, 124-06 101 Ave., P.O.Box 357, Richmond Hill, NY 11419-1410, Tel: 718-441-5207, FAX: 718-441-4930; FSC No.: 18212; Empl.: 45; *Sls. Mgr.:* Walter T. Clancy

AMERICAN TECHNICAL CERAMICS CORPORATION, 1 Norden La., Huntington Sta., NY 11746-2102, Tel: 516-547-5700, TELEX: 825707, FAX: 516-547-5748; FSC No.: 29990;11272-868-73; Empl.: 497; *Sls. Mgr.:* D. Davis, Dir. Sls. & Mktg.

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AMERICAN ULTRAVIOLET, 562 Central Avenue, Murray Hill, NJ 07974, Tel: 908-665-2211, TELEX: 13-9266, FAX: 908-665-9523; Empl.: 26; *Sls. Mgr.:* J. E. Moore; *Dist. Mgr.:* M. C. Stines

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FAX: 714-831-8548

AMERICAN ZETTLER, 75 Columbia, Aliso Viejo, CA 92656, Tel: 714-831-5000, TELEX: 67-8472; Empl.: 200; *Sls. Mgr.:* Fred Harmon ..... **A•2167; B•1410-1413**

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AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Scottsdale, Luscombe Engrg. Co.	602-949-9333
CA	Irvine, Interconn	714-733-1879
CA	Moorpark, Interconn	805-523-1582
CA	Newbury Park, Interconn	805-499-4024
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CA	San Jose, Arnold Tech. Sls., Inc.	408-954-0400
CO	Longmont, Luscombe Engrg. Co.	303-772-3342
CT	Madison, Focus Elctrn. Sls., Inc.	203-245-4314
IA	Cedar Rapids, J.R. Sls. Engrg. Inc.	319-393-2232
FL	Ft. Lauderdale, Synergistic Technlgs., Inc.	305-791-8255
FL	Melbourne, Synergistic Technlgs., Inc.	407-242-9661
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KS	Overland Pk., AME Sls.	913-262-3971
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MA	Taunton, Focus Elctrn. Sls., Inc.	508-824-3840
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NJ	Marlton, Naudain Assocs., Inc.	609-983-5300
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NM	Albuquerque, Thorson Desert States, Inc.	505-293-8555
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NY	Wantagh, R. E. Breuer Co. Inc.	516-783-7307
NC	Raleigh, Benchmark Tech. Sls. Inc.	919-850-0633
OH	Cincinnati, Makin & Assocs.	513-871-2424
OH	Dublin, Makin & Assocs.	614-793-9545
OH	Solon, Makin & Assocs.	216-248-7370
OR	Beaverton, Thorson Co. N.W.	503-644-5900
TX	Irving, AID Elctrns.	214-790-4761
UT	Midvale, Luscombe Engrg. Co.	801-565-9885
WA	Bellevue, Thorson Co. N.W.	206-455-9180
WI	Milwaukee, KMA Sls. Co.	414-259-1771
Can	Burlington, Ont., Alternate Source Comps. Ltd.	416-335-6385

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AL	Huntsville, Electro-Wise	205-721-0773
AZ	Tempe, Acacia Elctrns.	602-894-2874
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CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Monica, Master Distrs.	213-452-1229
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Lakewood, Acacia Elctrns.	303-232-2882
CT	E. Haven, J V Elctrns.	203-469-2321
CT	Wallingford, The Greene-Shaw Co.	203-265-3333
FL	Orlando, Time Elctrns.	407-841-6565
IL	Lisle, Comps., Inc.	708-852-7707
IN	Carmel, Altex Elctrns.	317-848-1323
MD	Jessup, Treeko Sls., Inc.	301-470-3300
MD	Savage, Pyttronic Inds.	301-953-9650
MA	Peabody, Time Elctrns./New Eng.	508-532-6200
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	New Brighton, Chris Elctrns. Distrs.	612-631-2647
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Oakland, Relay Spec.	201-337-1000
NJ	W. Berlin, General Comps., Inc.	609-768-6767
NY	Buffalo, Genesee Indl. Elctrns.	716-873-9661
NY	Farmingdale, Pride Elctrns.	516-293-4020
NC	Raleigh, Resco/Raleigh	919-781-5700
OH	Columbus, Time Elctrns.	614-761-1138
OR	Beaverton, Acacia Sls.	503-646-3377
PA	Montgomeryville, Pyttronics Inds.	215-643-2850
TX	Irving, Cypress Elctrns.	214-255-0065
TX	Richardson, RSC Elctrns.	214-644-3444
WA	Redmond, Time Elctrns.	206-882-1600
WI	Milwaukee, Progressive Image	414-321-4722

AMETEK CONTROLS DIV., Ametek Fiber Optic Products, 820 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-355-6900, TELEX: 29-1769, FAX: 215-355-2937; Empl.: 100; *Sls. Mgr.:* Jon Koval, Bus. Unit Mgr.

AMETEK, INC., Mansfield & Green Div., 8600 Sunset Dr., Largo, FL 34643, Tel: 813-536-7831, FAX: 813-539-6882; Empl.: 120; *Sls. Mgr.:* Gary Queensberry

LAMB ELECTRIC DIVISION, Ametek, Inc., 627 Lake Street, Kent, OH 44240, Tel: 216-673-3451, TELEX: 4332140, FAX: 216-673-8994; Empl.: 1,000; *Sls. Mgr.:* Roger Smith

PROCESS & ANALYTICAL INSTRUMENTS DIV., Ametek, Inc., 150 Freeport Road, Pittsburgh, PA 15238, Tel: 412-828-9040, TELEX: 6714789, FAX: 412-826-0399; Empl.: 110; *Sls. Mgr.:* Jerry Barth

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AMHERST INTERNATIONAL CORP., 540 Commercial St., Manchester, NH 03101, Tel: 603-644-3555, 1-800-547-5600, FAX: 603-644-3550; *Sls. Mgr.:* Brock Putney; *Dist. Mgr.:* Brock Putney

AMILON CORP., 49-12 30th Ave., Woodside, NY 11377, Tel: 718-274-1794, FAX: 718-278-5621; Empl.: 50; *Sls. Mgr.:* L. Rosenblatt

AMITRON
American Micro-Tronix Inc.

FAX: 508-686-0622

AMITRON, American Micro-Tronix, Inc., 85 Flagship Drive, North Andover, MA 01845, Tel: 508-686-1882; *Sls. Mgr.:* Raymond Simione ..... **A•1843**

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AZ	Tempe, Cain Technlg.	602-966-4322
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CA	Orange, Cain Technlg.	714-997-7311
CA	San Jose, Precision Svcs.	408-996-2808
CA	Van Nuys, Cain Technlg.	818-904-9392
CO	Englewood, Cain Technlg.	303-220-8118
CT	Litch Field, Intrade, Inc.	203-567-5901
CT	Wethersfield, Compak, Inc.	203-563-4784
FL	Melbourne Bch., Millett Assocs.	305-725-5055
MD	Columbia, PSA	215-245-0513
MA	Hudson, Compak, Inc.	617-568-0331
PA	Trevose, PSA	609-234-0661
NY	Great Neck, F&F Metro, Inc	516-482-4080
TX	Plano, BK Assocs.	214-437-4153
VA	Lynchburg, PSA	215-245-0513
VA	Oakton, PSA	215-245-0513

Local Distributors

CA	Los Alamitos, Semi- Dice, Inc.	213-594-4631
CA	Santa Clara, Semi-Dice, North	408-980-9777
MA	S. Easton, Semi Dice, Inc.	508-238-8344
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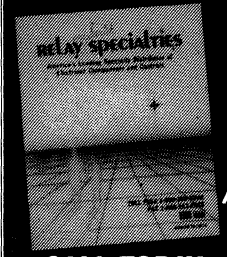
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NC Greenboro, Hammond Elctrns. 919-275-6391
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CO Englewood, Time Elctrns. 303-799-8851
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FL Ft. Lauderdale, Time Elctrns. 305-484-7778
FL Orlando, Hammond Elctrns. 305-849-6362
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GA Atlanta, Electro Air Corp. 404-351-3545
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GA Norcross, TTI, Inc. 404-662-0911
ID Boise, Kimball Elctrns. 208-342-3559
IL Bensenville, Hamilton Avnet Elctrns. 708-860-7780
IL Elmhurst, Semiconductor Spec. 312-279-1000
FL Orlando, TTI, Inc. 407-859-1000
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IN Carmel, Hamilton/Avnet 317-844-9533
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IA Cedar Rapids, Dee Elctrns. 319-365-7551
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MD Columbia, Time Elctrns. 301-964-3090
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MA Andover, Aved Elctrns. 508-688-3800
MA Bedford, Lex Elctrns. 617-275-5100
MA Burlington, QPL Elctrns. 617-229-2424
MA Middleboro, Glynn Elctrns. 508-947-4262
MA Needham, Cronin Elctrns. 617-449-5000
MA Peabody, Hamilton/Avnet Elctrns. 508-532-3701
MA Peabody, Time Elctrns. 508-532-6200
MA Westborough, In Stock Prods. 508-870-5750
MA Wilmington, Heiland Elctrns. 508-657-4870
MA Wilmington, Marshall Inds. 617-658-0810
MA Winchester, Webb Distbn. 617-729-5800
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MI Grandville, Hamilton/Avnet 616-531-0345
MI Livonia, Chelsea Inds. 313-525-1155
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MI Troy, Northern Wire/Cable 313-589-0510
MN Edina, Lex Elctrns. 612-941-5280
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MN Minneapolis, Stark Elctrns. 612-332-1325
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MN Minnetonka, TTI, Inc. 612-933-8555
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MN St. Paul, Gopher Elctrns. Co., Inc. 612-483-3322
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MO St. Charles, Lectronix 314-946-6424
MO St. Louis, Franklin Elctrns. 314-993-5333
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NH Manchester, Cronin Elctrns. 603-624-0105
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NJ Camden, G.R.S. Elctrns., Inc. 609-964-8560
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NJ Pinebrook, Time Elctrns. 201-882-4611
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Hamilton Avnet Elctrns. 505-345-0633
NY Bohemia, March Elctrns., Inc. 516-563-6000
NY East Syracuse, Time Elctrns. 315-432-0355
NY Elmsford, Ancar Elctrns. Supp., Inc. 914-592-7100
NY Farmingdale, Pride Elctrns., Inc. 516-293-4020
NY Hauppage, Marshall Inds. 516-273-2424
NY Hauppauge, Hamilton/Avnet 516-434-7420
NY Hauppauge, Lex Elctrns. 516-231-2500
NY Hauppauge, Time Elctrns. 516-273-0100
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NY Rochester, Hamilton/Avnet 716-475-9130
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NY Rochester, Masline Elctrns., Inc. 716-546-5373
NY Rome, Rome Elctrns., Inc. 315-337-5400
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NC Cary, Powell Elctrns. 919-467-1212
NC Greensboro, Golden Elctrns. 919-294-4653
NC Greensboro, Hammond Elctrns., Inc. 919-275-6391
NC Raleigh, Hamilton Avnet Elctrns. 919-878-0819
NC Raleigh, Marshall 919-878-9882
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Akron, AESCO Elctrns. 216-762-8818
OH Beechwood, Lex Elctrns. 216-464-2970
OH Cincinnati, Schuster Elctrns., Inc. 513-489-1400
OH Columbus, Elctrn. Mktg. Corp. 614-299-4161
OH Columbus, Hughes-Peters 614-294-5351
OH Columbus, Thompson Elctrns. 614-228-6191
OH Dayton, Bell Inds. 513-434-8231
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Hamilton/Avnet 513-439-8700
OH Dayton, Lex Elctrns. 513-439-1800
OH Dayton, Marshall 513-898-4480
OH Dayton, Stotts-Friedman 513-298-5555
OH Dublin, Time Elctrns. 614-761-1100
OH Solon, Hamilton/Avnet 216-349-4910
OH Solon, Marshall Inds. 216-248-1788
OH Solon, Repco Elctrns. 216-248-8900
OH Twinsburg, Schuster Elctrns., Inc. 216-425-8134
OH Westerville, Hamilton/Avnet 614-882-7389
OH Worthington, TTI, Inc. 614-848-5770
OK Oklahoma City, Electro Ent. 405-427-6591
OK Tulsa, Carlton-Bates 918-250-1626
OK Tulsa, Hamilton/Avnet 918-252-7297
OK Tulsa, Marshall Inds. 918-622-7151
OR Beaverton, Hamilton/Avnet 503-526-6200

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PA	Essington, Tri-Com, Inc.	215-521-3080
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PA	Mars, ALMO Elctrns., Inc.	412-776-9090
PA	Philadelphia, Almo Elctrns. Corp.	215-698-4000
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Pittsburgh, Hamilton/Avnet	412-281-4150
PA	Pittsburgh, Marshall Inds.	412-788-0441
PA	Wayne, Peak Elctrns., Corp.	215-293-9000
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TN	Nashville, Carlton-Bates	615-244-3562
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TX	Austin, Kent Elctrns. Corp.	512-834-1900
TX	Austin, Marshall	512-837-1991
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TX	Carrolton, Sterling Elctrns.	713-243-1600
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TX	Dallas, Lex Elctrns.	214-247-6300
TX	Dallas, Wallace Elctrns., Inc.	214-340-0400
TX	El Paso, Ideal Inds. Elctrn. Supp.	915-779-6647
TX	El Paso, Marshall Inds.	915-593-0706
TX	Ft. Worth, Carlton-Bates	817-831-0395
TX	Ft. Worth, TTI Inc.	817-831-8300
TX	Harlington, Marshall Inds.	512-542-4589
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Marshall	713-895-9200
TX	Richardson, Kent Elctrns. Corp.	214-669-2600
TX	Stafford, Hamilton-Avnet Elctrns.	713-240-7733
UT	Salt Lake City, Hamilton Avnet Elctrns.	801-972-4300
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
UT	Salt Lake City, Marshall	801-485-1551
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VA	Richmond, Sterling Elctrns. Corp.	804-226-2190
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WA	Bothell, Marshall Inds.	206-486-5747
WA	Redmond, Hamilton Avnet Elctrns.	206-881-6697
WA	Redmond, Pyramid Elctrns. Supp., Inc.	206-883-7200
WA	Redmond, Time Elctrns.	206-882-1600
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec. Co., Inc.	509-747-3053
WI	Milwaukee, Electronic Expeditors	414-228-8100
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
WI	Oshkosh, Electronic Inds.	414-235-8930
WI	Waukesha, Hamilton/Avnet Elctrns.	414-784-4511
WI	Waukesha, Marshall Inds.	414-797-8400
PR	Rio Piedras, Hamilton/Avnet	809-731-1110

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AMPHENOL, Bendix Connector Operations, 40-60 Delaware St., Sidney, NY 13838, Tel: 607-563-5011, TELEX: 932456, FAX: 607-563-5157; FSC No.: 77820; Empl.: 2500; *Sls. Mgr.:* Chas. Morse; *Dist. Mgr.:* Lew Lafornara

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AMPLIFIER RESEARCH

FAX: 215-723-5688

AMPLIFIER RESEARCH, 160 School House Rd., Souderton, PA 18964-9990, Tel: 215-723-8181, TWX: 510-661-6094; FSC No.: 30639; Empl.: 75; *Sls. Mgr.:* L. Pokorny **D•1002-1003, 1020-1021**

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AZ	Tempe, Mar Tech Assocs.	602-535-4961
CA	N. Hollywood, O'Halloran Assoc.	213-877-0173
CA	San Jose, O'Halloran Assoc.	408-243-1600
CO	Boulder, H. Bass. Assoc.	303-530-7509
CT	Yalesville, Larry Plante	203-269-3360
FL	Davie, W. A. Brown Instrs., Inc.	305-581-6444
FL	Melbourne, W.A. Brown Instrs., Inc.	407-723-0766
FL	Orlando, W.A. Brown Instrs., Inc.	407-648-9660
GA	Atlanta, W. A. Brown Instrs., Inc.	404-449-7160
IL	Park Ridge, Elctrn. Instr. Assocs.	708-298-2290
IN	Indianapolis, Elctrn. Instr. Assocs.	317-257-7231
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
LA	Lockport, Airep Elctrns.	504-693-3666
MD	Severna Park, Round Bay Eng.	301-647-8388
MA	Lexington, R. J. Sickles Assoc.	617-862-5100
MN	Minnetonka, Elctrn. Instr. Assocs.	612-933-7793
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NJ	Ridgefield Pk., Scientific Dvcs.	201-837-1004
NM	Albuquerque, Hewitt & Assocs.	505-299-7746
NY	Rochester, Eastern Sys. of NY	716-292-1460
NC	Cary, W. A. Brown Instrs., Inc.	919-460-1120
OH	Dublin, Micro Sls.	614-792-9117
OK	Tulsa, The Hugh J. Daly Co.	918-494-7711
PA	Philadelphia, R. Meyers Assoc.	215-224-1663
TX	Austin, Airep Elctrns.	512-328-0778
TX	Dallas, Airep Elctrns.	214-349-4360
TX	Houston, Airep Elctrns.	713-343-9611
UT	Bountiful, Herb Bass Assoc.	801-295-7100
WA	Seattle, J. J. Assocs., Inc.	206-246-6619
Can	Quebec, Tekron Communications	514-335-0152

AMPLIFONIX, INC., 2707 Black Lake Place, Philadelphia, PA 19154, Tel: 215-464-4000, FAX: 215-464-4001; FSC No.: 60979; Empl.: 75; *Sls. Mgr.:* Richard P. Dubois; *Dist. Mgr.:* Richard P. Dubois

AMPROBE INSTRUMENT, Core Industries, Inc, 630 Merrick Rd., Lynbrook, NY 11563, Tel: 516-593-5600, FAX: 516-593-5682; Empl.: 200; *Sls. Mgr.:* Duncan Ladd, VP Sls.; *Dist. Mgr.:* W. Eagle

AMPRO COMPUTERS,INC., 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-522-2100, FAX: 408-720-1305; Empl.: 51; *Sls. Mgr.:* Victor Maccharoli/Tim Lavelle/Phyllis Proscia, Sls. Admin.; *Dist. Mgr.:* Paul Getty, VP Sls.

AMPTEK, INC., 6 De Angelo Dr., Bedford, MA 01730, Tel: 617-275-2242, FAX: 617-275-3470; Empl.: 17

AMPTRONIX, INC., P.O. Box 8146, Rowland Heights, CA 91748, Tel: 213-666-1564; *Sls. Mgr.:* Lou Lim; *Dist. Mgr.:* Ching Lim

AMRAD & TRANSCON MFG. CO., Div. of D.J. Assocs., Inc., 8411 South Zero St., Fort Smith, AR 72903-7045, Tel: 501-452-3987, FAX: 501-452-7752; FSC No.: 55943; Empl.: 5; *Sls. Mgr.:* M. P. Beck; *Dist. Mgr.:* M. P. Beck

A M SENSORS, INC., 26 Keewaydin Dr., Unit B, Salem, NH 03079, Tel: 603-898-1543, FAX: 603-898-1638; Empl.: 10; *Sls. Mgr.:* Marc R. Saucier

AMTEK DIGITAL SYSTEMS, INC., See Actek, Inc.

AMUNEAL MANUFACTURING CORP., 4737 Darrah St., Philadelphia, PA 19124, Tel: 215-535-3000, FAX: 215-743-1715; FSC No.: 23740; Empl.: 55; *Sls. Mgr.:* Larry Maltin **C•1687**

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AZ	Phoenix, Shefler-Kahn Co.	602-257-9015
CA	Fremont, William Parks Assoc., Inc.	415-770-9058
CA	La Canada, C.E.M., Inc.	818-790-8358
CA	San Diego, C.E.M., Inc.	619-268-8911
CA	San Diego, C.E.M., Inc.	619-692-3551
CA	Santa Ana, C.E.M., Inc.	714-835-2702
CO	Wheatridge, Waugaman Assocs., Inc.	303-423-1020
CT	Meriden, MPS Elctrns.	203-235-1414
FL	Melbourne, Reynolds & Assocs., Inc.	800-255-1965,407-259-7000
MD	Baltimore, Muncy Sls.	301-484-6376
MA	Norwood, MPS Elctrns.	617-769-8700
NJ	Pennsauken, J.A. Maguire & Co. Inc.	609-665-5136
NM	Albuquerque, Shefler Kahn Co.	505-296-0749
NY	Yonkers, Sonkin Assocs.	914-968-8282
OH	Kettering, F.L.Ohmer & Assoc.	513-434-1454
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IA Cedar Rapids, Advent Elctrns. 800-332-8407
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TX	Richardson, Zeus Comps.	214-783-7010
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WA	Redmond, TTI, Inc.	206-882-0291
Can	Burnaby, B.C., Kaytronics, Inc.	604-294-2000
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ANORAD CORP., 110 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1995, TWX: 510-227-9894, FAX: 516-435-1612; Empl.: 280; *Sls. Mgr.:* Richard Scherer,VP Sls.

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AOFR, INC., 800 E. Campbell, Suite 108, Richardson, TX 75081, Tel: 214-644-1394, FAX: 214-480-9278; Empl.: 50; *Sls. Mgr.:* Dwain Lawhon

A. P. CIRCUIT, 397 Linden St, Brooklyn, NY 11237, Tel: 718-456-2717, TELEX: 428759, FAX: 718-456-2717 ..... **A•1654**

Local Sales Offices & Reps

MI	Southfield, Comtel Instrs.	313-358-2505
NJ	Matawan, Reps Five	201-495-2315
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-298-7573

A.P.C.S. AMERICA, 3286 Kentland Ct. SE, Grand Rapids, MI 49548, Tel: 616-247-1453; Empl.: 13; *Sls. Mgr.:* Julie A. Corby

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FAX: 602-888-3329

APEX MICROTECHNOLOGY CORP., 5980 N. Shannon Rd., Tucson, AZ 85741, Tel: 602-742-8600, TELEX: 170631; FSC No.: 60024; Empl.: 100; *Sls. Mgr.:* Richard Spielman; *Dist. Mgr.:* Bridget Riceci-Byrne, Intl. Sls. Mgr. ..... **D•1005-1007, 1598**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier, Inc.	205-536-1506
AZ	Tucson, Apex Microtechnology	602-742-8600
CA	Laguna Hills, Conprod	714-361-0765
CA	Los Altos, Kolm Mktg.	415-948-2635
CA	Los Altos, KOLM Mktg.	415-948-2635
CT	Guilford, Data Mark Inc.	203-453-0575
MD	Elicott City, Nelson Elctrns.	301-747-7887
GA	Duluth, Currie, Peak & Frazier, Inc.	404-497-9404
IL	Buffalo, Torkelson Assocs.	312-520-0710
IN	Indianapolis, Torkelson Assocs.	317-244-7867
IA	Cedar Rapids, Torkelson Assocs.	319-373-0200
MD	Ellicot City, Nelson Elctrns.	301-747-7887
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	Woburn, Signal Sls. Engrg.	617-938-7872
MN	Minneapolis, Torkelson Assocs.	612-835-2414
NJ	Flanders, K & R Engrg. Sls.	201-584-5235
NC	Greensboro, Currie, Peak & Frazier Inc.	919-373-0380
IN	Fort Wayne, TX Sales	219-489-4447
TX	Dallas, Repmasters	214-247-6236
TX	Sherman, Repmaster	214-247-6236
WI	Waukesha, Torkelson Assocs.	414-784-7736

Local Distributors

AZ	Tuscon, Apex	602-742-8600
FL	Tampa, Currie, Peak & Frazier	813-963-1076
KS	Olathe, Tech Sls. Assoc.	913-829-2800
NY	Southern, K & R Engrg. Sls.	800-631-9362
NY	St. Louis, Tech Sls. Assocs.	314-521-2044
Can	Mississauga, Ont., bbd Elctrns.	416-821-7800

APOLLO DISPLAY TECHNOLOGIES, INC., 182-2 Morris Ave., Holtsville, NY 11742, Tel: 516-654-1143, FAX: 516-654-1496; *Sls. Mgr.:* Richard Eicher ..... **B•1040**

APOLLO MAGNETICS CORP., 2720 W. Beverly Blvd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348, FAX: 213-384-4067; Empl.: 420; *Sls. Mgr.:* Charles Williams

APPLIED COMPONENTS, AC Interface, 22391 Gilberto, Rancho Santa Margarita, CA 92688, Tel: 714-858-9488, FAX: 714-589-7267; FSC No.: 5930; Empl.: 5; *Sls. Mgr.:* Curtis Armijo

APPLIED CONTROLS CO., INC., 1275 Bloomfield Ave., Fairfield, NJ 07004, Tel: 201-227-5454, FAX: 201-882-1422; FSC No.: 4A725; Empl.: 20; *Sls. Mgr.:* W. Merel

APPLIED DATA COMMUNICATIONS, 14272 Chambers Rd., Tustin, CA 92680, Tel: 714-731-9000, TELEX: 183823 ADC, FAX: 714-838-7172; Empl.: 50; *Sls. Mgr.:* David M. Besse

APPLIED DATA SYSTEMS, 409A East Preston St, Baltimore, MD 21202, Tel: 800-541-2003, 410-576-0335, FAX: 410-576-0338; Empl.: 6; *Sls. Mgr.:* Edward Shea; *Dist. Mgr.:* Edward Shea

APPLIED ELECTRO TECHNLG., INTL., See STI-Control Components Div.

APPLIED INFORMATION SYSTEMS, INC., 500 Eastowne Dr., Suite 207, Chapel Hill, NC 27514, Tel: 919-942-7801, 800-334-5510, TELEX: 701365, FAX: 919-493-7563; *Sls. Mgr.:* John Wyatt

APPLIED MAGNETICS, 75 Robin Hill Rd., Goleta, CA 93117, Tel: 805-683-5353, FAX: 805-967-8227; FSC No.: 11935; Empl.: 12,000; *Sls. Mgr.:* O. M. Fundingsland

APPLIED MICRO CIRCUITS CORP., 6195 Lusk Blvd., San Diego, CA 92121, Tel: 619-450-9333, TWX: 910-337-1136,, FAX: 619-450-9885-FAX; FSC No.: 367 4112; Empl.: 235; *Sls. Mgr.:* Greg Barnhart

APPLIED MICROSYSTEMS CORP., 5020 148th Ave NE, Redmond, WA 98052, Tel: 206-882-2000, TELEX: 185196, FAX: 206-883-3049; Empl.: 200; *Sls. Mgr.:* Joe Gomula

APPLIED MICROWAVE DIV. EPSCO, See Epsco Microwave

APPLIED PLASTICS TECHNOLOGY, 45 Broadcommon Rd., Bristol, RI 02809, Tel: 401-253-0200; FSC No.: 9330; Empl.: 30; *Sls. Mgr.:* John A. MacIntyre Jr.

APPLIED POWER CONVERSION

FAX: 201-385-0702

APPLIED POWER CONVERSION, Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 70 ..... **D•1588-1593**

Local Sales Offices & Reps

CA	Escondido, Larry Ford	619-743-1557
CO	Boulder, AS Rep Co.	303-442-8018
CT	Cheshire, Scientific Comps.	203-272-2963
FL	Land O'Lakes, A J Power Source	813-996-2583
MO	St. Louis, Abrams & Assocs.	314-569-0447
NH	Salem, Integrated Technlg.	603-898-6333
NM	Albuquerque, IMEC	505-275-0936
NY	Rochester, A.J. Electro Mktg.	716-426-3598
PA	West Chester, TCA Inc.	215-692-6853
TX	Garland, Carey McMahill	214-681-1414
WA	Edmonds, Power Sources	206-743-6641
Can	Rexdale, Ont., QPL Elctrns.	416-674-8858

APPLIED REASONING CORP., 86A Sherman St., Cambridge, MA 02140, Tel: 617-492-0700, TELEX: 6714194, FAX: 617-492-7908; *Sls. Mgr.:* Paul Blumeufeld

APPLIED SOFTWARE TECH., INC., 1908 Cliff Valley Way, N.E., Atlanta, GA 30329, Tel: 404-663-8660; Empl.: 29; *Sls. Mgr.:* Jim A. Moss

APPLIED STATISTICS INC., 3080 Centerville Rd., St. Paul, MN 55117, Tel: 612-481-0202, FAX: 612-481-0410; Empl.: 25

APPROVED PURIFICATION CORP., 1088 R Hope St., Stamford, CT 06907, Tel: 203-357-0141, FAX: 203-356-1697 ..... **B•1878**

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APS DYNAMICS, INC., 5731 Palmer Way, Ste. A, Carlsbad, CA 92008, Tel: 619-438-4848, TELEX: 4995113 (SHAKE), FAX: 619-438-8845; Empl.: 5

APTEK TECHNOLOGIES, INC., Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33442, Tel: 305-421-8450, TELEX: 441020, FAX: 305-421-8044; FSC No.: 36741; Empl.: 150; *Sls. Mgr.:* Jerry D. Moore, Dir. Mktg./ Sls.; *Dist. Mgr.:* D.L. Gilley, Sr.

A.P.W. CO., INC., 72 W. Main, Rockaway, NJ 07866, Tel: 201-627-0643, FAX: 201-627-6396; Empl.: 14

apx

FAX: 516-433-1457

APX-ARSTAN PRODUCTS, 264 Duffy Ave., Hicksville, NY 11801, Tel: 516-433-1313; Empl.: 300; *Sls. Mgr.:* David Baum ..... **A•2168-2169; D•1594-1597**

Local Sales Offices & Reps

CA	Santa Clara, Source Tronics	408-988-8801
FL	Dunedin, John White Assoc.	813-733-5319
MA	Framingham, Bob Mirabella	617-877-0884
MA	Wellesley, Brownstone Assoc.	508-877-0884
MN	Golden Valley, Highland	612-546-2123
NM	Albuquerque, Syntech	505-266-7951
NY	Hauppauge, Sticom Sls.	516-366-4221
MO	Independence, Hitec Central	816-796-6684
NC	Raleigh, C-Tech	919-782-8100
TX	Richardson, John Duncan Assoc.	214-437-3967
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WA	Vancouver, Elctrn. Mktg. Grp.	503-684-5935

Local Distributors

NC	Raleigh, Century Elctrns.	919-872-2203
PA	Norristown, Century Elctrns.	215-631-5400

AQUALARM, Marine Safety Systems, Inc., 1151 D. Bay Blvd., Chula Vista, CA 91911, Tel: 619-575-4011, FAX: 619-575-4012; FSC No.: 2V373; Empl.: 8; *Sls. Mgr.:* John L. Hooper

ARCO ELECTRONICS, 9822 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8707, FAX: 818-882-6513; FSC No.: 84171; Empl.: 10; *Sls. Mgr.:* Randy Ryan ..... **A•1655-1657**

Local Sales Offices & Reps

CA	Chatsworth, Arco	818-882-8707
IN	Granger, Gregory Sls.	219-272-9629
MA	Taunton, Focus Elctrn. Sls.	617-824-3840
MN	St. Paul, Northport Eng.	612-457-8000
NY	Syracuse, Py'Tronics	315-454-9346
CA	Chatsworth, Arco Elctrns.	818-882-8707

ARCOLECTRIC CORP., 9001 Canoga Ave., Canoga Park, CA 91304, Tel: 818-700-1933, FAX: 818-700-9541; *Sls. Mgr.:* Carrie Donze; *Dist. Mgr.:* Carrie Donze ..... **B•1141, 1648**

Local Distributors

CA	Haywood, Electro Comps.	415-783-5800
FL	Lakeland, Wesgarde	813-644-7564
CA	Los Angeles, Electric Switches	800-252-4640, 800-421-8855
CA	Tustin, Western Switches	213-627-6126
CA	Van Nuys, Wesgarde Comp.	818-786-3724
CT	Hartford, Wesgarde Comp.	203-527-7705
IL	Carol Stream, Wesgarde Comp.	708-653-1460
KS	Overland Park, Wesgarde Comp.	913-262-2718
MD	W. Springfield, T. F. Cushing	413-788-7341
MI	Madison Hts., Galco Ind.	313-542-9090
MN	Minneapolis, Scorpio	612-473-8656
MO	St. Louis, Wesgarde Comp.	314-567-7776
NH	Nashua, Wesgarde Comp.	603-880-1971
NJ	Denville, Lashen Elctrns.	201-627-3783,
NJ	Mt. Laurel, Wesgarde Comp.	609-778-8190
OH	Westerville, Wesgarde Comp.	614-885-0319
OR	Eugene, Larsco	503-484-7491
TX	Dallas, Wesgarde Comp.	214-357-1768
TX	Garland, Barcon	214-414-1863

ARC SYSTEMS, INC., 2090 Joshuas Path, Hauppauge, NY 11788, Tel: 516-582-8020, FAX: 516-582-8038; FSC No.: 67245; *Sls. Mgr.:* Robert Miller

AREMCO PRODUCTS, INC., Box 429, Ossining, NY 10562, Tel: 914-762-0685, FAX: 914-762-1663; Empl.: 30; *Sls. Mgr.:* Brian Miles

A.R.F. PRODS., 2559 75th St., Boulder, CO 80301, Tel: 303-443-4844, FAX: 303-443-4846; FSC No.: 4G971; Empl.: 10

ARGA CONTROLS, 35 E. Glenarm St., Pasadena, CA 91105, Tel: 213-682-3314, FAX: 818-799-9407; FSC No.: 50290; Empl.: 25; *Sls. Mgr.:* Linda Galman

ARGO ELECTRONICS, INC., 5054 Bleecker St., Baldwin Park, CA 91706, Tel: 818-962-8422, FAX: 818-960-7312; Empl.: 12

ARGOS PRODS., 600 S. Sycamore St., Genoa, IL 60135, Tel: 815-784-5118; Empl.: 35; *Sls. Mgr.:* Ron Evers

Local Sales Offices & Reps

CA	Burlingame, Meyer, Ross & Fleming	415-348-6800
FL	Ocala, Bencsik Assoc.	904-732-9775
GA	Atlanta, Murphy & Cota	404-875-2525
IL	Arlington Hgts., Arch Hoyne	708-398-1681
IN	Mulberry, Maish Sls.	317-296-2322
MA	North Scituate, W.A. Hendrickson	617-545-0652
MN	Edina, Foster Tech. Sls.	612-941-9800
MO	Kansas City, Nevco	816-421-1751
NJ	Fort Lee, TMC Sls.	201-944-5665
NY	Syracuse, Lewis & Dunnigan	315-446-5522
OH	Dayton, Shamrock Elctrn	513-258-1227
PA	Wynnewood, Stinson Assocs.	215-896-7378
WA	Lynnwood, Pacnor Mktg.	206-284-8020
EXP	N.Y., New York, Roburn Agencies	212-989-5939

ARGO TRANSDATA CORP., 1 Heritage Pk., Clinton, CT 06413-0554, Tel: 203-669-2233, FAX: 203-669-4316; Empl.: 20

ARIEL CORPORATION, 433 River Rd., Highland Pk., NJ 08904, Tel: 908-249-2900, FAX: 908-249-2123; *Sls. Mgr.:* Irene Getvay

ARIES ELECTRONICS, INC.

FAX: 908-996-3891

ARIES ELECTRONICS, Box 130, Frenchtown, NJ 08825, Tel: 908-996-6841; FSC No.: 51167; Empl.: 160; *Sls. Mgr.:* Frank Folmsbee ..... **A•1722; B•1649; C•1281-1288**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Fountain Hills, Contact Aries Elctrns.	908-996-6841
CA	San Mateo, Larsen Assoc.	415-358-9559
CA	Westlake Vlg., Elkins & Assoc.	818-597-1075
CO	Denver, West Inc.	303-477-8180
FL	Melbourne, The R-Rep Co.	407-242-9800
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Bloomingdale, Orion Mktg.	708-893-2111
WI	Hartland, Selective Sls.	414-367-1133
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
MD	Glen Burnie, Macrotech Assoc. Ltd.	301-766-1111
MA	Harvard, Enterprise Tech.	508-772-6003
MI	Novi, I.E. Hampton & Assoc.	313-344-8860
MI	St.Joseph, I.E. Hampton & Assoc.	616-938-0862
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co.	816-436-6445
NJ	Ho-Ho-Kus, DJ Fisher Co.	201-652-0080
NY	Fairport, TAC Sls., Inc.	716-377-2250
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OH	Willoughby Hills, Versatron	216-944-0082
OR	Hillsboro, Doran Sls. Assocs.	503-640-4500
PA	Harrisburg, All-Tech Mktg.	717-540-1204
PA	West Chester, All-Tech Mktg.	215-344-0134
TX	Dallas, REM Comps.	214-234-1069
TX	Houston, REM Comps.	713-589-9721
WA	Redmond, Doran Sls. Assocs.	206-885-1885

Local Distributors

AL	Huntsville, Comp. Dist.	205-883-7501
AL	Huntsville, Gateway Megatech	205-830-5955
AL	Huntsville, Gateway MegaTech.	205-830-5955
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Dalis	602-275-2626
CA	Canoga Park, Timco Comps.	818-992-5040
CA	Compton, Harper SID	213-979-5090
CA	Fremont, Frys Elctrns.	415-770-3743
CA	Gardena, Cal, Switch & Signal	213-770-2330
CA	Irvine, IEC	714-837-9960
CA	Sacramento, IEC	916-363-6030
CA	San Diego, Harper SID	619-578-2500
CA	San Francisco, Peters De Laet	415-873-9595
CA	San Jose, Harper SID	408-943-9490
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Sunnyvale, Fry's Elect.	408-733-1770
CA	Sunnyvale, Frys Elctrns.	408-733-1770

CA	Torrance, Pyramid/Kent	714-773-0781
CO	Denver, I.E.C.	303-292-6121
CO	Englewood, Component Dist.	303-799-4915
CO	Englewood, Indelco	303-694-9444
CT	Danbury, Pilgrim	203-792-7274
CT	Wallingford, Cronin	203-265-3134
FL	Ft. Lauderdale, KSM	305-971-5900
FL	Melbourne, CDI	407-724-9910
FL	Pompano Bch., Peerless Radio	305-973-4141
GA	Atlanta, Gateway Megatech	404-497-0799
GA	Atlanta, KSM	800-554-9227
ID	Boise, Kimball	208-342-3559
IL	Hoffamn Estates, IEC	708-843-2040
IL	Northbrook, Classic	312-272-9650
CT	Norwalk, Cobra Comps.	203-847-6442
IN	Indianapolis, Gateway Megatech	317-844-3906
IN	Indianapolis, Meunier	317-635-3511
MD	Baltimore, Resco	301-529-0500
MD	Beltsville, Resco Washington	301-937-9100
MD	Columbia, Peerless Radio	301-997-1717
MD	Jessup, Gateway MegaTech	301-792-7527
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Ann Arbor, Gateway Megatech	313-761-2980
MI	Grand Rapids, Calder Elect.	616-698-7400
MI	Southfield, Michigan Lectrols	313-353-1350
MN	Minneapolis, Bergquist Elect.	612-835-2322
MN	New Brighton, Chris	612-631-2647
MO	St. Louis, Beckwith Computer	314-343-6463
NH	Manchester, Cronin	603-624-0105
NH	Manchester, Glynn	603-622-8131
NJ	Lynbrook, NY, Peerless Radio	201-906-1181
NJ	Moorestown, Marlac Elect	609-234-4200
NM	Albuquerque, International Elect.	505-291-9951
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Cary, Powell Elctrns.	919-467-1212
OH	Columbus, Gateway Megatech	614-447-0222
OH	Dayton, Gateway Megatech	513-298-6342
OH	Warren, REM Elctrns.	216-373-1300
OH	Willoughby, Gateway Megatech	216-953-0333
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, IEC	503-641-1690
PA	Bristol, AIM Elect.	215-785-3500
PA	Erie, REM Elect	814-453-5626
PA	N. Versailes, CMD Elctrns.	412-678-6020
TX	Addison, Connec-Tek	214-245-1266
TX	Austin, Wofford	512-339-1131
TX	Dallas, Wofford	214-320-0294
TX	El Paso, International	915-598-3406
TX	Houston, Altair Co.	713-462-3029
TX	Houston, Wofford	713-847-3583
TX	Irving, Harper SID	214-621-0500
TX	Richardson, Altair Co.	214-231-5155
UT	Salt Lake City, Kimball	801-328-2075
UT	West Valley, IEC	801-977-9750
WA	Bellevue, IEC	206-455-2727
WA	Redmond, Pacific	206-881-2363
WA	Redmond, Pyramid	206-883-7200
WA	Tukwilla, Carlyle	206-251-0700
WI	Milwaukee, Progressive	414-321-4722
WI	New Berlin, Classic Comps.	414-786-5300
Can	Toronto, Alternate Source	416-335-6385
Can	Toronto, SEMAD	416-475-8500
Can	Vancouver, Deskin Sls.	604-273-4983

ARI INDUSTRIES, INC., 381 ARi Court, Addison, IL 60101, Tel: 708-953-9100, 800-237-6725, FAX: 708-953-0590; FSC No.: 04849; Empl.: 56; *Sls. Mgr.:* D. J. MacKenzie; *Dist. Mgr.:* D. J. MacKenzie

ARISTO GRID LAMP PRODS., 35 Lumber Road, Roslyn, NY 11576, Tel: 516-484-6141, FAX: 516-484-6992; Empl.: 21

ARIUM CORPORATION, 1931 Wright Circle, Anaheim, CA 92806-6052, Tel: 714-978-9531, TELEX: 754903 ARIUM UD, FAX: 714-978-3341; Empl.: 40; *Sls. Mgr.:* Dave Blakemore

ARKAY ENGRAVERS, INC., 10-3 Drew Court, Ronkonkoma, NY 11779, Tel: 516-467-7795, FAX: 516-467-8310; FSC No.: 6Z099; *Sls. Mgr.:* Kenneth Kaplan

ARK ELCTRNS. CORP., 1325 Industrial Hwy., Southampton, PA 18966, Tel: 215-322-6510, FAX: 215-322-4231; Empl.: 20

ARK LES CORPORATION, 51 Water St, Watertown, MA 02172, Tel: 617-924-2330, TELEX: 24-4659, FAX: 617-924-5460; Empl.: 600; *Sls. Mgr.:* Ted Devnew

ARK-LES CORP, P.O.BOX 14466, Raleigh, NC 27620, Tel: 919-231-2000, FAX: 919-231-9825; Empl.: 350

ARLON, Flexible Technologies Division, P.O. Box 4305, 199 Awarial St., E. Providence, RI 02914, Tel: 401-434-2340, 1-800-735-2340, TELEX: 6972602, FAX: 401-434-2557; Empl.: 60; *Sls. Mgr.:* Herbert A. Howard; *Dist. Mgr.:* William Pollock

ARMBAR INDUSTRIES INCORPORATED

FAX: 908-679-3222

ARMBAR INDUSTRIES, INC., 139 White Oak Lane, Old Bridge, NJ 08857, Tel: 908-679-3377; FSC No.: 2R610; Empl.: 11; *Sls. Mgr.:* Stephen Gregg ..... **A•1011**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Prods.	205-880-1156
MD	Potomac, C.E. Tech. Elctrns.	301-235-1942
MA	Lowell, Underwood Sls.	617-256-8191
MO	Grandview, R. R. Burton Assocs.	816-763-5385
NJ	Brielle, EMC Technlgsts.	908-223-6699
PA	Saegertown, Multi-Phase	814-763-3640
TX	Dallas, Blackburn Assocs.	214-750-8484

ARMEL ELECTRONICS, 1601 75th St., N. Bergen, NJ 07047, Tel: 201-869-4201, TWX: 710-992-8842, FAX: 201-869-4304; FSC No.: 91663; Empl.: 55; *Sls. Mgr.:* V. A. Pasqualino

ARNOLD ENGINEERING COMPANY, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152, Tel: 815-568-2000, FAX: 815-568-2228; Empl.: 650; *Sls. Mgr.:* E. F. Migely, V.P. Mktg./Sls.

ARNOLD MAGNETICS

FAX: 805-484-4113

ARNOLD MAGNETICS, 4000 Via Pescador, Camarillo, CA 93012, Tel: 805-484-4221, TWX: 910-343-6468; FSC No.: 04879; Empl.: 130; *Sls. Mgr.:* Glen Underwood ..... **D•1599-1603**

Local Sales Offices & Reps

AL	Huntsville, Arnold Magnetics Corp.	800-421-8181
AZ	Phoenix, Arnold Magnetics Corp.	800-421-8181
CA	Los Angeles, Arnold Magnetics Corp.	805-484-4221
CA	San Jose, Stout Inds.	408-746-0470
CO	Denver, Arnold Magnetics Corp.	800-421-8181
FL	Melbourne, Arnold Magnetics Corp.	800-421-8181
GA	Atlanta, Arnold Magnetics Corp.	800-421-8181
IL	Chicago, Arnold Magnetics	800-421-8181
MD	Silver Springs, Youth Assocs.	301-598-5740
MA	Wayland, High-Tech	508-653-3838
MN	Minneapolis, Arnold Magnetics Corp.	800-421-8181
MO	St. Louis, Arnold Magnetics	800-421-8181
NY	Buffalo, Arnold Magnetics	800-421-8181
NY	New Rochelle, Ascor Elctrns.	914-235-8838
OH	Cleveland, Arnold Magnetics	800-421-8181
OH	Dayton, Arnold Magnetics	800-421-8181
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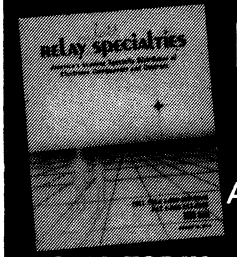
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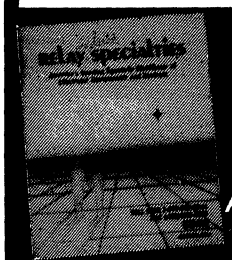
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CA	San Diego, SC Cubed	619-458-5808, FAX:619-458-5823
CA	Thousand Oaks, SC Cubed	805-496-7307, FAX:805-495-3601
CA	Tustin, SC Cubed	714-731-9206, FAX:714-731-7801
CO	Englewood, Omega Ltd.	303-762-1921, FAX:303-762-1928
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IL	Downers Grove, Rockford Controls	312-960-2046
IN	Indianapolis, Luebbe Sls.	317-845-7389
IN	Indianapolis, Luebbe Sls. Co.	317-845-7387
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Leawood, Dy-Tronix	913-339-6333
KS	Wichita, Dy-Tronix	316-838-0884
MA	Sharon, Augat Sls.	617-784-7766
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Minneapolis, H.M.R.	612-888-2122
MN	St. Paul, Count/Man Assoc.	612-645-9151
MO	Bridgeton, Dy-Tronix	314-291-4777
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NY	Yonkers, Sonkin Assoc.	914-968-8282
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Charlotte, Quantum Mktg.	704-523-8828
NC	Kernersville, Wallace Elect. Sls.	919-996-2742
NC	Raleigh, Quantum Mktg.	919-846-5728
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Dayton, Luebbe Sls.	513-294-0426
NH	Manchester, Augat Sls.	603-647-7276
OH	Westlake, Luebbe Sls.	216-899-0070
OR	Beaverton, J.J. Backer Co.	503-627-0775
PA	Pittsburgh, Luebbe Sls.	412-364-0490
TN	Greenville, Interep Assoc.	615-639-3491
TN	Murfeesboro, Alpha Mktg.	615-896-6102
TN	Oakridge, Alpha Mktg.	615-482-4681
TX	Austin, Augut Sls.	512-272-9060
TX	Dallas, Augat Sls.	214-788-4211
TX	Houston, Augat Sls.	713-781-9343
UT	Salt Lake City, Butterworth Mktg.	801-972-5566
VA	Charlottesville, Trinkle Sls. Inc.	609-795-4200
WA	Seattle, J.J. Backer Co.	206-285-1300
WI	Madison, Rockford Controls	608-223-8750
PR	Rio Piedras, DK Mktg.	809-765-5380
Can	Mississauga, Ont., Augat Elctrns. Inc.	416-677-1500

Local Distributors

CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Gardenia, Calswitch	213-770-2330
CA	San Jose, Capstone	408-453-9804
CA	Sunnyvale, Abacus	408-732-2000
CA	Sunnyvale, Time Elctrns.	408-734-9888
CT	Wallingford, Sager Elec.	203-265-4600
FL	Orlando, Sager Elec.	407-240-3114
FL	Orlando, Time Elctrns.	407-841-6565
IL	Addison, Pioneer	312-495-9680
IL	Bensenville, Hamilton/Avnet Elctrns.	312-860-7700
IL	Itasca, Capstone	708-250-0200
IL	Shaumburg, Time Elctrns.	708-303-3900
MD	Columbia, Sager Elec. Supp.	301-995-6580
MA	Hingham, Sager Elec.	617-749-6700
MA	Lexington, Pioneer	617-861-9200
MA	Peabody, Hamilton/Avnet Elctrns.	508-531-7430
MA	Wilmington, Capstone	508-657-5874
MA	Woburn, Sterling Elctrns.	617-938-6200
NH	Salem, Sager Elec.	603-898-1348
NJ	Cherry Hill, Hamilton/Avnet Elctrns.	609-424-0100
NY	E. Syracuse, Time Elctrns.	315-432-0555
NY	Hauppauge, Sager Elec.	516-348-1300
NY	Hauppauge, Time Elctrns.	516-273-0100
NC	Raleigh, Sager Elec. Supp.	919-850-9550
PA	Mars, Sager Elec. Supp.	412-772-2233
PA	Philadelphia, Sager Elec. Supp.	215-464-4336
TX	Austin, Hamilton/Avnet Elctrns.	512-837-8911
TX	Austin, Time Elctrns.	512-339-3054
TX	Carrollton, Capstone	214-347-4301

Components

MA	Norwood, Gerber Elect.	617-769-6000
MA	Peabody, Time Elect.	508-532-6200
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, Milgray Elect.	516-420-9800
NY	Melville, Capstone Elec.	516-391-1300
OH	Cleveland, Pioneer Technlgs.	216-587-3600
TX	Houston, Sterling Elect.	713-623-6600

Systems

CA	Monrovia, Erik-A Elect	213-574-1020
IN	Indianapolis, Bell Inds./Graham Div.	317-634-8202
IA	Cedar Rapids, Deeco Inc.	319-365-7551
NY	Bohemia, Car-Lac Elect	516-567-4200
TX	El Paso, Ideal Elect	915-779-6647

Test Probes and Fixtures

AZ	Tempe, D.C. Elect Supp.	602-438-1234
CA	Costa Mesa, Hamilton Electro Sls.	714-641-1850
CA	Santa Clara, D.C. Elect. Supp.	408-980-1199
CA	Tustin, DC Elect Supp.	714-259-9066
IL	Addison, Pioneer	312-495-9680
IL	Chicago, Newark Elect	312-784-5100
MA	Waltham, Vector Sls.	617-893-7780
NJ	Union, Meridian Supp. Co.	800-648-8378, 201-687-6220
OR	Beaverton, Comp. Resources	503-641-8488
TX	El Paso, REM Elect. Supp.	915-778-7333
TX	Houston, Arrow Elctrns.	713-530-4700
WA	Redmond, Comp. Resources	206-454-8666

Test Probes and Fixtures

CT	Wallingford, Arrow Elctrns.	203-265-7741
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Altamonte Springs, Pioneer/Technlgs.	305-834-9090
FL	Winter Pk., Hamilton/Avnet Elctrns.	305-628-3888
FL	Winter Pk., Milgray/Florida	305-647-5747

AUGAT/PYLON CO., INC., P.O. Box 2510, Attleboro Falls, MA 02763, Tel: 508-699-9800, TELEX: 948095; Empl.: 400; *Sls. Mgr.:* Gillis Mellon

AUGAT/RDI, 525 Randy Rd., Carol Stream, IL 60188, Tel: 708-682-4100, FAX: 708-682-4562; FSC No.: 53337; Empl.: 85; *Sls. Mgr.:* Jim Steranko, Mktg. Mgr.; *Dist. Mgr.:* Jim Steranko, Mktg. Mgr.

FAX: 612-493-1911

AULT, INCORPORATED, 7300 Boone Ave. N, Minneapolis, MN 55428, Tel: 612-493-1900; Empl.: 300; *Sls. Mgr.:* Greg Harris ..... **D•1618-1619**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	Santa Clara, Magna Sls.	408-727-8753
CT	Wallingford, Marathon Sls., LTD	203-663-2734
FL	Deerfield Bch., Sls. Engrg. Concepts Inc.	305-426-4601
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Itasca, MSI	708-285-1000
IA	Des Moines, Beams Co.	515-255-1148
KS	Shawnee Mission, Beams Co.	913-631-0300
MA	Framingham, Marathon Sls., LTD	508-875-3566
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Minneapolis, Cahill, Schmitz & Cahill	612-646-7217
MO	St. Louis, Beams Co.	314-434-8448
NJ	Fairfield, T.A.M.	201-575-4130
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Portland, Jas. J. Backer Co.	503-627-0775
PA	Philadelphia, All-Tech Mktg.	717-540-1204
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Seattle, Jas. J. Backer Co.	206-285-1300
Can	Toronto, Deskin Sls.	416-475-1412

Local Distributors

Can	Markham, Deskin Sls.	416-475-1412
CA	Van Nuys, Natl. Electro Sls. Corp.	800-423-2664
CO	Littleton, Lange Sls.	303-795-3600
MA	Sharon, Adcour	617-784-8123
MO	St. Charles, Finnigan Elctrns.	314-946-6201
OH	Cincinnati, Hughes Peters	513-351-2000
TX	Fort Worth, Allied Elctrns.	800-433-5700
UT	Salt Lake City, Std. Supp. Co.	801-453-3371
WA	Seattle, Radar Elec.	206-282-2511
Can	St. Laurent, Que., Tech-Rep Elctrns., Ltd.	514-331-2860

AURIC CORP., 470 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4100, FAX: 201-242-5796; Empl.: 60; *Sls. Mgr.:* Michael Aleksinas

AUSTRIA MIKRO SYSTEME INTERNATIONAL, Schloss Premstaetten, Unterpremstaetten, Austria A-8141, Tel: (03136) 36 66-0, TELEX: 312547 AMS A, FAX: (03136) 2501, 3650; Empl.: 550; *Sls. Mgr.:* Mr. Wilfried Beie

AUSTRON, INC., See FTS Austron

AUTEC POWER SYSTEMS, 9301-101 Jordan Ave., Chatsworth, CA 91311, Tel: 818-341-6123, FAX: 818-341-5726; Empl.: 100; *Sls. Mgr.:* Jeanne Hirsch ..... **D•1620-1624**

Local Sales Offices & Reps

CA	Los Alamitos, Power Specialists, Inc.	213-594-9418
Can	Etobicoke, Ont., Canadian Mktg. Technlg.	416-740-4005
Can	Pointe Claire, Que., Canadian Mktg. Technlg.	514-694-6088

AUTOMATED PRODUCTION CONCEPTS, 63 Hillside Terrace, Wayne, NJ 07470, Tel: 201-831-8300, FAX: 201-633-7755; Empl.: 4

AUTOMATED PROD. EQUIP. CORP., 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1197, TWX: 510-228-2120, FAX: 516-289-4735; FSC No.: 57216; *Sls. Mgr.:* Arthur Ayala

AUTOMATIC COIL CORP., A DSG Company, 3545 N.W. 71st Street, Miami, FL 33147, Tel: 305-696-6660, FAX: 305-696-0626; FSC No.: 03765; Empl.: 245; *Sls. Mgr.:* Roger Millheim .. **A•1159-1163, 1495-1498, 2174**

Local Sales Offices & Reps

AL	Huntsville, Mountain Electro Mktg.	205-881-3937
CA	San Clemente, Com-Star	714-498-8722
CT	Glastonbury, Liberty Electro.	203-657-8023
FL	Spring Hill, Mountain Electro Mktg.	813-996-7653
GA	Norcross, Mountain Electro Mktg.	404-448-5594
IN	Indianapolis, Joe Keith	317-856-3619
KS	Kansas City, Hitec Central	816-796-6684
MA	Topsfield, Liberty Electro.	508-887-6655
MO	Bridgeton, Hitec Central	314-291-5920
MO	Bridgeton, HiTec Central	314-291-5920
NJ	Cherry Hill, Vantage Sls. Co.	609-424-6777
NJ	S.Orange, Kahgan Brody Assoc.	201-763-6038
NY	Hempstead, Kahgan Brody Assoc.	516-538-2300
TX	Plano, Corwin Assoc. Inc.	214-424-8333
NC	Raleigh, Mountain Electro Mktg.	919-878-8606
OK	Brethany, Design Mktg.	405-789-5911
PA	Pittsburgh, Catalyst Sls., Inc.	412-826-3434

AUTOMATIC SWITCH CO., 50-60 Hanover Road, Florham Park, NJ 07932, Tel: 1-201-966-2000, TELEX: 136422, FAX: 1-201-966-2628; Empl.: 1,200; *Sls. Mgr.:* Wayne Bouchard

AUTOMATIC SYSTEMS DEVELOPERS, P.O. Box 3210, Industry St., Poughkeepsie, NY 12603, Tel: 914-473-5530, FAX: 914-454-2538; Empl.: 650; *Sls. Mgr.:* Stanley Bachman

AUTOMATIC TIMING & CONTROLS CO., 201 So. Gulph Rd., King of Prussia, PA 19406, Tel: 215-337-5500, 800-441-8245, TELEX: 84-6437; Empl.: 300; *Sls. Mgr.:* R. L. Swanson ..... **D•1129**

Local Sales Offices & Reps

AZ	Chandler, Automation West	602-940-0884
CA	Gardena, Instrument Lab.	213-327-3282
CA	San Francisco, Instr. Lab	408-434-0160
CO	Englewood, E & M Sls.	303-761-6202
FL	Lakeland, A.A. Elec. Div.	813-665-6941
GA	Norcross, A.A.Electric Div. of AEC	404-449-8670
IL	Downers Grove, Rockford Controls	708-960-2046
KY	Louisville, Air-Hydro Power	502-451-1000
LA	New Orleans, Mid South Sls.	504-641-7480
MD	Baltimore, Jobe & Co.	301-288-0560
MA	Hingham, Hingham Bay Corp.	617-740-1900
MI	Brighton, H. H. Barnum Co.	313-229-2961
MN	Minneapolis, Daniel J. Minor Co.	612-885-0622
MO	Salina, Kriz Davis Co.	913-827-4497
MO	St. Louis, E. Mooney Co.	314-878-9910
NE	Omaha, Lakeland Engrg. Equipt.	402-734-2600
NJ	Newark, ATC	201-278-1121
NM	Albuquerque, E & M Sls.	505-883-8955
NY	Buffalo, Niagara Electric Sls.	716-825-3100
NY	Rochester, Niagara Electric Sls.	716-272-9150
NY	Syracuse, Niagara Elec. Sls.	315-437-1656
NC	Charlotte, Brown & Morrison	704-554-8570
OH	Cincinnati, Anderson-Bolds	513-528-5680
OH	Cleveland, Anderson-Bolds	216-360-9800
OK	Tulsa, Driscoll Auto. Control	918-663-6625
OR	Portland, Coons Western	503-295-0411
PA	King of Prussia, Applied Controls	215-265-3832
PA	Pittsburgh, Gilson Engrg. Sls.	412-369-0100
TX	Houston, GEA of Texas	713-781-3005
UT	Salt Lake City, Control Equip.	801-487-7741
VA	Richmond, Jobe & Co.	804-672-6508
WA	Everett, T&T Instr. Co.	206-742-9833
WI	Cedarburg, Automation Engrg.	414-377-7500

AUTOMATION DISPLAYS INC., 3533 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-9595, FAX: 715-834-9596; Empl.: 21

AUTOMATION ELCTRNS., R.J.A. Inds., Inc., 9640 Topanga Cyn Pl. Bldg. J, Chatsworth, CA 91311, Tel: 818-998-5124, FAX: 818-998-6654; Empl.: 25; *Sls. Mgr.:* Robert J. Aiani

AUTOMATION PRODS., INC., 3030 Max Roy, Houston, TX 77008, Tel: 713-869-0361, TELEX: 775-959, FAX: 713-869-7332

AUTOMATIX INC., 755 Middlesex Turnpike, Billerica, MA 01821, Tel: 506-667-7900, FAX: 508-663-5482; Empl.: 92; *Sls. Mgr.:* Peter Mayek, Dir. of Sls.

AUTOMOTION, INC., 683 Airport Blvd., Ann Arbor, MI 48108, Tel: 313-662-7771, FAX: 313-662-3707; Empl.: 25; *Sls. Mgr.:* David E. Drenning ..... **B•1245**

Local Sales Offices & Reps

CA	Laguna Hills, South Rep	714-951-1084
CT	Seymour, Sturdy Corp.	203-888-1480
FL	Ft. Lauderdale, Motion Controls, Inc.	305-434-5682
MA	Wellesley Hills, Sturdy Corp.	617-235-2330
MN	Little Canada, Assured Sls.	612-482-1309
NH	Derry, Sturdy Corp.	603-434-8440
KS	Shawnee Mission, J.F. Gleeson & Assoc.	913-362-4422
NY	Sidney, Charles Co.	607-563-8064
MO	Florissant, J.F. Gleeson & Assoc.	314-921-8446
OR	Portland, Controltek, Inc.	503-641-0876
PA	Wexford, Intek Sys.	412-935-0440
TX	Richardson, Control Dynamics	214-644-6945
WA	Spokane, Controltek, Inc.	509-922-2971

AUTOROLL MACHINE CORPORATION, 11 River St., Middleton, MA 01949, Tel: 508-777-2160, TELEX: 940250, FAX: 508-777-9453; Empl.: 120

AUTOSPLICE, INC., 10121 Barnes Canyon Rd., San Diego, CA 92121, Tel: 619-535-0077, FAX: 619-535-0130; Empl.: 197; *Sls. Mgr.:* Ken Krone

AUTOSWAGE PRODUCTS, 726 River Rd., Shelton, CT 06484, Tel: 203-929-1401, FAX: 203-929-6187; Empl.: 170; *Sls. Mgr.:* R. D'Autrechy

Local Sales Offices & Reps

AZ	Phoenix, McKee & Assoc., Inc., I.	602-494-1020
CA	Glendale, Halderman & Frazier	818-957-4554
CO	Arvada, Darrell Higgins & Assoc.	303-421-8601
IN	Greensburg, Comp. Resources	812-663-5608
MD	Upperco, Berwanger & Co.	301-374-5354
MI	Harper Woods, Wm. S. Turner & Co.	313-881-8585
MN	Minnetonka, Crum Co., Inc.	612-938-2573
MO	Maryland Heights, Meiners Sls.	314-739-1114
NY	Pittsford, Production Mktg. Grp.	716-248-5835
PA	Mechanicsburg, Par Assocs., Inc.	717-761-1797
SC	Fort Mills, Eagle Sales, Inc.	803-548-2222
TX	Arlington, Paine & Murray, Inc.	817-461-6331
WA	Bellevue, H.J. Sls. Co.	206-453-1957
Can	Candiac, Que., W. H. Elctrns. Registered	514-632-3685

AUTOTROL CORPORATION, P.O. Box 557, Crystal Lake, IL 60014, Tel: 815-459-3080, TELEX: 72-2417, FAX: 815-459-3227; Empl.: 140; *Sls. Mgr.:* Debora L. DeVries

AUTRONICS CORP., 314 E. Live Oak, Ste. A, Arcadia, CA 91006, Tel: 818-445-5470, TWX: 910-582-3216, FAX: 818-446-0014; FSC No.: 03972; Empl.: 100; *Sls. Mgr.:* Annabelle Cloud, Contracts Mgr.; *Dist. Mgr.:* Gary Noyes

AVA ELECTRONICS CORPORATION, P.O. Box 184, 4000 Bridge St., Drexel Hill, PA 19026, Tel: 215-284-2500, TELEX: 3711411, FAX: 215-259-8379; Empl.: 100; *Dist. Mgr.:* Martin Bisk

AVA INSTRUMENTATION, INC., 8010 Highway 9, Ben Lomond, CA 95005, Tel: 408-336-2281, FAX: 408-336-5049; FSC No.: 61933; Empl.: 7; *Sls. Mgr.:* Allan Hughes

AVANTEK, INC., 481 Cottonwood Dr., Milpitas, CA 95035-7492, Tel: 408-432-3080, TWX: 310-371-8717, FAX: 408-954-0633; Empl.: 2300; *Dist. Mgr.:* John Locke

Local Sales Offices & Reps

CA	Westlake Vl., Avantek, Inc.	805-373-3870
IL	Palatine, Avantek, Inc.	708-358-8963
MD	Columbia, Avantek, Inc.	301-381-2600

Local Distributors

AZ	Tempe, Sertek, Inc.	800-334-7127
CA	San Diego, Insight Elctrns.	800-677-7716
CA	Sunnyvale, Penstock, Inc.	408-730-0300
CA	Westlake Vl., Sertek, Inc.	800-334-7127
FL	Ft. Lauderdale, Nu Horizons	305-735-2555
FL	Melbourne, Comp. Dists. Inc.	800-558-2351
IL	Palatine, Penstock Midwest	708-934-3700
MD	Beltsville, Applied Specialists, Inc.	301-595-5395
MD	Columbia, Nu Horizons	301-995-6330
MA	Wakefield, Nu Horizons	617-246-4442
NJ	Fairfield, Penstock-East	201-808-1414
NJ	Marlton, Nu Horizons	215-557-6540
NJ	Pinebrook, Nu Horizons	201-882-8300
NY	Amityville, Nu Horizons	516-226-6000
NY	Rochester, Nu Horizons	716-248-5980
NC	Raleigh, Comp. Dists. Inc.	919-859-3391
PA	Ardmore, Penstock East	201-808-1414
TX	Dallas, Insight Elctrns.	800-677-7716
TX	Dallas, Thorson Distbg. Co.	214-233-5744
WA	Bellevue, Penstock, Inc.	206-454-2371
Can	Sertek, Inc.	800-548-0409

AVANTI CIRCUITS, INC., 17650 N. 25th Ave., Phoenix, AZ 85023, Tel: 1-800-234-1556, FAX: 1-602-375-1909; Empl.: 65; *Sls. Mgr.:* Steve Tappan

AVASEM CORPORATION, 1271 Parkmoor Ave., San Jose, CA 95126, Tel: 408-297-1201, FAX: 408-925-9460; Empl.: 55; *Sls. Mgr.:* Richard Konrad

AVELEM, La Billardiere, Gargilesse, France 36190, Tel: 33-54478672, FAX: 33-54477799; Empl.: 20

AVEL-LINDBERG INC., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776, Tel: 203-355-4711, FAX: 203-354-8597; Empl.: 225; *Sls. Mgr.:* Melanie B. Roman ..... **A•2175-2177; D•1625**

Local Distributors

CT	Wallingford, Sager Elctrl. Supp. Co.	203-265-4600
MA	Hingham, Sager Elctrl. Supp. Co.	617-749-6700
MA	Hingham, Sager Electrical Supp. Co.	617-749-6700

AVENS CORP., 256 Lincoln Ave., Brooklyn, NY 11208, Tel: 718-827-5991, 800-452-1966, FAX: 718-235-9805; Empl.: 15; *Sls. Mgr.:* Peter Eng ..... **A•1658-1660**

AVEX ELECTRONICS, 1683 Winchester Rd., P.O. Box 1026, Bensalem, PA 19020, Tel: 215-638-1515, 800-345-1295, FAX: 215-638-9108; FSC No.: 58414; *Sls. Mgr.:* Dona Logan; *Dist. Mgr.:* Michael S. Batley VP/GM ..... **D•1431-1433**

Local Sales Offices & Reps

CO	Denver, Tessco	303-778-1119
IL	Cary, Bob Burns Assoc.	708-516-3322
IN	Carmel, New Era	317-844-4530
NM	Albuquerque, Genl. Mktg.	505-892-3426
PA	Philadelphia, Allpower Tech.	215-289-6025
TX	Rowlett, Campion Sls.	800-877-7623

AVIBANK MANUFACTURING, INC., 210 S. Victory Blvd, P.O. Box 391, Burbank, CA 91503-0391, Tel: 818-843-4330, TWX: 910-498-2215; FSC No.: 84256; Empl.: 485; *Sls. Mgr.:* D. Ladin



FAX: 908-382-4996

AVIONIC INSTRUMENTS, 1414 Randolph Ave., Avenel, NJ 07001, Tel: 201-388-3500, 908-388-3500, TELEX: 844413; Empl.: 160; *Sls. Mgr.:* Bryce Wiedeman; *Dist. Mgr.:* Mike Barnaba ..... **D•2160-2166**

Local Distributors

NJ	Avenel, REA Intl. Ltd.	201-382-7100

AVTECH

FAX: 613-226-2802

AVTECH ELECTROSYSTEMS LTD., P.O. Box 5120, Stn. F, Ottawa, Ontario, Canada K2C 3H4, Tel: 613-226-5772; Empl.: 8 ..... **D•1222**

Local Sales Offices & Reps

MA	Westford, ICS Assocs, Inc.	508-692-3545
NM	Albuquerque, Tech. Mktg. Specialists	505-884-3444
NY	Ogdensburg, Avtech Electrosystems Ltd.	315-472-5270
Can	Ottawa, Ont., Avtech Electrosystems Ltd.	613-226-5772

AVTEL DIV., UNITRON INC., 10925 Miller Rd., Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511, FAX: 214-341-2099; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* Fred Cullum

AVX CORPORATION, Box 867, Myrtle Bch., SC 29577, Tel: 803-448-9411, TWX: 810-661-2252, FAX: 803-626-2442; FSC No.: 9K916; *Sls. Mgr.:* Allan Cole; *Dist. Mgr.:* Robert Burns

AVX FILTERS CORP., 11144 Penrose St., Sun Valley, CA 91352, Tel: 818-767-6770, TWX: 910-498-4998; FSC No.: 59942; Empl.: 210; *Sls. Mgr.:* Terry Cantine, Prod. Mktg. Mgr.

AXEL ELECTRONICS, INC., 134-20 Jamaica Ave., Jamaica, NY 11418, Tel: 718-291-3900, FAX: 718-526-0248; FSC No.: 13058; Empl.: 160; *Sls. Mgr.:* J. Alaimo, VP Sls.

NORMAN N. AXELROD ASSOCS.: ELECTRO-OPTICAL, LASER, & MACHINE VISION DIV., 445 East 86th Street, New York, NY 10028, Tel: 212-228-0900

AXIAL MAGNETICS, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, Tel: 805-527-0900, FAX: 805-527-4968; *Sls. Mgr.:* K. G. Kroll

AXIS CORPORATION, 4715 Viewridge Ave.,Ste. 110, San Diego, CA 92123, Tel: 619-560-7737, FAX: 619-560-8260; FSC No.: 9S849; Empl.: 21; *Sls. Mgr.:* Mark J. Prager; *Dist. Mgr.:* Jack Robinson

AYDIN CORP., 700 Dresher Rd., Horsham, PA 19044, Tel: 215-657-7510, TELEX: 685-1211, FAX: 215-657-3830; Empl.: 2,000; *Sls. Mgr.:* B. Jack Miller

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CA	Santa Ana, Norstan Elctrns.	714-667-7826

BABCOCK DISPLAY PRODUCTS, INC., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, Tel: 714-491-5100, TELEX: 249646, FAX: 714-490-1368; Empl.: 150; *Sls. Mgr.:* Brian Lundstram ..... **B•1041**

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BALLANTINE LABORATORIES, Noise Unlimited Inc., 9 Saddle Rd., Cedar Knolls, NJ 07927, Tel: 201-984-1900, FAX: 201-984-1479; FSC No.: 50423; Empl.: 30; *Sls. Mgr.:* Joe Deery; *Dist. Mgr.:* Joe Deery

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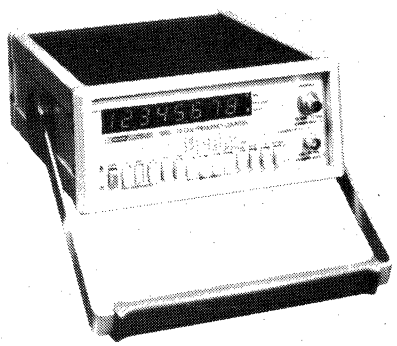

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MN Eden Prairie, Professional Mktg. Svcs. Inc. 612-934-5939,FAX:612-934-9433
NH Nashua, Intersell 603-880-6500,FAX:603-595-0050
NY Fayettsville, Martin P. Andrews 315-637-5291, FAX:315-637-9734
NY Great Neck, Industron Assocs. 516-487-2620, FAX:516-482-6698
OH Cleveland, Technical Sls. Assocs. 216-461-0826, FAX:216-461-5811
PA Doylestown, Tech. Instr. Sls. 215-345-4110, FAX:215-345-4138
TX Dallas, The Thorsen Co. S.W. 214-233-5744, FAX:214-702-0993
WA Seattle, Datacom Assocs. 206-285-2525, FAX:206-285-0772

BEI

FAX: 619-931-1212

BEI MOTION SYSTEMS COMPANY, Corporate Off., 2111 Palomar Airport Rd., Ste. 250, Carlsbad, CA 92009, Tel: 619-931-1500, TWX: 910-380-5402; Empl.: 20 .... **B•1879-1881**

Local Sales Offices & Reps
CA Garden Grove, BEI Motion Sys. Co. 714-534-5830
CA San Rafael, BEI Motion Sys. Co. 415-492-2840
CO Westminster, BEI Motion Sys. Co. 303-426-1566
FL Clearwater, BEI Motion Sys. Co. 813-791-6043
IL Rockford, BEI Motion Sys. Co. 815-968-9528
MA Needham Hgts., BEI Motion Sys. Co. 617-455-1414
MA Norwell, BEI Motion Sys. Co. 617-878-9820
MI Plymouth, BEI Motion Sys. Co. 313-451-0359
NJ Parsippany, BEI Motion Sys. Co. 201-984-5600
OH Cincinnati, BEI Motion Sys. Co. 513-232-4545
OR Beaverton, Thorson Co. NW 503-644-5900
PA Lancaster, BEI Motion Sys. Co. 717-299-6243
TX Cleburne, BEI Motion Sys. Co. 817-556-2211
WA Bellevue, Thorson Co. Northwest 206-455-9180
Can Willowdale, Willer Engrg., Ltd. 416-499-4421

BEI MOTION SYSTEMS COMPANY, Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-2600, TWX: 910-333-4534, FAX: 619-471-2675; *Sls. Mgr.:* Hank Robinson .... **B•1879**

Refer to BEI Motion Sys. Co., Corporate Off. Carlsbad, CA for sales off. info.

BEI MOTION SYSTEMS COMPANY, Digital Products Div., P.O. Box 3838, Little Rock, AR 72203, Tel: 501-851-4000, TWX: 910-722-7384, FAX: 501-851-5476; *Sls. Mgr.:* Mike Jumper .... **B•1879**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, Tel: 805-968-0782, TELEX: 888069, FAX: 805-968-3154; *Sls. Mgr.:* Glenn Avolio .... **B•1879**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Itek Encoder Div., 178 A Street, Needham Hgts., MA 02194, Tel: 617-455-1414, FAX: 617-455-6514; *Sls. Mgr.:* Marvin Kansky .... **B•1879-1881**

Refer to BEI Motion Systems Co., Corporate Off., Carlsbad, CA for sales office info.

BEI MOTION SYSTEMS COMPANY, Kimco Magnetics Div., 150 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5671, TWX: 910-322-1168, FAX: 619-744-8815; *Sls. Mgr.:* Mike Lopez ..... **B•1879**

Refer to BEI Motion Systems Co., Corporate Off., Carlsbad, CA for sales office info.

BEI MOTION SYSTEMS COMPANY, Chatsworth Encoder Div., 9223 Deering Avenue, Chatsworth, CA 91311, Tel: 818-341-6161, FAX: 818-882-4553; *Sls. Mgr.:* Ken Rendler ..... **B•1879**

Refer to BEI Motion Sys. Co., Corporate Off.,Carlsbad, CA for sales office information.

BELDEN WIRE AND CABLE COOPER INDS., See Cooper Industries/Belden

bel BEL FUSE INC.

FAX: 201-432-9542

BEL FUSE, 198 Van Vorst St., Jersey City, NJ 07302, Tel: 201-432-0463; Empl.: 225; *Sls. Mgr.:* A. Sutta; *Dist. Mgr.:* Dennis Ackerman ..... **A•1492, 1499-1528, 2178-2181; B•1346, 1352-1355; D•1629-1630**

Local Sales Offices & Reps

CA	Irvine, Groh Assoc.	714-837-9871
FL	Maitland, D.J. Ellis & Assoc.,Inc.	407-645-1101

Fuses

AL	Huntsville, Beacon Elect.	205-881-5031
CA	Irvine, Groh Assocs.	714-837-9871
CA	Redwood City, James S. Heaton Co.	415-367-9000
FL	Maitland, Beacon Elect.	305-647-3498
FL	Boca Raton, Beacon Elec.	305-997-5740
IL	Chicago, LTD	708-773-2900
FL	Clearwater, Beacon Elect.	813-769-2378
FL	Melbourne, Beacon Elect.	305-724-8010
GA	Atlanta, Beacon Elect.	404-256-9640
ID	Boise, N.R. Schultz Co.	208-377-8686
MN	St. Paul, Northport Engrg.	612-457-8000
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994
KS	Leawood, Dy-Tronix	913-339-6333
MD	Randallstown, Beacon North, Inc.	703-478-2480
NH	Amherst, David A. Cowley Assoc.	603-673-7050
NY	Rochester, Tri-Tech Elec.	716-385-6500
NJ	New Brunswick, Winch Sls. Assocs.	201-613-1515
NC	Raleigh, Beacon Elect.	919-787-0330
OH	Cleveland, Arthur Baier Co.	216-461-6161
OR	Beaverton, N.R. Schultz Co.	503-643-1644
PA	Hatboro, AQS	215-674-3562
TN	Knoxville, Insul-Reps., Inc.	615-691-7586
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Bellevue, N.R. Schultz Co.	206-454-0300
PR	Hato Rey, Max Anderson Co., Inc.	809-751-2026
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Delay Lines

AL	Hunstville, Beacon Elect.	205-881-5031
AZ	Scottsdale, SMS & Assoc.	602-998-0831
CA	Irvine, Groh Assoc.	714-837-9871
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Longwood, D-Assocs., Inc.	407-830-8976
CA	Redwood City, James S. Heaton Co.	415-367-9000
ID	Boise, N.R. Schultz Co.	208-377-8686
IL	Chicago, LTD	708-773-2900
GA	Atlanta, Beacon Elect.	404-256-9640
KS	Leawood, Dy-Tronix	913-339-6333
MD	Randallstown, Beacon North, Inc.	703-478-2480
MN	S. St. Paul, Northport Engrg.	612-457-8000
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994
NH	Amherst, David A. Cowley Assocs.	603-673-7050
NJ	E. Brunswick, Winch Sls. Assoc.	201-613-1515
MO	St. Louis, Dy-Tronix	314-291-4777
OH	Cleveland, Arthur Baier Co.	216-461-6161
NY	E. Rochester, Tri-Tech Elec.	716-385-6500
OR	Beaverton, N.R. Schultz	503-643-1644
PA	Hatsboro, AQS	215-674-3562
NC	Raleigh, Beacon Elect.	919-787-0330
TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
UT	Midvale, Front Range Mktg.	801-566-2500
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Bellevue, N.R. Schultz Co.	206-454-0300
TN	Knoxville, Insul. Reps.	615-691-7586
PR	Hato Rey, M. Anderson Co., Inc.	809-751-2020
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Local Distributors

FL	Boca Raton, D & R	407-977-8751
PA	Bristol, Aim Elctrns.	215-785-3500
Can	Scarborough, Ont., Carsten Elctrns.	416-495-7705
AL	Huntsville, CDI	205-883-7501
CA	Anaheim, Deco	714-630-8252
CA	City of Industry, Ital Elctrns.	818-968-8515
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Hayward, Kea Elctrns.	415-887-2900
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Force Elctrns.	408-943-1324
CA	Santa Clara, Pyramid	408-727-9810
FL	Ft. Lauderdale, CDI	305-971-4950
GA	Norcrossss, CDI	404-441-3320
MD	Columbia, DK Elctrns.	301-995-1950
MO	St. Charles, Finnigan Elctrns.	314-946-6201
MA	Marlboro, Hardware Specialty	617-481-8622
MN	New Brighton, Chris Elctrns.	612-631-2647
NH	Hudson, Bell Inds.	603-882-1133
NY	Bohemia, Key Comps.	516-567-7500
NC	Raleigh, CDI	919-787-7311
OR	Beaverton, Comp. Resources	503-641-8488
PA	Cornwall Hgts., Reliance Merchandising	215-638-8200
PA	Harrisburg, Cumberland Elctrns.	717-232-9715
TX	Dallas, Fuses Inc.	214-341-6407
VA	Falls Church, CDI	703-241-8227
WA	Kent, Pyramid	206-872-5800

BELL, FLOYD, INC., 897 Higgs Ave., Columbus, OH 43212, Tel: 614-294-4000, FAX: 614-291-0823; FSC No.: 56493; *Sls. Mgr.:* Tom Shain ..... **D•1028-1029**

Local Sales Offices & Reps

IL	Mt. Prospect, Robert Adams Sls. Co.	312-297-8733
MD	Columbia, Tyler Griffin Co.	301-995-1215
PA	Paoli, Tyler Griffin Co.	215-647-1550

BELL, F. W., INC., 6120 Hanging Moss Rd., Orlando, FL 32807, Tel: 407-678-6900, TWX: 810-853-3115, FAX: 407-677-5765; FSC No.: 18479; *Sls. Mgr.:* Stephen L. Dakel; *Dist. Mgr.:* Stephen L. Dakel ..... **B•1882; D•1130, 1226-1228**

Local Sales Offices & Reps

AL	Adamsville, Southrep	205-674-3056
AZ	Tempe, Trembly Assoc.	602-967-2058
CA	Arcadia, Jim Robins Assocs.	818-574-0049
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CO	Wheat Ridge, Trembly Assoc.	303-421-8900
FL	Winter Springs, Lighthouse Mktg.	407-366-0073
IL	Palatine, Golbeck Milota Assoc.	708-705-0602
KS	Lenexa, Dytec/South, Inc.	913-888-0215
KS	Wichita, Dytec/South, Inc.	316-263-7090
ME	Bethel, Shain Assoc.	207-836-3200
MD	Hampstead, Technical Instr. Sls.	301-239-4452
MA	Bellmont, Shain Assocs.	617-489-3598
MA	Hingham, Shain Assoc.	617-740-2334
MO	Maryland Hgts., Dytec/South Inc.	314-739-0665
NE	Omaha, Dytec/South, Inc.	402-334-1222
NV	Las Vegas, Trembly Assoc.	702-739-9770
NH	Nashua, Shain Assoc.	603-881-4881
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NM	Albuquerque, Trembly Assoc.	505-266-8616
NC	Raleigh, Eastern Elctrns.	919-876-7591
PA	Lansdale, Technical Instr. Sls.	215-361-7850
PA	Pittsburgh, Technical Instr. Sls.	412-767-5110
TX	Carrollton, Seaton Corp.	214-980-9860
UT	Salt Lake City, Trembly Assoc.	801-295-4703
WA	Bellevue, Scientific Dvcs.-NW	206-747-5169
WI	Madison, Golbeck Milota Assoc.	608-222-7037

Local Distributors

AZ	Phoenix, Jensen Tools & Alloys	602-968-6241
AL	Birmingham, Argo & Co.	205-787-1100
ID	Boise, Radar Elec. Co. Inc.	208-336-2227
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
MA	N. Andover, Contact East	508-682-2000
CA	Pomona, Inspection Technlgs.	714-626-2600
CA	San Marcos, Mitchell Instrs.	619-744-2690
OR	Portland, Radar Elec. Co.	503-232-3404
GA	Atlanta, P & R Instrs.	404-391-9117
IN	Muncie, Wesco	317-284-6335
IL	Mattoon, Electronic Lab & Sls.	217-235-0546
IL	Palatine, Golbeck Milota Assocs.	708-705-0602
MD	Baltimore, Davis Instrmn.	301-358-3900
MA	Hingham, Shain Assocs.	617-740-2334
MI	Livonia, Electro Sls. Assoc.	313-421-7500
NY	Rochester, Transcat	800-828-1470
NY	Whitehouse, Power Electro Supply	718-767-1447
OH	Chesterland, Electro Sls. Assoc.	216-729-0190
OH	Dayton, Electro Sls. Assoc.	513-426-5551
TX	Dallas, Seaton Elctrns.	214-980-9860
PA	Reading, Barbey Elctrns.	215-376-7451
SC	Charleston, Cameron Barkley Co.	803-745-2837
TN	Chattanooga, Edwin Bohr Elctrns.	615-877-8207
PA	Pittsburgh, Electro Sls. Assoc.	412-322-9000
WA	Seattle, Radar Elec. Co.	206-282-2511

BELL INDS., J. W. Miller Div., 306 E. Alondra Blvd. P.O. Box 2859, Gardena, CA 90247-1059, Tel: 213-515-1720, FAX: 213-515-1962; FSC No.: 76493; Empl.: 30 ..... **A•1164-1169**

Local Sales Offices & Reps

AZ	Mesa, Fetty/Schoenduve, Inc.	602-844-8289
CA	Campbell, Shur Sls.	408-374-5577
NC	Raleigh, C-Tech Sls. Co.	919-782-8100
CO	Denver, West, Inc.	303-477-8180
FL	Clearwater, HHP Assocs., Inc.	813-797-4447
FL	Pompano Bch., HHP Assocs., Inc.	305-971-5750
FL	Winter Park, HHP Assocs., Inc.	407-740-0320
IL	Elk Grove Vl, Levy, Grams & Lassers	708-272-8500
IN	Carmel, Current Elctrn. Mktg., Inc.	317-844-1770
MD	Sykesville, DJC Elctrn. Sls., Inc.	301-795-7020
MA	Burlington, Conti-Younger Assocs., Inc.	617-273-1582
MD	Woodbine, DJC Elctrn. Sls.	301-795-7020
MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Eden Prairie, Electro Mark, Inc.	612-944-5850
MS	Hattiesburg, Mfgs. Sls. & Mktg. Svcs.	601-264-4755
NJ	Englewood, Epstein & Siebel Assoc.	201-569-7600
NY	Marcellus, J.G. Welch Sales	315-673-1009
NY	Rochester, J.G. Welch Sales	716-244-1100
OH	St. Mary's, Thomas Shelby & Co., Inc.	419-394-3377
OR	Portland, Caruso Assoc. Inc.	503-246-5439
TX	Ft. Worth, Chet Wells & Co.	817-284-0261
WA	Bellevue, Caruso Assoc. Inc.	206-455-8811
EXP	N.Y., Yonkers, Roburn Agencies, Inc.	914-968-1016
Can	Calgary, Alberta, Cana Rep Group	403-243-5148
Can	Montreal, Que., Cana-Rep. Grp., Inc.	514-276-4477
Can	Surrey, B.C., Cana Rep Group	604-589-8593
Can	Willowdale, Cana Rep Group	416-250-6683

BELLOFRAM CORPORATION, State Route 2, Box 305, Newell, WV 26050, Tel: 304-387-1200, 800-727-5646, FAX: 304-387-1212; Empl.: 300; *Sls. Mgr.:* David Lewis; *Dist. Mgr.:* David Lewis

BELTING INDUSTRIES CO., INC., 20 Boright Ave., Kenilworth, NJ 07033, Tel: 201-272-8591, TELEX: 229854, FAX: 201-272-3825; Empl.: 125; *Sls. Mgr.:* Gene Hobson

BELMONT INSTRUMENT CORP., Pinehurst Pk., 8 Cook St., Billerica, MA 01821, Tel: 508-663-0212, FAX: 508-663-0214 ..... **D•2176**

BEMCO, 2255 Union Place, Simi Valley, CA 93065, Tel: 805-583-4970, FAX: 805-583-5033; Empl.: 43; *Sls. Mgr.:* Glenn Elliott

BENCHMARQ MICROELECTRONICS, INC., 2611 Westgrove 101, Carrollton, TX 75006, Tel: 214-407-0011, FAX: 214-407-9845; Empl.: 35; *Sls. Mgr.:* John Landau

BENDIX CONNECTOR OPERATIONS, See Amphenol, Bendix Connector Ops.

BENDIX CORP., MOTOR COMPS. DIV., See Facet Entprs.

BENDIX ELECTRIC POWER DIVISION, Allied Signal Aerospace, 118 Hwy. 35, Eatontown, NJ 07724, Tel: 201-542-2000, TELEX: 132-444, FAX: 201-389-7758; FSC No.: 83298;Multiple; Empl.: 1,000; *Sls. Mgr.:* R. Freeman

BENJAMIN INTERNATIONAL, INC., 16 Newtown Plaza, Plainview, NY 11803, Tel: 516-753-0700, FAX: 516-753-0839

BENTLY NEVADA CORP., P.O. Box 157, Minden, NV 89423, Tel: 800-227-5514, 702-782-3611, TELEX: 354437, FAX: 702-782-9253; FSC No.: 1561105

BERG, W. M., INC., 499 Ocean Ave., East Rockaway, NY 11518, Tel: 516-599-5010, TELEX: 9103506176, FAX: 516-599-3274; Empl.: 150; *Sls. Mgr.:* Marie Raitz

BERGQUIST
When Performance Counts

FAX: 612-835-4156

BERGQUIST, 5300 Edina Ind'l., Minneapolis, MN 55435, Tel: 800-347-4572; FSC No.: 55285; Empl.: 170; *Sls. Mgr.:* Bob Savage; *Dist. Mgr.:* Duane Dungey ..... **B•1800-1801; C•1670-1673, 1714-1715**

Local Sales Offices & Reps

CA	Foster City, Bergquist	415-572-9439
CA	Santa Ana, Bergquist Co.	714-542-3383

FL Clearwater, Tech-Rep 813-530-1619
MI Minneapolis, Bergquist 612-835-2322
MA Brookline, Harman Assocs. 617-232-6687
NY Lynbrook, P. Saftler Assocs. 516-593-7880
NY No. Syracuse, Leonard D. Allen 315-458-7470
OH Cleveland, Staff Co. 216-331-5100
OR Tigard, Elctrn. Comp. Sls. 503-245-2342
TX Lewisville, Bergquist 214-317-1502
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

Local Distributors

AL Huntsville, Component Dist., Inc. 205-883-7501
CA Fountain Valley, Components Center 213-582-0667
CA Hawthorne, Electrosonic 213-970-0997
CA Mtn. View, Energy Sls. 415-969-0800
CA San Diego, Southland Fasteners 619-578-6630
CO Aurora, JET Elctrns. 303-364-1000
FL Ft. Lauderdale, Components Dist. Inc. 305-973-6915
GA Norcross, Components Dist. Inc. 404-441-3320
IL Chicago, NEP Elctrns. 312-625-8400
MA Brookline, Harman Sls. 617-232-6687
NC Raleigh, Components Dist. Inc. 919-834-9465
TX Dallas, Components Dist. Inc. 214-694-0373
WA Redwood, Murphy Elctrns. 206-881-1234

BERKELEY NUCLEONICS CORP., 1121 Regatta Sq., Richmond, CA 94804, Tel: 510-234-1100, TELEX: 677-1167, FAX: 510-236-3105; Empl.: 30; *Sls. Mgr.:* E. J. Buchs ..... **D•1229**

For immediate assistance please contact: Tele-sales Department (510-234-1100) All sls. engrg. svcs. in U.S. & Canada are provided by our factory-direct sls. & applications staff.

BERKELEY PROCESS CONTROL, INC., 5327-K Jacuzzi St, Richmond, CA 94804, Tel: 415-526-3333, FAX: 415-525-1894; Empl.: 33; *Sls. Mgr.:* Ken Shane; *Dist. Mgr.:* Ken Shane

BERKSHIRE TRANSFORMER CORP., Route 341, P.O. Box 129, Kent, CT 06757, Tel: 203-927-3541, FAX: 203-927-4583; FSC No.: 89870; Empl.: 105; *Sls. Mgr.:* Janis R. Donovan

BERK-TEK INC., 132 White Oak Road, New Holland, PA 17557-9722, Tel: 717-354-6200, FAX: 717-354-7944; FSC No.: 19449; Empl.: 350; *Sls. Mgr.:* Brad Hubinek, Jerry Petty, Natl. Sls. Mgrs.; *Dist. Mgr.:* Allan Schoonover, Mktg. Mgr.

BERMAR CORP., P.O. Box 12844, Research Triangle Park, NC 27709, Tel: 919-489-4316; *Sls. Mgr.:* M. Conland



FAX: 516-935-1766

BERTAN ASSOCS., 121 New South Rd., Hicksville, NY 11801, Tel: 516-433-3110, TWX: 510-221-2144; FSC No.: 6130; Empl.: 140; *Sls. Mgr.:* Jim Donley ... **D•1631-1636**

Local Sales Offices & Reps

AL Huntsville, Currie, Peak, Frazier 205-536-1506
AZ Phoenix, Thor Engrg. 602-437-1463
CA Encino, King-Way Assoc. 818-788-4124
CA Los Altos, Cain-White & Co. 415-948-6533
CO Boulder, H. Bass Assocs. 303-530-7509
CT Farmington, Ray Perron & Co., Inc. 203-673-4825
GA Norcross, Currie, Peak, Frazier 404-449-7662
IL Arlington Hgts., Coombs Assocs. 312-439-9810
KS Lenexa, Midtec Assoc. 913-541-0505
MD Randallstown, Beacon North 703-591-1300
MA Needham, Ray Perron & Co., Inc. 617-449-6162
MI Detroit, Geotronix, Inc. 313-559-2440
MN Minneapolis, Electronic Instrs. 612-374-5628
MO St. Louis, Midtec Assoc. 314-275-8666
NM Albuquerque, Thorson/Desert States Co. 505-293-8555
NY Elmont, Crane & Egert Corp. 516-872-0800
NY Hicksville, Bertan Assocs., Inc. 516-433-3110
NY Liverpool, Northern Tech. Sls. Co. 315-451-1091
OH Cleveland, Geotronix 216-659-6100
PA Audubon, Holmes Assocs. 215-666-0636
TX Dallas, Automated Motion Control 214-340-4192
UT Bountiful, H. Bass Assoc. 801-295-7100
VA Fairfax, Beacon North 703-591-1300
WA Bellevue, Cain-White & Co., Inc. 206-462-2118
WI Milwaukee, Coombs Assocs. 414-351-6123
Can Downsview, Ont., Rayonics Sci., Inc. .. 416-736-1600

BERTSCH U.S.

FAX: 619-727-4436

BERTSCH U.S., 2142F Industrial Ct, Vista, CA 92083, Tel: 619-727-7420; FSC No.: 619-727-4436; Empl.: 25; *Sls. Mgr.:* B. Linko ..... **B•1246-1247**

BEST POWER TECHNOLOGY, INC., P.O. Box 280, Necedah, WI 54646, Tel: 608-565-7200, 800-356-5794, TELEX: 701934, FAX: 608-565-2221; Empl.: 600ò; *Sls. Mgr.:* Donald Soe ..... **D•2177**

Local Sales Offices & Reps

WI Necedah, Best Power Technlg. Inc. ... 800-356-5794

BEST TECHNOLOGY INC., 400 Boren Ave. North, Seattle, WA 98109, Tel: 206-382-1300, FAX: 206-382-0186; Empl.: 8 ..... **B•1833**

Local Sales Offices & Reps

CA Mountain View, Straube Assocs. 415-969-6060
CO Westminster, Straube Assocs. 303-426-0890

BESWICK:COOPER U.K. LTD., Alert Works, Frome, United Kingdom BA11 1PP, Tel: (0373) 64311, TELEX: 449196 G, FAX: (0373) 73175

BETA AUTOMATION, INC., 3541 Old Conejo Rd., Newbury Park, CA 91320, Tel: 805-499-5785, FAX: 805-499-9071; Empl.: 8; *Sls. Mgr.:* James Valentino

BETA REVIEW, INC., PO Box 38, Millwood, VA 22646, Tel: 703-837-1436, FAX: 703-837-3063; Empl.: 2; *Sls. Mgr.:* Norman M. Fine



FAX: 508-842-0748

BETATHERM CORP., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545, Tel: 508-842-0516; Empl.: 80 ..... **B•1834-1837**

BEY ELECTRIC, INC., 362 Main St., Box 548, Lincoln Park, NJ 07035, Tel: 201-694-5000, FAX: 201-694-7975; *Sls. Mgr.:* Fred DeMauro, Gen. Mgr. ..... **A•2182**

BG ELECTRONICS, EPC Corp., 519 South 5th Avenue, Mt. Vernon, NY 10550-4430, Tel: 914-664-5591, FAX: 914-664-4729; FSC No.: 33791; Empl.: 6; *Sls. Mgr.:* Don Edwards ..... **D•1081**

B-G INSTRUMENTS, INC., P.O. Box 1867, Vashon, WA 98070, Tel: 206-567-5000, FAX: 206-567-5010; *Sls. Mgr.:* John Baum ..... **D•1081**

Local Sales Offices & Reps

WA Spokane, B-G Instrs., Inc. 509-238-4757

B. G. LABORATORIES, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-722-2376, FAX: 607-722-4204; FSC No.: 26522; Empl.: 150



FAX: 612-894-9380

BH ELECTRONICS, INC., 12219 Wood Lk. Dr., Burnsville, MN 55337, Tel: 612-894-9590; FSC No.: 08450; Empl.: 300; *Sls. Mgr.:* Fred LaMarche ..... **A•1170-1171, 2184-2185**

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AZ Fountain Hills, Halbar Assocs. 602-837-2464
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MI St. Joseph, I. E. Hampton & Assocs. 616-983-0862
MN Osseo, Gaffney Sls. Co. 612-425-5484
NC Raleigh, Tingen Tech. Sls. 919-870-6670
OH Worthington, R J Mktg. 614-888-7638
NY Smithtown, PAF Assocs. 516-360-0940
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TX Dallas, Precision Sls. 214-701-9031
WA Redmond, Halbar PNW, Inc. 206-882-0990
WI Theinsville, TFL Assoc. 414-242-6800
Can Toronto, Strategic Elctrns. 416-602-0855

BIBCO, INC., 258 Territorial, Benton Harbor, MI 49022, Tel: 616-925-8445, 800-851-5701, FAX: 616-925-3081; Empl.: 150; *Sls. Mgr.:* Carol McMellen

BICC-VERO ELECTRONICS, INC., 1000 Sherman Ave, Hamden, CT 06514, Tel: 203-288-8001, TWX: 510-227-8890, FAX: 203-287-0062; Empl.: 50; *Sls. Mgr.:* John Bruno

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MD Lutherville, J. A. Dougherty Sls. 301-321-7890
MA Plainville, Entprs. Tech. 617-695-4700
MI Brighton, Elctrn. Sources, Inc. 313-227-3598
MN Chanhassen, Jen-Ray Sys. 612-934-8607
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TX Richardson, Microlog 214-644-2945
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BICRON ELECTRONICS, 50 Barlow Street, Canaan, CT 06018, Tel: 203-824-5125, FAX: 203-824-1137; FSC No.: 10617; Empl.: 120; *Sls. Mgr.:* Frank Pierzga ..... **A•2186-2187; B•1615, 1883**

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VA Arlington, Homersmith 215-543-2434
VA Salem, Homersmith, Inc. 703-387-1600
WI Milwaukee, KMA Sls. Co. 414-259-1771

BIDDLE INSTRUMENTS, 510 Township Line Rd., Blue Bell, PA 19422, Tel: 215-646-9200, TELEX: 685 1045 JGBCO, FAX: 215-643-2670; Empl.: 285

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BINDICATOR, P.O. Box 61009, 1915 Dove St, Port Huron, MI 48061-0009, Tel: 313-987-2700, TWX: 810-231-5261 BINDICATOR P THY, FAX: 313-987-4476; Empl.: 60; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Secord

BIOMATION INSTRUMENTS, 335 Perth St., PO Box 156, Almonte K0A1A0, Tel: 613-256-2821, FAX: 613-256-4707; FSC No.: OAG953; Empl.: 3; *Sls. Mgr.:* Andy Guest

BIOMATION, 19050 Pruneridge Ave., Cupertino, CA 95014-0718, Tel: 408-988-6800, FAX: 408-988-1647; *Sls. Mgr.:* Mark Zamoyski

BIOSOFT, P.O. Box 10938, Ferguson, MO 63135, Tel: 314-524-8029, FAX: 314-525-8129

BIRD ELECTRONIC CORP., 30303 Aurora Rd., Cleveland, OH 44139-2794, Tel: 216-248-1200, TELEX: 706898 Bird Elec. UD, FAX: 216-248-5426; FSC No.: 70998; Empl.: 267; *Sls. Mgr.:* W. F. Kail; *Dist. Mgr.:* Greg Johns

BIRTCHER CORP., See EG & G Birtcher

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BISHOP GRAPHICS, INC., 5210 Lewis Rd., Agoura, CA 91304, Tel: 818-991-2600, TELEX: 66-2400 BISHOP WKVG, FAX: 818-889-3744; Empl.: 140; *Sls. Mgr.:* Robert Reiss

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Bivar

FAX: 714-951-3974

BIVAR, INC., 4 Thomas, Irvine, CA 92718, Tel: 714-951-8808, TELEX: 852348; FSC No.: 32559; Empl.: 20; *Sls. Mgr.:* Thomas Silber; *Dist. Mgr.:* Thomas Silber ..... **C•1015**

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CA	Solana Beach, Cook Entprs.	619-753-7272
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FL	Indian Harbour Beach, Symco, Inc.	407-777-0994
GA	Norcross, Twentieth Century Mktg.	404-446-1999
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IN	Indianapolis, Richmar Elec. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MA	Norwood, The MacInnis Co.	617-762-8090
NC	Raleigh, 20th Century Mktg. Inc.	919-790-9383
OH	Cleveland, Marlow Assocs.	216-831-8232
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Can	Markham, Ont., Avotronics, LTD.	416-475-2024
NY	Victor, Net Sls.	716-924-1844

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AZ	Phoenix, EKO Sales	602-437-4646
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CA	Fremont, Vic/Tal Sls.	415-651-6420
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CA	Milpitas, MS Inserts	408-946-6565
CA	Mission Hills, Coast Air Inc.	818-898-2288
CA	Mission Viejo, Opto Plus, Inc.	714-380-8654
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CA	North Hollywood, Elctrn. Hardware Ltd.	818-982-6100
CA	Oxnard, R. C. Dudek	805-988-4882
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Diego, Western Fasteners	619-292-5115
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Santa Fe Springs, F T R Fasteners	714-957-0202, 213-946-6464
CA	Sunnyvale, R. C. Dudek	408-734-3830
CA	Torrance, MS Inserts	213-539-1530
CO	Littleton, Indelco	303-795-3431
CO	Wheatridge, Colorado Elctrn. Hdwr.	303-431-4334
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GA	Peachtree City, Engineered Comps.	404-487-7600
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MA	Winchester, Webb Distbn.	617-729-5800
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BKL, 421 Feheley Dr., King of Prussia, PA 19406, Tel: 215-277-2910, FAX: 215-277-2956; Empl.: 34

BLACKHAWK NETWORKS CORP., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545, Tel: 608-752-8701, FAX: 608-752-8701; FSC No.: 12724; Empl.: 10; *Sls. Mgr.:* D. Adee

BLACKHOLE TECHNOLOGY, 225 East St., Winchester, MA 01890, Tel: 617-721-7690, FAX: 617-721-7260; Empl.: 5; *Sls. Mgr.:* John W. McDonough, Jr.

BLATEK, INC.

FAX: 814-231-2087

BLATEK, INC., 2820 E. College Ave., Ste. F, State College, PA 16801, Tel: 814-231-2085, 814-231-2086; Empl.: 20 ..... **B•1885**

BLH ELECTRONICS, INC., 75 Shawmut Road, Canton, MA 02021-9111, Tel: 617-821-2000, TELEX: 172116, FAX: 617-828-1451; FSC No.: 03089; Empl.: 170; *Sls. Mgr.:* Kristin Scharf

BLILEY ELECTRIC CO., 2545 W. Grandview Blvd., Erie, PA 16506, Tel: 814-838-3571, FAX: 814-833-2712; FSC No.: 71034;3098; Empl.: 135 ..... **A•1308-1317**

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BOGEN COMMUNICATIONS, INC., Sound Prods., 50 Spring St., P.O. Box 575, Ramsey, NJ 07446, Tel: 201-934-8500, FAX: 201-934-9832; *Sls. Mgr.:* David A. Chambers; *Dist. Mgr.:* Christopher Wildfoerster

BOKER'S, INC., 3104 Snelling Ave., Minneapolis, MN 55406-1937, Tel: 612-729-9365, FAX: 612-729-8910; FSC No.: 85446; Empl.: 110; *Sls. Mgr.:* Andy Tscholl

BOMAR CRYSTAL COMPANY, 201 Blackford Ave., Middlesex, NJ 08846, Tel: 908-356-7787, 800-526-3935, FAX: 1-908-356-7362; Empl.: 40; *Sls. Mgr.:* Beth Shapiro, OEM Sls. Mgr. ..... **A•1318-1320**

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BOMCO, See MuShield Co.

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BOPLA ENCLOSURES, 7330 Executive Way, Frederick, MD 21701, Tel: 301-696-9300, FAX: 301-696-9494; FSC No.: 4Y520; Empl.: 35 ..... **C•1016**

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IL Chicago, Paddock Mktg./Sls. 312-452-7852
MA Needham, T.E.S.C.O. 617-444-7925
PA Lancaster, Indl. Comps. Inc. 215-889-0650
WA Federal Way, K. R. Jensen Sls. 206-874-2772

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OR Portland, Radar Elctrns. 503-232-3404
PA Harrisburg, Cumberland Elctrns. 717-232-5999
PA Lancaster, Peak Elctrns. 215-293-9000
WA Seattle, Radar Elec. 206-282-2511

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BOSCH, ROBERT, CORP., 2800 S. 25th Ave., Broadview, IL 60153, Tel: 708-865-5200; *Sls. Mgr.:* Dieter Bloecks; *Dist. Mgr.:* Dave Robson ..... **B•1429**

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CA Montrose, Luscombe Engrg. 818-249-9000
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MA Burlington, Conti-Younger Assocs. 617-273-1582
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OH Richfield, Geotronix Inc. 216-659-6100
PA Norristown, Brandon Assocs. 215-278-0500
TX The Colony, Juliana Co. 214-625-1075
WA Mercer Island, Electronic Comp. Sls. .. 206-232-9301

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IL N. Chicago, Sound Quest/Delta 708-473-1200
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TX The Colony, The Juliana Co. 214-625-1075

BOSCHERT, INC., Computer Products/Boschert, 3797 Spinnaker Ct., Fremont, CA 94538, Tel: 415-657-6700, FAX: 415-683-6400

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CA Irvine, QuadRep. Southern 714-727-4222
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CA San Jose, QuadRep, Inc. 408-432-3300
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NY Wappingers Falls, Bob Dean, Inc. 914-297-6406
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BRAEMAR CORP., 11400 Rupp Drive, Burnsville, MN 55337, Tel: 612-890-5135; Empl.: 130; *Sls. Mgr.:* Ron Zylstra

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KS Topeka, Acme Radio Supp. Co. 913-235-1363
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MA Billerica, Eastern Video Sys. 617-667-0009
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MA Waltham, Linear Elect. 617-894-7300
NH Dover, American Radio Corp. 603-742-6800
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TN Knoxville, Bondurant Bros. Co. 615-573-9151
TX Denison, Denison Elctrns. 214-465-0341
TX Texarkana, Lavender Elec. 501-773-4631
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VT Cavendish, C S Svc. & Supp. Co. 802-226-7582
VA Norfolk, Todd Elec. 804-855-3111
WA Seattle, Amateur Radio Supp. 206-767-3222
MN Minneapolis, Boerger & Assoc. 612-560-3435

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MA Taunton, Focus Elctrn. Sls. 508-824-3840

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BRUEL & KJAER INSTRS. INC., 185 Forest St., Marlboro, MA 01752-3093, Tel: 508-481-7000, TWX: 710-347-1187, FAX: 508-485-0519; Empl.: 100

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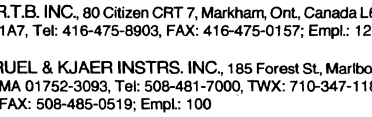
BT & D TECHNOLOGIES, 2 Righter Pkwy II Ste. 200, Wilmington, DE 19803, Tel: 302-479-0300, FAX: 302-479-9560; Empl.: 350; *Sls. Mgr.:* Paul V. O'Donnell



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Can Rexdale, Ont., QPL Electronics 416-674-8859, FAX:416-675-6871

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GA Atlanta, Par Assoc. 404-391-9117, FAX:404-395-6346
IL Long Grove, Robert Adams Sls. 708-634-3384, FAX:708-634-3385
KS Lenexa, Midtec Assoc. 913-541-0505, FAX:913-541-1729
MD Columbia, Tyler Griffin Co. 301-995-1215, FAX:301-995-0344
MA Belmont, Elctrn. Comps. & Svc. 617-484-8680, FAX:617-484-8693
MI Beachwood, Elctrn. Sls. Masters, Inc. 216-831-9555,FAX:216-831-8647
MN Minneapolis, A. J. Warner Co. 612-823-8272
MO St. Louis, Midtec Assocs., Inc. 314-275-8666, FAX:314-275-8859
NJ Ocean, P. Saftler Assocs. 908-922-3014, FAX:908-922-8198
NM Albuquerque, Moss Mktg. 505-292-7505, FAX:602-249-4767
NY Fulton, P. Saftler Assocs. 315-592-7184, FAX:315-592-4152
NY Lynbrook, P. Saftler Assoc. 516-593-7880, FAX:516-593-7637
NC Charlotte, PAR Assocs., Inc. 704-535-9858, FAX:704-535-5347
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OK Tulsa, Advance Tech. Sls. 918-664-0482, FAX:918-664-5467
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OR Portland, Radar Elec. 503-232-3404, FAX:503-235-0428
TX El Paso, Ideal Indl. Elctrn. 915-779-6647
WA Richland, Radar Elec. 509-943-8336, FAX:509-943-6790
WA Seattle, Radar Elec. 206-282-2511, FAX:206-282-1598
WA Spokane, Radar Elec. 509-747-3053

BUD INDUSTRIES, INC., 4605 E. 355th St., Willoughby, OH 44094-0431, Tel: 216-946-3200, FAX: 216-951-4015; FSC No.: 71218; Empl.: 200; *Sls. Mgr.:* Bill DeRoche; *Dist. Mgr.:* B. K. Haas

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FAX: 708-215-9606

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CO Littleton, Harthun Assoc. 303-795-5545
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Can Scarborough, Ont., Burgess Switch Co. 416-299-0852

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FL Miami, B & R Elctrns. Supp. Inc. 305-255-4510
FL W. Palm Bch., Atlantic Elec. Inc. 407-686-8553
IL Chicago, Leeds Electro Comp. 312-625-3800
IL Harvey, George Elctrns. 708-331-1983
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BURLING INSTRUMENTS, INC., P.O. Box 298, Chatham, NJ 07928-0298, Tel: 201-635-9481, FAX: 201-635-9530; Empl.: 23; *Sls. Mgr.:* Roger Nation

BURNDY CORPORATION, An FCI Company, Richards Ave., Norwalk, CT 06852, Tel: 203-838-4444, FAX: 203-852-6228/6227; Empl.: 3500; *Sls. Mgr.:* Frank Zanattaro

BURR-BROWN CORP., P.O. Box 11400, Tucson, AZ 85734, Tel: 602-746-1111, TELEX: 66-6491, TWX: 910-1111, FAX: 609-741-3895; Empl.: 1500; *Sls. Mgr.:* M. Dickey/B. McGrath/J. Stoupa ..... **D•1637-1639**

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GA Atlanta, Rep Inc. 404-938-4358
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IA Cedar Rapids, Rep Assoc. Corp. 319-373-0152
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MI Farmington, Burr-Brown Corp. 313-474-6533
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BURTON ELECTRICAL ENGINEERING, Wyle Laboratories, 111 Maryland Street, El Segundo, CA 90245, Tel: 213-322-0615, TELEX: 858485, TWX: 910-348-6699, FAX: 213-322-4520; FSC No.: 81861; Empl.: 55; *Sls. Mgr.:* Bill Owen

BUSSCO INC., 119 Standard St., El Segundo, CA 90245, Tel: 213-322-6580, TWX: 910-348-6295, FAX: 213-322-8130; FSC No.: 29593; Empl.: 55

BUSSMANN:COOPER INDUSTRIES, P.O. Box 14460, St. Louis, MO 63178, Tel: 314-394-2877, TELEX: 44 841; FSC No.: ;Multiple; Empl.: 3000; *Sls. Mgr.:* John Monter; *Dist. Mgr.:* John Monter

BYTE CRAFT LIMITED, 421 King St. N., Waterloo, Ont., CAN N2J 4E4, Tel: 519-888-6911, FAX: 519-746-6751; Empl.: 5; *Sls. Mgr.:* Judi Banks

BYTEK CORP., Instrument Systems Div., 543 NW 77th St., Boca Raton, FL 33487-1323, Tel: 407-994-3520, TELEX: 4998369 BYTEK, FAX: 407-994-3615; Empl.: 45; *Sls. Mgr.:* Madeline Selwitz

BYTEX CORP., 120 Turnpike Rd., Southborough, MA 01772, Tel: 508-480-0840, TELEX: 951151; Empl.: 250; *Sls. Mgr.:* Stephen Giambra, VP, Sls.

CABLEFORM INC., Zion Cross Roads, Troy, VA 22974, Tel: 804-589-8224, TELEX: 822434, FAX: 804-589-3803; *Sls. Mgr.:* Richard L. Shannon ... **A•1850-1851; D•1640**

Local Sales Offices & Reps
VA Troy, Cableform, Inc. 804-589-8224
EXP Troy, VA, Cableform, Inc. 804-589-8224

CABLESCAN, INC., Subsidiary of Eubanks Engrg. Co., 145 E. Emerson Ave., Orange, CA 92665, Tel: 714-998-1961, TELEX: 291693, FAX: 714-921-2493; *Sls. Mgr.:* Richard Heintz

CABLESTAR, INCORPORATED, 310 S. Franklin St., Glasgow, KY 42141, Tel: 800-338-8223, FAX: 502-651-2973; Empl.: 25; *Sls. Mgr.:* Larry Hollon

CABLE SYSTEMS, INC., 210 Broadway, Everett, MA 02149, Tel: 617-389-7080, FAX: 617-389-4758; FSC No.: 33426; Empl.: 70; *Sls. Mgr.:* James R. Collmer

CABLETEST

FAX: 416-475-2609

CABLETEST INTERNATIONAL INC., 951 Denison St. E., Unit 21, Markham, Ont., Canada L39 3W9, Tel: 416-475-2607; Empl.: 50 ..... **D•1230-1233**

Local Sales Offices & Reps
NJ Toms River, Heyco Stamped Prods. .. 908-280-1800

CABLETEST PRODUCTS CO., P.O. Box 494, Malden, MA 02148, Tel: 617-665-2932; Empl.: 28; *Sls. Mgr.:* H. E. Holley; *Dist. Mgr.:* H. E. Holley

CABLETRON SYSTEMS, INC., 35 Industrial Way, Rochester, NH 03867, Tel: 603-332-9400, FAX: 603-332-4616; Empl.: 1500; *Sls. Mgr.:* Jack Branowski

CABLE USA, INC., 2584 So. Horseshoe Dr., Naples, FL 33942-3560, Tel: 813-643-6400, FAX: 813-643-4230; FSC No.: 67050; Empl.: 55; *Sls. Mgr.:* Joe Giordano

CABLEX, INC., 96 Inverness Dr. E., Ste. J, Englewood, CO 80112, Tel: 303-792-5760, FAX: 303-792-3006; Empl.: 50; *Sls. Mgr.:* Ken Harms; *Dist. Mgr.:* Reed C. Mulder

CABOT BERYLCO, DIV. OF CABOT CORP., See NGK Berylco, Div. of NGK Metals Corp.

CABTRON SYSTEMS INC.

FAX: 708-272-1095

CABTRON SYSTEMS, INC., 200 N. Anets Dr., Northbrook, IL 60062, Tel: 708-498-6090; Empl.: 45; *Sls. Mgr.:* Mike Gober ..... **C•1018**

Local Sales Offices & Reps
AZ Tempe, Sierra Tech. Grp. 602-894-2335
CA Hayward, Larsen Assocs. 415-358-9559
CA Orange, XBX Sls., Inc. 714-998-8200
CA San Diego, XBX Sls., Inc. 619-586-1577
CO Englewood, Sierra Tech. Grp. 303-790-1700
CT Watertown, May Tech 203-274-3777
FL Orlando, D.A.I. 407-299-7754
GA Lilburn, Phillip Matthews Corp. 404-381-1662
IN Indianapolis, Liberty Sls. 317-888-8396
KS Wichita, Buckman & Assocs. 316-267-2052
MD Silver Spring, Ansell Engrg. 301-949-1655
MA Reading, May Tech. 617-942-7135
MI Livonia, Lowell-Wendt 313-464-2722
MN St. Paul, Countryman Assocs. 612-645-9151
MO St. Charles, Buckman & Assocs. 314-947-4727
NJ Kenvil, Components for Elctrns. 201-927-6662
NM Organ, Sierra Tech. Grp. 505-382-5542
NC Kings, Phillip Matthews Corp. 919-983-9790,
OH Dayton, Geotronix 513-854-5939
OH Richfield, Geotronix 216-659-6100
OR Portland, McLaren, Inc. 503-297-2248
PA Allison Pk., Geotronix 412-487-1770
PA Blue Bell, Comp. for Elctrns. 215-825-3939
TX Dallas, Dunbar Assocs. 214-239-7151
UT Holladay, Sierra Tech. Grp. 801-272-3733
WA Kirkland, McLaren 206-827-9400

CAC MICROCIRCUITS INC., Bel Fuse, 2 Southgate Dr., Mt. Carmel, IL 62863, Tel: 618-263-4343, FAX: 618-263-4295; Empl.: 148; *Sls. Mgr.:* Warren Mitch ..... **A•1723**

Local Sales Offices & Reps
AL Huntsville, Interep 205-881-1096
AZ Scottsdale, Arcom Sls. 602-947-5745
CA Redwood City, James S. Heaton Co. .. 415-367-9000
CA Valencia, C & N and Assoc. 805-254-5844
CO Boulder, Front Range Mktg. 303-443-4780
FL Longwood, D-Assocs. 407-830-8976
GA Norcross, Interep 404-449-8680
IL Itasca, LTD Technlgs. 708-773-2900
IN Indianapolis, Insul-Reps, Inc. 317-251-1994
IA Cedar Rapids, Dy-Tronix 319-377-8275
KS Wichita, Dy-Tronix Inc. 316-838-0884
MN S. St. Paul, Northport Engrg. 612-457-8000
MO Raytown, Dy-Tronix 913-229-6333
MO St. Louis, Dy-Tronix 314-291-4777
NH Amherst, D. A. Crowley & Assocs., Inc. 603-673-7050
NJ Ft. Lee, Neptune 201-461-2789
NY Plainview, Neptune 516-349-1600
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Cleveland, Arthur H. Baier, Inc. 216-461-6161
OR Beaverton, N.R. Schultz Co. 503-643-1644
PA Hatboro, AQS Electro 215-674-3562
TN Knoxville, Insul-Reps 615-691-7586
TX Austin, Oeler & Menelaides, Inc. 512-453-0275
UT Salt Lake City, Front Range Mktg. 801-566-2500
VA Charlottesville, DVS 804-973-0303
WA Bellevue, N.R. Schultz Co. 206-746-1890
WI Milwaukee, LTD Technlgs. 414-774-1000

CADDELL-BURNS MFG., 258 E. 2nd St., Mineola, NY 11501-3508, Tel: 516-746-2310, FAX: 516-742-2416; Empl.: 30 ..... **A•1172-1186**

CADDELL COIL CORP., P.O. Box 1235, South St., Middletown Springs, VT 05757, Tel: 802-235-2019; Empl.: 6; *Sls. Mgr.:* James Caddell

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OH	Cleveland, Arthur H. Baier Co.	216-461-6161
OH	Dayton, Arthur H. Baier Co.	513-276-4128
OR	Beaverton, Elctrn. Sources	503-627-0838
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

TX	Houston, Lenert Co.	713-225-1465

CAD ENGRG. & ASSEMBLY INC., 8663 Tyler Blvd., Mentor, OH 44060, Tel: 216-255-7744, FAX: 216-255-5900; Empl.: 28

CADILLAC PLASTIC & CHEM. CO. DIV. OF M.A. HANNA, 143 Indusco Ct., Troy, MI 48083, Tel: 313-583-1200, TWX: 810-232-1886, FAX: 313-583-4715; Empl.: 1000

CAD UTILITY CO., 21115 Devonshire St., Ste.318, Chatsworth, CA 91311, Tel: 805-527-8630, FAX: 805-526-5093; Empl.: 6; *Sls. Mgr.:* Stan Chambers

CAIG LABS., 1175-0 Industrial Ave., Escondido, CA 92029-1431, Tel: 619-743-7143, FAX: 619-743-2460; Empl.: 15; *Sls. Mgr.:* Laurie Skultety; *Dist. Mgr.:* Laurie Skultety

CALABRO INDS., INC., See UNITRACK Div., Calabro Inds., Inc.

CAL-AV, INC., 515B Westchester Drive, Campbell, CA 95008, Tel: 408-371-0666, FAX: 408-371-0672; Empl.: 8

CALAY SYSTEMS, INC., 16842 Von Karman Ave., No. 100, Irvine, CA 92714, Tel: 714-863-1700, TELEX: 6711321, FAX: 714-863-0310; Empl.: 70

CAL CRYSTAL LAB., INC., 1142 N. Gilbert, Anaheim, CA 92801, Tel: 714-991-1580, 800-333-9825, FAX: 714-491-9825; Empl.: 30; *Sls. Mgr.:* Audrey Gevers

CALEX MFG. CO., INC., 3355 Vincent Rd., Pleasant Hill, CA 94523, Tel: 510-932-3911, TELEX: 269888, FAX: 510-932-6017; FSC No.: 29988; Empl.: 75; *Sls. Mgr.:* Steve Mathias ..... **D•1008, 1641-1648**

Local Sales Offices & Reps

CA	Long Bch., Saber Entprs., Inc.	213-595-5646
CA	Mtn. View, Saber Entprs., Inc.	415-968-0427
CA	San Diego, Saber Entprs., Inc.	619-271-1523
CO	Parker, Davis Assocs.	303-841-8648
CT	Tolland, R.G. Assocs.	203-875-4201
GA	Marietta, Testech Entprs., Inc.	404-971-2298
IL	Carpentersville, Precision Meas. Prods. Inc.	708-426-4446
MA	Hanover, R.G. Assocs.	617-293-5233
MA	Lowell, R.G. Assocs.	508-458-9802
NJ	Cherry Hill, Analectro Tech. Rep., Inc.	609-795-6676
NC	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix	513-854-5939
OR	Portland, Topp Engrg.	503-244-7265
PA	Allison Pk., Geotronix	412-487-1770
MI	Sterling Hgts., Geotronix	313-254-0520
TX	Houston, Chauvin Engrg. Co.	713-668-4770
TX	Richardson, Chauvin Engrg. Co.	214-220-1234
VA	Burke, Analectro Tech. Rep., Inc.	703-922-4317
WA	Bellevue, Topp Engrg. Sls. Co.	206-747-5400
WA	Greenacres, Topp Engrg. Sls.	509-928-4177

Local Distributors

OH	Richfield, Alpha Distr.	216-659-7100

CALIBRON INSTRUMENTS, Burton-Rogers Co., 220 Grove St., Waltham, MA 02154, Tel: 617-894-6440, FAX: 617-893-8393; Empl.: 14; *Dist. Mgr.:* W. Burton

CALIFORNIA AUTOMATION INC., 11815 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-452-1341

CALIFORNIA AVIONICS LABS., See Cal-Av, Inc.

CALIFORNIA DC, 2150 Anchor Ct., Newbury Park, CA 91320, Tel: 805-499-3621, FAX: 805-498-8381; Empl.: 100; *Sls. Mgr.:* C. Paton; *Dist. Mgr.:* C. Paton

CALIFORNIA EASTERN LABS. INC., 4590 Patrick Henry Dr., Santa Clara, CA 95056-0964, Tel: 408-988-3500, TELEX: 346393, TWX: 171197; Empl.: 118

California INSTRUMENTS

FAX: 619-279-8139

CALIFORNIA INSTRUMENTS CORP., 5125 Convoy St., Ste. 201, San Diego, CA 92111-1216, Tel: 619-279-8620, 800-356-2244, TELEX: 695047 CALICO SDG; FSC No.: 16067; Empl.: 70; *Sls. Mgr.:* D.R. Chilcoat, G.R. Holland ..... **D•2179-2181**

Local Sales Offices & Reps

AL	Huntsville, Sci. Dvcs.-SE	205-536-1969
AZ	Tempe, Sci. Dvcs.-West	602-730-9774
CA	Huntington Beach, Sci. Dvcs. West	714-840-3501
CA	San Jose, Scientific Dvcs.	408-554-0455
CO	Broomfield, Sci. Dvcs.-West	303-469-5145
CT	Mt. Carmel, Sci. Dvcs.-NE	203-248-9361
FL	Orlando, Scientific Dvcs.-SE	407-841-8180
IL	Arlington Hts., Berndt Assoc.	708-632-0900
IN	Carmel, Berndt Assoc.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-541-1007
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MD	Hunt Valley, Electronic Resources, Inc.	301-584-7547
MA	Waltham, Sci. Dvcs.-NE	617-890-5816
MN	Minneapolis, Berndt Assoc.	612-546-2021
MO	St. Louis, Ramsey Assocs.	314-532-9386
NJ	Ridgefield Park, Sci. Dvcs. East, Inc.	201-440-3430
NM	Albuquerque, Sci. Dvcs.-West	505-883-3668
NY	Rochester, TAE-Rep, Inc.	716-586-8710
NY	Whitney Pt., TAE-Rep, Inc.	607-692-3705
NC	Raleigh, Sci. Dvcs.-SE	919-859-0868
OH	Cincinnati, Dietrich & Assoc.	513-984-8924
OH	Independence, Dietrich & Assoc.	216-642-7965
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
OR	Beaverton, Northwest T&M	503-645-9000
PA	Horsham, Sci. Dvcs. East	215-956-0700
PA	Pittsburgh, Dietrich & Assoc.	412-892-2992
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-579-2995
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WA	Bellevue, N.W. Test & Measurement	206-881-8857
WI	Milwaukee, Berndt Assocs.	414-545-8400
Can	Markham, Ont., Multitest Elctrns.	416-470-2929
Can	N. Vancouver, B.C., Jerome & Francis Co., Ltd.	604-986-1286

CALIFORNIA MICRO DEVICES, INC., 215 Topaz Street, Milpitas, CA 95035, Tel: 408-263-3214, FAX: 408-263-7846; FSC No.: 56427; Empl.: 70; *Sls. Mgr.:* Stephen R. Pass

CALIFORNIA MICROWAVE, 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-732-4000, TELEX: 35 2016, TWX: 910-339-9231, FAX: 408-732-4244; Empl.: 1020

CALMARK CORPORATION

FAX: 818-287-7350

CALMARK CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-0451; FSC No.: 52094; Empl.: 90; *Sls. Mgr.:* Peter Jeanseau; *Dist. Mgr.:* Peter Jeanseau ..... **C•1019**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Oceanside, Noo Rep. Tech. Sls.	619-941-0558
CA	San Gabriel, Calmark Corp.	818-287-0451
CA	Santa Clara, Calmark Corp.	408-988-1260
FL	Winter Springs, Sunland Assocs.	407-365-9533
IL	Downers Grove, Golten Assoc.	708-512-0093
IA	Cedar Rapids, Stan Clothier Co.	319-393-1576
KS	Olathe, Stan Clothier Co.	913-829-0013
MD	Cockeysville, Dalbrook Corp.	301-666-2212
MI	Farmington Hills, W.R.Hummon	313-474-0661
MN	St. Paul, Innovate Sls.	612-225-9772
MO	St. Charles, Stan Clothier Co.	314-928-8078
NJ	Fort Lee, Neptune Elect.	201-461-2789
NY	E. Syracuse, Fountain, Young & Co.	315-437-7733
NY	Plainview, Neptune Elect.	516-349-1600
NC	Matthews, Arthur, Harris & Assocs.	704-845-1085
OH	Miamisburg, Electronics Comps., Inc.	513-866-3340
OH	Rocky River, Electronic Comps., Inc.	216-331-5330
OR	Beaverton, Unicomp, Inc.	503-643-1645
PA	Colmar, Dalbrook Corp.	215-997-2770
TX	Richardson, Zonk Assocs.	214-238-7651
TX	Stafford, Zonk & Assocs.	713-561-7777
WA	Snohomish, Unicomp, Inc.	206-568-0511
EXP	Ireland/Cappoquin, Calmark Ireland, Ltd.	353-58-54205
EXP	San Gabriel, CA, Calmark Corp.	818-287-0451
PR	Santruce, SISCO	809-726-3137
Can	Islington, Ont., Pipe-Thompson Ltd.	416-236-2355

Local Distributors

AZ	Phoenix, Aero-Space Southwest	602-582-2779
CA	Fremont, Terminal Sls. Corp.	415-656-7722
CO	Denver, Solder Tec.	303-623-5000
IL	Elk Grove, Martec Assocs.	708-956-8090
MD	Beltsville, Petricko, Inc.	301-937-4960
MA	Haverhill, Cord	617-374-0100
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
NJ	Corbin City, Index	609-628-4040
NM	Albuquerque, Betatron	505-821-1122
NY	Elmsford, Multimetrics Co.	914-347-3667
NY	Endwell, Pryme-Line Distrs.	607-748-5200
OH	Miamisburg, E.C.I. Distrs.	513-866-3340
TX	El Paso, International Elex.	915-598-3406
TX	Richardson, Zec Sls.	214-669-0895
Can	Mississauga, Ont., Rush Elex. Ltd.	416-677-7280

CALMOS SEMICONDUCTOR, INC., 20 Edgewater Street, Kanata, Ontario, Canada K2L 1V8, Tel: 613-836-1014, 800-267-7231, TELEX: 053-4501, FAX: 613-831-1742; Empl.: 52; *Sls. Mgr.:* Vince Venebs; *Dist. Mgr.:* Carol Norton

CAL-R, INC., See Sfernice, Inc.

CAL-SCOPE, Exceltron Inc., 473-707 Macara Ave., Sunnyvale, CA 94086, Tel: 408-730-4573, 1-800-828-3547, FAX: 408-730-9537; Empl.: 4; *Sls. Mgr.:* Michi A. Kawaguchi

CAL-TEK ENGINEERING, 36 Riverside Drive, Kingston, MA 02364, Tel: 617-585-5666; Empl.: 5

CAMBRIDGE AEROFLO, INC., 900 Mt. Laurel Circle, Shirley, MA 01464, Tel: 508-45-2346, TELEX: 948503, FAX: 508-425-2338; Empl.: 25

CAMBRIDGE ELECTRONICS LABORATORIES, 20 Chester St., Somerville, MA 02144, Tel: 617-629-2805, TELEX: 948580 RACE

CAMBRIDGE FILTER CORP., P.O. Box 4906, Syracuse, NY 13221-4906, Tel: 315-457-1000, TELEX: 322096, FAX: 315-457-7341; Empl.: 400-500

CAMBRIDGE INSTRUMENTS, INC., Optical Systems Division, P.O. Box 123, Buffalo, NY 14240, Tel: 716-891-3000, TELEX: 91-285 REICHERT BUF UW; Empl.: 650; *Sls. Mgr.:* Ronald Armstrong, VP Sls. & Mktg.

CAMBRIDGE PRODUCTS, 244 Woodland Ave., Bloomfield, CT 06002, Tel: 203-243-1761, 800-243-8814, FAX: 203-242-7006; Empl.: 32; *Sls. Mgr.:* Bill Pitcher; *Dist. Mgr.:* Bill Pitcher

CAMBRIDGE TECHNOLOGY, INC., 23 Elm Street, Watertown, MA 02172, Tel: 617-923-1181, TWX: 910-250-7539 CAMTECH BSN, FAX: 617-924-8378; Empl.: 33; *Sls. Mgr.:* Bruce Rohr

C.A.M. GRAPHICS CO., INC., 15 Ranick Dr. W., Amityville, NY 11701, Tel: 516-842-3400, FAX: 516-842-1005; FSC No.: 63203; Empl.: 50; *Sls. Mgr.:* Michele Forbes

CANADA WIRE AND CABLE LIMITED, 250 Ferrand Dr., Don Mills, Ontario, Canada M3C 3J4, Tel: 416-424-5000, TELEX: 065-24120, FAX: 416-424-1008; Empl.: 5,000; *Sls. Mgr.:* John Murphy (Long Beach)

CANADIAN THERMOPLASTICS OP., FERRO CORP., Ferro Indl. Prods. Ltd. Thermoplas.Div., 354 Davis Road, Oakville, ONT. L6J 2X1, Tel: 416-845-4277, TELEX: 06-982218; *Sls. Mgr.:* Wayne Smith

CANADIAN THERMOSTATS & CONTROL DEVICES LTD., 8415 Mountian Sights, Montreal, PQ, Canada H4P2B8, Tel: 514-739-3274, TELEX: 05-825619, FAX: 514-739-2902; Empl.: 20; *Sls. Mgr.:* Richard W. Murk

C & C JETRONIC, INC., Research Pk. 318 Wall St., Princeton, NJ 08540, Tel: 609-921-8540, FAX: 609-921-7971; Empl.: 30; *Sls. Mgr.:* C. Jerry Chiang ..... **A•2188; C•1393; D•1652**

C & C TECHNOLOGY INC., Bldg. 9, Unit 60, 245 W. Roosevelt Rd., West Chicago, IL 60185, Tel: 708-231-0015, TELEX: 4974811, FAX: 708-231-0345; Empl.: 6; *Sls. Mgr.:* Randy Cochran

C&D CHARTER POWER SYSTEMS, 3043 Walton Rd., Plymouth Meeting, PA 19462, Tel: 215-828-9000, TELEX: 685 1059 CD BAT UW, TWX: 510-660-8436, FAX: 215-828-6579; Empl.: 1500

C & K COMPONENTS, INC., 2035 Hwy. 70 East, Clayton, NC 27520, Tel: 919-553-3131, ESYLNK: 62951859, FAX: 919-553-4758; Empl.: 250 ..... **B•1655**

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Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Tempe, Reptronix, Ltd.	602-345-4580
CA	Auburn, Ewing-Foley, Inc.	916-885-6591
CA	Los Altos, Ewing-Foley	415-941-4525
CA	Montrose, Luscombe Eng.	818-249-9000
CA	San Diego, Luscombe Eng.	619-292-4323
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Boca Raton, Beacon Elctrns.	407-997-5740
FL	Longwood, Beacon Elctrns.	407-332-1940
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Elk Grove Vlg., Control Sls.	708-595-2110
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
MO	Raytown, Cen Tech, Inc.	816-358-8100
KY	Louisville, Bromberg & Assoc.	502-456-1498
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Randallstown, Beacon North, Inc.	703-478-2480
MI	Farmington Hills, Rathsburg Assoc.	313-489-1500
MN	Minnetonka, Gibb Elctrns.	612-935-4600
MO	Bridgeton, Cen Tech, Inc.	314-291-4230
MO	Kansas City, Hill & Co.	816-361-1669
MO	St. Louis, Hill & Co.	314-842-6868
NM	Albuquerque, Reptronix	505-292-1718
NY	Port Washington, Ashtec, Inc.	516-767-0336
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, Beacon Elctrns.	919-787-0330
NC	Raleigh, JLS Assoc.	919-846-6445
OH	Beachwood, Thompson & Assocs.	216-831-6277
OH	Dayton, Thompson & Assocs.	513-435-7733
OR	Tigard, LD Elctrns.	503-684-8221
PA	Santurce, Beacon Elctrns.	809-728-5040
PA	Wayne, Quality Comps.	215-687-3553
TX	Austin, R. F. Kimball Co., Inc.	512-443-5284
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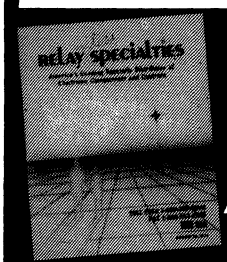

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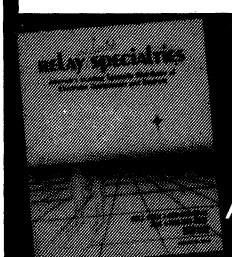

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CENTENT CO., 3879 S. Main St., Santa Ana, CA 92707, Tel: 714-979-6491; Empl.: 14; *Sls. Mgr.:* A. Freimanis

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CENTRAL DATA CORP., 1602 Newton Dr., Champaign, IL 61821, Tel: 217-359-8010, FAX: 217-359-6904; Empl.: 60; *Sls. Mgr.:* Avon Morgan; *Dist. Mgr.:* Avon Morgan

CENTRAL SEMICONDUCTOR CORP., 145 Adams Ave., Hauppauge, NY 11788, Tel: 516-435-1110, FAX: 516-435-1824; Empl.: 50

CENTRONIC, INC., THE MORGAN CRUCIBLE COMPANY, SPEC. MATLS. & TECH DIVISION, 1829 B DeHavilland Dr., Dept. E, Newbury Park, CA 91320-1702, Tel: 805-499-5902, FAX: 805-499-7770; FSC No.: 63334; Empl.: 23; *Sls. Mgr.:* George Pankau; *Dist. Mgr.:* Yuval Tamari ..... **B•1322**

Local Sales Offices & Reps
CA Newbury Pk, Centronic, Inc., E-O Comps. Div. 805-499-5902

CENTURION INTERNATIONAL, INC., 3425 N. 44 St., Lincoln, NE 68504, Tel: 402-467-4491, FAX: 402-467-4528; Empl.: 160; *Sls. Mgr.:* Steven C. Bowles; *Dist. Mgr.:* Bob Bonebright

C.E. PRECISION ASSEMBLIES, INC., 101 S. McKemy Ave., Chandler, AZ 85226, Tel: 602-940-0740, FAX: 602-961-4754; FSC No.: 67810; Empl.: 24; *Sls. Mgr.:* Henry Richards

CERAMASEAL, Box 260, New Lebanon, NY 12125, Tel: 518-794-7800, TELEX: 14-5442, FAX: 518-794-8080; FSC No.: 07601; Empl.: 85; *Sls. Mgr.:* Gene D. Sawin

CERAMAWIRE, Box 1084, Cranford, NJ 07016, Tel: 908-276-1170; Empl.: 4; *Sls. Mgr.:* Edward Hamilton

CERAMIC DEVICES INC., 8145 Ronson Rd., San Diego, CA 92111, Tel: 619-560-7575, FAX: 619-560-4906; FSC No.: 66230; Empl.: 40; *Sls. Mgr.:* Linda Parrish

CERAMIC MAGNETICS, INC., 16 Law Dr., Fairfield, NJ 07004, Tel: 201-227-4222, FAX: 201-227-6735; Empl.: 90

CERA-MITE CORP., 1327 Sixth Ave., Grafton, WI 53024, Tel: 414-377-3500, FAX: 414-377-7309; Empl.: 215; *Sls. Mgr.:* Claude Marquardt

CERCAST GROUP HOWMET CORPORATION, 3905 Industrial Blvd., Montreal-North, Que H1H 2Z2, Tel: 514-322-2371, FAX: 514-322-1340; Empl.: 1100; *Sls. Mgr.:* Dieter Rupp

CERMETEK MICROELECTRONICS INC., 1308 Borregas Ave., Sunnyvale, CA 94089, Tel: 408-752-5000, FAX: 408-752-5004; Empl.: 50; *Sls. Mgr.:* Thomas Newton

C.G. INSTRUMENTS CORP., Electromatic Controls Corp., 2495 Pembroke Ave., Hoffman Estates, IL 60195, Tel: 708-882-5757, FAX: 708-882-7234; Empl.: 27; *Sls. Mgr.:* Mike Meurer; *Dist. Mgr.:* Mike Meurer

CGRS MICROTECH, P.O. Box 102L, Langhorne, PA 19047, Tel: 215-757-0284; Empl.: 5; *Sls. Mgr.:* J. Swope; *Dist. Mgr.:* J. Swope

CHACE PRECISION METALS, INC., 1704 Barnes St., Reidsville, NC 27320, Tel: 919-342-2381, FAX: 919-342-4012; Empl.: 190; *Sls. Mgr.:* Pat J. Urban

CHA INDUSTRIES, 4201 Business Center Dr., Fremont, CA 94538, Tel: 415-683-8554, TELEX: 334426, FAX: 415-683-3848; *Sls. Mgr.:* Jack Patten

CHALCO ENGRG. CORP., Chalco Industries, Inc., 15126 S. Broadway, Gardena, CA 90248-1898, Tel: 213-321-0121, 213-323-5525, FAX: 213-323-0405; Empl.: 95; *Sls. Mgr.:* Steven Kierman, Dir. Sls.



FAX: 708-451-7585

CHAMPION TECHNOLOGIES, INC., 2553 N. Edgington, Franklin Park, IL 60131, Tel: 708-451-1000; Empl.: 175; *Sls. Mgr.:* Greg Dec ..... **A•1321**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	Campbell, Kottmeier Assocs.	408-371-8700
CA	Irvine, Prism Assocs.	714-252-1208
CA	San Diego, Spinnaker Sls.	619-451-8595
FL	Longwood, Delmac Sls.	407-831-0040
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Itasca, Micro Sls.	708-285-1000
IN	Indianapolis, Schank Elctrn. Mktg.	317-842-6204
AZ	Phoenix, Integrated Sys. & Dvc. Sls.	602-971-8250
MD	Columbia, Third Wave Solutions	301-290-5990
MA	Natick, Wayland Engrg. Sls.	508-655-6080
MI	Farmington Hills, Schank Elctrn. Mktg. Inc.	313-626-2551
MN	Minneapolis, Horizon	612-884-6515
CO	Littleton, Contec Mktg., Inc.	303-973-8490
NY	E. Rochester, W. Kreger Assocs.	716-381-4430
NY	Great Neck, Trionic Assoc.	516-466-2300
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Solon, J.R. Thornberry Co.	216-248-4995
TX	Austin, Electra Reps.	512-339-1163
TX	Dallas, Electra Reps.	214-248-3852
Can	Brampton, Ont., Cantec Reps. Inc.	416-791-5922
WA	Redmond, Electronic Mktg. Grp.	206-882-0962
WI	Brookfield, Micro Sls.	414-786-1403
IL	Franklin Pk., Champion Technlgs.	708-451-1000

Local Distributors

CA	San Jose, Passive Technlgs.	408-435-5566
IL	Palatine, OHM Elctrns.	708-359-5500
NY	Bayshore, Brookdale Elctrns.	516-242-8033

CHAMPLAIN CABLE CORP., Huber & Suhner(USA)Corp., 12 Hercules Dr., Colchester, VT 05446, Tel: 802-655-2121, FAX: 802-655-2025; FSC No.: 05973; Empl.: 300o; *Sls. Mgr.:* M.Brennan; *Dist. Mgr.:* J. Brooks

CHANDLER PRODUCTS, 1491 Chardon Rd., Cleveland, OH 44117, Tel: 216-481-4400; *Sls. Mgr.:* Nick Andos

CHANNEL INDUSTRIES, 839 Ward Dr., Santa Barbara, CA 93111, Tel: 805-967-0171, TELEX: 658416, FAX: 805-683-3420; Empl.: 75

CHAPMAN CORP., P.O. Box 10700, 125 Presumpscot St., Portland, ME 04104, Tel: 207-773-4726, TELEX: 493 1536 CHAP UI, FAX: 207-775-7369; Empl.: 42; *Sls. Mgr.:* John Goodwin; *Dist. Mgr.:* Peter DeFilipp

CHARLES INDS. LTD., Charles Center, 5600 Apollo Drive, Rolling Meadows, IL 60008, Tel: 708-806-6300, TWX: 910-687-3375, FAX: 708-806-6231; Empl.: 100; *Sls. Mgr.:* Laurie Goro

CHARLES RIVER DATA SYSTEMS, INC., 983 Concord St., Framingham, MA 01701, Tel: 508-626-1000, TELEX: 681-7373, FAX: 508-626-1046; Empl.: 170; *Sls. Mgr.:* David Greer; *Dist. Mgr.:* David Greer



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CHATSWORTH DATA CORPORATION, 20710 Lassen St., Chatsworth, CA 91311, Tel: 818-341-9200; Empl.: 95; *Sls. Mgr.:* Hank Boehm ..... **D•1234**

CHAUVIN ARNOUX, Chauvin Arnoux-France, 15 Faraday Dr., Dover, NH 03820, Tel: 603-749-6434, FAX: 603-742-2346

CHEMICAL ABSTRACTS SERVICE, American Chemical Society, 2540 Olentangy River Road, Columbus, OH 43202-1505, Tel: 614-447-3600, FAX: 614-447-3709; *Sls. Mgr.:* Tom Gornick

CHEMREX INC., ResTech Prods. Div., 6120 E. 58th Ave., Commerce City, CO 80022, Tel: 303-289-5651, FAX: 303-289-5283; *Sls. Mgr.:* Michael P. Manegold

CHEMTRONICS INC., 681 Old Willets Path, Hauppauge, NY 11788, Tel: 516-582-3322, 800-645-5244, TELEX: 968567, FAX: 516-582-3046; FSC No.: 21267; Empl.: 112; *Sls. Mgr.:* Louis Friedman; *Dist. Mgr.:* Scott Friedman

CHENANGO INDUSTRIES, INC., 200 Stage Road, Vestal, NY 13850, Tel: 607-748-1572, TWX: 510-252-0899, FAX: 717-879-4220; *Sls. Mgr.:* Rick Hammond

CHEROKEE INTERNATIONAL, INC., Core Industries, 2841 Dow Avenue, Tustin, CA 92680-7211, Tel: 714-544-6665, TWX: 510-101-0493, FAX: 714-838-4742; Empl.: 350; *Sls. Mgr.:* Dennis Pouliot ..... **D•1653-1657**

Local Sales Offices & Reps

CA	Santa Clara, Cindel, Inc.	408-988-8331
FL	Del Ray Beach, Phelps Assoc.	407-276-7591
GA	Atlanta, Naylor Assoc.	404-373-5036
AZ	Phoenix, Chaparral Elctrns.	602-996-5909
IL	Downers Grove, Richmar Elctrns.	708-968-0118
IL	Prairie Vl., Crosslink Elctrns.	913-649-7100
IN	Indianapolis, Richmar Elctrns. Corp.	317-846-6383
KS	Prairie Village, Crosslink Elctrns.	913-649-7100
MN	Minneapolis, Robt. W. Marshall Co., Inc.	612-929-0457
NH	Amherst, Bennetron	603-880-7008
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Wappinger Falls, Bob Dean, Inc.	914-297-6406
NC	Resch. Triangle Pk., Naylor Assocs., Inc.	919-544-6630
OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix, Inc.	216-659-6100
OR	Beaverton, Elctrns. N.W.	503-629-9241
PA	Allison Pk., Geotronix, Inc.	412-487-1770
TX	Dallas, Richmar Elctrns.	214-424-8388
VA	Charlottesville, DVS Co.	804-973-0303
WA	Redmond, Elctrns. N.W.	206-557-0851
Can	Downsview, Ont., Elbit Elctrns.	416-633-5050



FAX: 708-360-3566

CHERRY ELECTRICAL PRODUCTS, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, Tel: 708-662-9200; Empl.: 1,000; *Dist. Mgr.:* George Di Martino ..... **B•1044-1045, 1661-1665, 1802**

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs. S.W.	602-944-9542
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	San Jose, O'Donnell Assocs. N., Inc.	408-432-1940
CA	Torrance, O'Donnell Assocs., Inc.	213-539-9664
CO	Denver, Spectrum Mktg. Assocs., Inc.	303-480-9991
CT	Branford, Coakley, Boyd & Abbett, Inc.	203-481-2218
FL	Orlando, Cahill Assocs.	407-282-5117
FL	Palm City, Cahill Assocs.	407-288-3113
IL	Waukegan, Cherry Elctrl. Prods.	708-662-9200
IN	Ft. Wayne, Menze Sls., Inc.	219-747-5616
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-Tronix, Inc.	913-339-6333
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MI	Farmington Hills, Cherry Elctrl. Prods., Automotive	313-477-4477
MI	Grand Rapids, Miltimore Sls., Inc.	616-942-9731
MI	Novi, Miltimore Sls., Inc.	313-349-0260
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	W. Caldwell, Grimm, Siegel Assocs., Inc.	201-575-9300
NM	Albuquerque, O'Donnell Assocs., S.W.	505-889-4522
NY	Pittsford, Elcom Sls., Inc.	716-385-1400
NY	Skaneateles, Elcom Sls., Inc.	315-685-8967
NC	Raleigh, CSR Elctrns., Inc.	919-878-9200
OK	Tulsa, Comptech Sls., Inc.	918-622-7744
OR	Beaverton, Westmark Elctrns., Inc.	503-641-8780
TN	Knoxville, CSR Elctrns.	615-689-7911
TX	Austin, Comptech Sls., Inc.	512-343-0300
TX	Houston, Comptech Sls., Inc.	713-492-0005
TX	Irving, Comptech Sls., Inc.	214-751-1181
UT	Ogden, Spectrum Mktg. Assocs., Inc.	801-972-8552
VA	Fairfax, Colrud Corp.	703-904-0240
WA	Bellevue, Westmark Elctrns., Inc.	206-454-1944
Can	Coquitlam, B.C., r.n. Longman Sls., Inc.	604-931-4744
Can	Kirkland, Que., r.n. Longman Sls., Inc.	514-694-3911
Can	Mississauga, Ont., r.n. Longman Sls., Inc.	416-670-8100
Can	Ottawa, Ont., r.n. Longman Sls., Inc.	613-564-0100

Local Distributors

AL	Birmingham, Ack Radio Supp. Co.	205-322-0588
AL	Huntsville, Powell Elctrns.	205-837-5300
CA	Inglewood, Newark Elctrns.	213-671-7377
CA	San Jose, Powell Elctrns.	408-943-9020
AZ	Tempe, L Comp, Inc.	602-730-1633
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Compton, Harper S.I.D.	213-979-5090
CO	Denver, Newark Elctrns.	303-757-8531
CA	Gardena, Cal Switch	213-770-2330
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Oakland, Brill Elctrns.	415-834-5888
CA	Sacramento, Integrated Elec.	916-363-6030
CA	San Diego, Harper S.I.D.	619-578-2500
CA	San Jose, Harper S.I.D.	408-943-9490
CA	Sunnyvale, Target Elctrns.	408-733-0384
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Sager Elctrns.	203-265-4600
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Denver, Integrated Elec.	303-292-6121
CT	Wallingford, G.R.S. Midan Elec., Inc.	203-265-2077
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Atlanta, Ack Radio Supp. Co.	404-351-6340
IL	Champaign, Klaus Radio, Inc.	217-356-1896
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Ft. Wayne, Bell Inds.	219-423-3422
IL	Palatine, OHM Elctrns., Inc.	708-359-5500
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Indianapolis, Bell Inds./Graham	317-875-8200
IN	Indianapolis, PEI Genesis Elec.	317-879-0700
IN	South Bend, PEI Genesis Elect.	219-287-2911
IA	Cedar Rapids, Advent Elec., Inc.	319-363-0221
GA	Norcross, Reptron Elctrns.	404-446-1300
MD	Annapolis Jct., Powell Elctrns.	301-953-3435
MD	Savage, Pyttronic Inds., Inc.	301-792-0780
MA	Needham, Cronin Elctrns., Inc.	617-449-5000
MA	Newton, Greene-Shaw Co.	617-969-8900
MI	Livonia, Reptron Elect., Inc.	313-525-2700
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Minneapolis, Sterling Elctrns.	612-831-2666
MO	Kansas City, L Comp, Inc.	816-241-0111
MO	Maryland Hgts., L Comp, Inc.	314-291-6200
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Oakland, Relay Specs.	201-337-1000
NJ	Teterboro, E.A.C. Elec., Inc.	201-288-4477
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Buffalo, Summit Dists.	716-887-2800
MD	Columbia, Sager Elctrns.	301-995-6580
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Rochester, Summit Dists.	716-334-8110
NC	Cary, Powell Elctrns.	919-467-1212
NC	Raleigh, Sager Elctrns.	919-850-9550
NC	Winston-Salem, Kirkman Elect.	919-722-9131
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Dayton, Bell Inds.	513-435-8660
OH	Valley View, Newark Elctrns.	216-447-8860
OH	Warren, REM Elctrns. Supp. Co.	216-373-1300
OH	Worthington, Reptron Elctrns.	614-436-6675
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Integrated Elec.	503-641-1690
OR	Portland, Radar Elec.	503-232-3404

OR Portland, Tek-Elec. 503-246-5451
PA Erie, REM Elctrns. Supp. Co. 814-453-5626
PA Montgomeryville, Pyttronics Inds., Inc. 215-643-2850
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Philadelphia, PEI Genesis Elect. 800-523-0727, 800-222-1772
PA Philadelphia, Sager Elctrns. 215-464-4336
TX Garland, Newark Elctrns. 214-487-8144
MA Hingham, Sager Elctrns. 617-749-6700
TX Houston, Newark Elctrns. 713-270-4800
TX Irving, Harper S.I.D. 214-621-0500
TX Irving, Powell Elctrns. 214-550-0547
MI Oak Park, Newark Elctrns. 313-967-0600
TX Stafford, Southwest Elec., Inc. 713-240-4000
UT N. Salt Lake City, Integrated Elctrns. .. 801-298-1869
UT Salt Lake City, Stand. Supp. Co. 801-486-3371
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Integrated Elctrns., Inc. 206-455-2727
WA Seattle, Radar Elctrns. 206-282-2511
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
WI Waukesha, Hawk Elctrns. 414-547-4457
Can Burnaby, B.C., ITT/Rae Ind. Elect. 604-291-8866
Can Calgary,Alberta, ITT/Rae Ind. Elect. ... 403-273-2780
Can Concord, Ont., ITT/RAE Ind. Elect. 416-736-1144
Can London, Ont., C. M. Peterson Co., Ltd. 519-434-3204
Can Mississauga, Ont., Newark Elctrns. 416-670-7799

CHERRY SEMICONDUCTOR CORP, 2000 S. County Trail, East Greenwich, RI 02818, Tel: 401-885-3600, TELEX: WUI 6817157; FSC No.: WUI 6817157;;;401-885-5786; Empl.: 365

CHESSELL CORP., 1 Pheasant Run, Newtown, PA 18940, Tel: 215-968-0660, FAX: 215-968-0662; Empl.: 82; *Sls. Mgr.:* Richard Veit; *Dist. Mgr.:* R. Veit

CHESTER CABLE CORP., Sub. Alcatel NA Cable Sys. Inc., 15 Oakland Ave., Chester, NY 10918, Tel: 914-469-2141, TWX: 510-249-4813, FAX: 914-469-9935

CHESTERFIELD PRODUCTS, INC., 37 Midland Ave., Elmwood Park, NJ 07407, Tel: 201-797-9655, FAX: 201-797-9504; Empl.: 35; *Sls. Mgr.:* Bob Fiordalisi ..... **A•1661-1663**

Local Sales Offices & Reps
NM Phoenix, CPS Assocs., Inc. 602-246-1097
CA Carlsbad, MTM Intl., Inc. 619-729-6338
IL Chicago, Tech. Sls. 312-237-7210
MD Baltimore, Advanced Tech. Sls. 301-323-3140
MA Framingham, Bengal Assocs. 617-877-2639
MA Randolph, Bengal Assocs. 617-961-4120
NY Syracuse, Rep Tech, Inc. 315-437-2845
TX Richardson, Carl Tinch Sls. Co. 214-231-1322

CHICAGO BLOWER CORP., 1675 Glen Ellyn Rd., Glendale Heights, IL 60139, Tel: 708-858-2600, ESYLNK: 62912209, FAX: 708-858-7172; Empl.: 250; *Sls. Mgr.:* R.W. Wessel

CHICAGO CONDENSER CORP., 2900 West Chicago Ave., Chicago, IL 60622, Tel: 312-227-7070, FAX: 312-227-6646; FSC No.: 5910; *Sls. Mgr.:* Joan Looi ..... **A•1019**

CHICAGO LASER SYSTEMS, INC., 4034 N. Nashville Ave., Chicago, IL 60634, Tel: 312-282-2710, TELEX: 6711269 LASER UW, FAX: 312-282-8455; *Sls. Mgr.:* Bernard Alpiner, V.P.

CHICAGO LOCK CO., 4311 W. Belmont Ave., Chicago, IL 60641, Tel: 312-282-7177, TELEX: ITT 4994023, FAX: 312-282-8199; Empl.: 375; *Sls. Mgr.:* Dale N. Padjen

CHIU TECHNICAL CORP., 252 Indian Head Rd., Kings Park, NY 11754, Tel: 516-544-0606, FAX: 516-544-0809; FSC No.: 38-32, 38-41; Empl.: 25; *Sls. Mgr.:* Frank A. Denny, V.P. Mktg.



FAX: 716-538-6345

CHLORIDE ELECTRO NETWORKS, Chloride Power Electronics, Inc., 1 Technology Place, Caledonia, NY 14423, Tel: 716-538-4421, TWX: 510-254-0422; Empl.: 350; *Sls. Mgr.:* Gary Balfour ..... **A•2189; D•1658, 2182**

Local Sales Offices & Reps
CA Mission Veijo, Jim Anl 714-454-8997
FL Lakeland, Robert Coughlin 813-667-1663
MD Laurel, R.W. Mitscher Co. 301-498-6090
NH Nashua, Bell Ctrls. 603-882-6984
NY Liverpool, Thomas Ealy 315-652-3149

CHLORIDE EL PASO, Chloride Power Elctrns., 10931 Pellicano Drive, El Paso, TX 79935, Tel: 915-592-9985, FAX: 915-595-1664; FSC No.: 08715; Empl.: 1000; *Sls. Mgr.:* Robin Lee

CHOMERICS, INC.:W.R. GRACE & CO., 77 Dragon Ct, Woburn, MA 01888, Tel: 617-935-4850, TWX: 710-393-0173; Empl.: 650; *Sls. Mgr.:* Louis M. Yantosca; *Dist. Mgr.:* Gary L. Wood ..... **C•1674**

Local Sales Offices & Reps
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CA Carson, Chomerics 213-518-6921
CO Boulder, Front Range Mktg. 303-443-4780
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WA Seattle, Chomerics 206-624-3763

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MI Mt. Clemens, E.I.S. 313-791-8510
MN Mounds View, Indl. Gasket 612-785-2266
MO Kansas City, E.I.S. 816-471-5966
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NY Lancaster, Sealing Dvcs. 714-684-7600
OH Chargin Falls, Electrolock 216-543-6626
OR Portland, E.I.S. 503-227-3601
PA Essington, Tri-Com, Inc. 215-521-3080
SC Greenville, Electrolock 803-297-9830
TN Memphis, E.I.S. 901-947-4176
TX Dallas, Oriental Gasket 214-956-9100
UT Salt Lake City, E.I.S. 801-483-1226
VA Bluefield, E.I.S. 703-322-5424
WA Tukwilla, E.I.S. 206-241-1010
WI Mequon, Fabrico 414-241-5300
Can Markham, Ont., Matrix Technlg. 416-477-4442

CHR, Furon, 407 East St., P.O. Box 1911, New Haven, CT 06509, Tel: 203-777-3631, TWX: 710-465-0264; Empl.: 116; *Sls. Mgr.:* Joseph T. Ballentine; *Dist. Mgr.:* Joseph T. Ballentine

CHRISTIANA INDUSTRIES CORP., 6500 North Clark, Chicago, IL 60626, Tel: 312-465-6330, FAX: 312-465-6271; Empl.: 250; *Sls. Mgr.:* Mitchell Waters; *Dist. Mgr.:* Mitchell Waters

CHRISTIE ELECTRIC CORP., 18120 S. Broadway, Gardena, CA 90248, Tel: 213-715-1402, TWX: 910-349-6260, FAX: 213-618-8368; FSC No.: 02294; Empl.: 90; *Sls. Mgr.:* Scott Marvel

CHROMALOX INSTRS. & CONTROLS, 1382 Heil-Quaker Blvd., La Vergne, TN 37086-3536, Tel: 615-793-3900, TELEX: 55-5129, FAX: 615-793-3563; Empl.: 110; *Sls. Mgr.:* Mary Hausman ..... **D•1131**

CHROMATICS, 2558 Mountain Ind. Blvd, Tucker, GA 30084, Tel: 404-493-7000, FAX: 404-493-1314; FSC No.: FSCM 59992

CHRONO-LOG CORP., 2 W. Park Rd., Havertown, PA 19083, Tel: 215-853-1130, FAX: 215-853-3972; Empl.: 20; *Sls. Mgr.:* Kathy Jacobs ..... **D•1084**

Local Sales Offices & Reps
AL Huntsville, Dynamic Measurements ... 205-535-6663
Can Scarborough, Canadian Applied Technlg. 416-431-0004

CHURCHILL CORP., 344 Franklin St., Box G, Melrose, MA 02176, Tel: 617-665-4700, FAX: 617-662-5291; FSC No.: 94867; Empl.: 30; *Sls. Mgr.:* W. Schermerhorn

CIC COMPONENTS INDS. CO., LTD., 4FL No. 5 Lane 130, Min-Chung Rd., Hsin Tien City, Taiwan R.O.C., Tel: 886-2-9174302, TELEX: 35261 MEISCO, FAX: 886-2-9124480; Empl.: 30; *Sls. Mgr.:* James Huang

CICOIL CORP., 24960 Ave. Tibbitts, Valencia, CA 91355-3428, Tel: 805-295-1295, FAX: 805-295-0813; Empl.: 75; *Sls. Mgr.:* James Alderson

CIDTEC (CID TECHNOLOGIES INC.), 101 Commerce Blvd., Liverpool, NY 13088, Tel: 315-451-9410, FAX: 315-451-9421

CIMCO WIRE & CABLE, INC., See Specialty Cable Corp.

CINCH CONNECTOR DIVISION, Labinal Components & Systems Inc., 1501 Morse Ave., Elk Grove Village, IL 60007, Tel: 312-981-6000, TWX: 910-222-1796; *Sls. Mgr.:* James L. Hartranft Jr.; *Dist. Mgr.:* Scott Campbell

CINCH CYLINDRICAL DIVISION, Labinal Comps. & Systems, Inc., 8821 Science Center Dr., Minneapolis, MN 55428, Tel: 612-537-1010, FAX: 612-537-9614; *Sls. Mgr.:* Jim Simmons; *Dist. Mgr.:* Scott Campbell

CINCINNATI ELECTROSYSTEMS, 420 Wards Corner Rd., Loveland, OH 45140, Tel: 513-831-6800; TELEX: 312328, FAX: 513-831-4866; Empl.: 110; *Sls. Mgr.:* Brian Doherty

CINCINNATI SUB-ZERO PRODS., 12011 Mosteller Rd., Cincinnati, OH 45241, Tel: 513-772-8810, TELEX: 214390 SUBZERO CIN, FAX: 513-772-9119; Empl.: 117; *Sls. Mgr.:* Harold Zeilman

CIPHER DATA PRODUCTS, INC., an Archive Co., 10101 Old Grove Rd., San Diego, CA 92131, Tel: 619-578-9100, FAX: 619-693-4435; Empl.: 1500; *Sls. Mgr.:* Wes Bankston, VP Sls.

CIPRICO INC., 2955 Xenium Lane, Plymouth, MN 55441, Tel: 612-559-2034, FAX: 612-559-8799; Empl.: 79; *Sls. Mgr.:* Bill Rost

CIRCOM INC., 505 W. Main St., Bensenville, IL 60106, Tel: 708-595-4460, FAX: 708-595-4615; Empl.: 38; *Sls. Mgr.:* R. Alan Rosenberg

CA CIRCUIT ASSEMBLY CORP.

FAX: 714-855-4298

CIRCUIT ASSEMBLY CORP., 18 Thomas St., Irvine, CA 92718-2703, Tel: 714-855-7887, TELEX: 183109UD; FSC No.: 52072; Empl.: 275; *Sls. Mgr.:* Robert R. Brinckman; *Dist. Mgr.:* Robert R. Brinckman ..... **C•1316-1322**

Local Sales Offices & Reps
AL Huntsville, L & D, Inc. 205-837-1469
AZ Scottsdale, BSE, Inc. 602-483-0373
CA San Diego, Varigon-San Diego, Inc. ... 619-576-0100
CA Santa Clara, Westrep 408-988-8833
CO Englewood, Deltron Co. 303-741-2122
FL Clearwater, Tech-Rep Assoc., Inc. 813-572-9900
FL Ft. Lauderdale, Tech-Rep Assoc., Inc. 305-791-2708
FL Merritt Island, Tech-Rep Assoc., Inc. .. 407-453-3313
FL Winter Sprgs., Tech-Rep Assoc., Inc. .. 407-699-4010
GA Atlanta, L & D, Inc. 404-395-7079

BRILL ELECTRONICS
(415) 834-5888
610 E 10th St Oakland CA 94606
CHERRY
(213) 452-8002
1220 Olympic Bl Santa Monica CA 90404

IL	Itasca, LTD Technlgs., Inc.	708-773-2900
IL	Roscoe, LTD Technlgs., Inc.	815-389-4316
IN	Carmel, Frank E. Kahsar Sls.	317-844-9353
MD	Rising Sun, LHR Elctrns., Inc.	301-658-4058
MA	Randolph, The TMR Grp.	617-961-4486
MI	Grand Haven, Frank E. Kahsar Sls.	616-846-7590
MI	Warren, Frank E. Kahsar Sls.	313-795-3530
MN	Osseo, Gaffney Sls., Inc.	612-425-5484
MO	Grandview, Harris Hanson Co.	816-763-6200
MO	St. Louis, Harris Hanson Co.	314-432-3611
NJ	Berkeley Hgts., Cambridge Allen & Assoc.	201-464-0203
NJ	Moorestown, LHR Elctrns., Inc.	609-778-1019
NM	Albuquerque, SynTech	505-266-7951
NY	Forest Hills, Cambridge Allen & Assoc.	718-592-6361
NY	Rochester, Apex Assocs., Inc.	716-272-7040
NC	Raleigh, L & D, Inc.	919-876-5301
NC	Wilmington, L & D, Inc.	919-256-8110
OH	Cincinnati, Frank E. Kahsar Sls.	513-922-3133
OH	Columbus, Frank E. Kahsar Sls.	614-252-4009
OH	Mentor, Frank E. Kahsar Sls.	216-257-1166
OR	Portland, General Elctrns.	503-297-8500
PA	Sewickley, Frank E. Kahsar Sls.	412-741-4155
PA	Wexford, Frank E. Kahsar Sls.	412-935-8561
TN	Bristol, L & D, Inc.	615-878-2266
TX	Houston, Procomp Sls. Co.	713-681-1591
TX	Hurst, Procomp Sls. Co.	817-589-0336
TX	Richardson, Procomp Sls. Co.	214-669-1500
UT	American Fork, Deltron Co.	801-263-9413
VA	Midlothian, LHR Elctrns., Inc.	804-794-6013
VA	Richmond, L & D, Inc.	804-257-7717
WA	Redmond, General Elctrns.	206-867-0969
WI	Milwaukee, LTD Technlgs., Inc.	414-774-1000

Local Distributors

AL	Birmingham, Newark Elctrns.	205-942-4044
AL	Huntsville, Comp. Resources	205-837-1469
AL	Huntsville, Component Distrs.	205-851-7800
AL	Huntsville, Newark Elctrns.	205-837-9091
AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Newark Elctrns.	602-244-0133
AZ	Phoenix, Tri Tek	602-371-0860
AZ	Tempe, Circuit Specialists	602-966-0764
AZ	Tucson, Newark Elctrns.	602-628-7891
AR	Little Rock, Newark Elctrns.	501-225-8130
CA	Chatsworth, Passive Comps.	818-341-1745
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	Foster City, Newark Elctrns.	415-572-8300
CA	Irvine, Mann Southwest	714-380-4170
CA	Los Angeles, All American	213-320-0240
CA	Orange, Newark Elctrns.	714-634-8224
CA	San Diego, Southland Comps. Inc.	619-673-3800
CA	San Jose, All American	408-943-1200
CA	San Jose, Powell Elctrns.	408-943-9020
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Santa Ana, B D S Elctrns.	714-662-1050
CA	Santa Clara, Trinity Elctrns.	408-980-9011
CA	Santee, Mouser Elctrns.	619-449-2222
CO	Colorado Springs, Newark Elctrns.	719-576-2644
CO	Denver, C.S.I.D.	303-292-9594
CO	Denver, Comp. Distributors	303-770-6214
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Indelco	303-694-9444
CO	Englewood, Nep Elctrns.	303-799-9898
CT	Bloomfield, Newark Elctrns.	203-243-3985
CT	Bridgeport, Park Distrs.	203-366-7200
CT	East Hartford, Newark Elctrns.	203-289-1416
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Clearwater, Component Distrs.	813-796-0466
FL	Deerfield Beach, Vantage Comps.	305-429-1001
FL	Ft. Lauderdale, All American	305-572-7999
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Jacksonville, Newark Elctrns.	904-399-5041
FL	Longwood, Intertec	407-834-7777
FL	Maitland, Electronic Equip.	407-539-0888
FL	Melbourne, Component Distrs.	407-724-9910
FL	Miami, All American	305-621-8282
FL	Miami, Electronic Equip.	305-526-6000
FL	Plantation, Newark Elctrns.	305-587-2372
FL	Pompano Bch., Electronic Equip.	305-960-1200
FL	Tampa, Electronic Equip.	813-988-0810
FL	West Palm Beach, Atlantic Electronics	407-686-8553
GA	Atlanta, Newark Elctrns.	404-951-2363
GA	Norcross, Component Distrs.	404-441-3320
GA	Norcross, Newark Elctrns.	404-448-1300
HI	Aiea, Newark Elctrns.	808-487-8951
ID	Boise, Newark Elctrns.	208-342-4311
IL	Addison, Belford Elctrns.	708-691-1000
IL	Bensenville, Goold Elctrns.	708-860-7171
IL	Champaign, Klaus Radio	217-356-1986
IL	Elk Grove, Bell Inds.	708-640-1910
IL	La Salle, Klaus Radio	815-223-7400
IL	Peoria, Klaus Radio	309-691-4840
IL	Quincy, Klaus Radio	217-223-7560
IL	Schaumberg, Q P S Elctrns.	708-884-6620
IL	Schaumburg, Newark Elctrns.	312-843-0700
IL	Springfield, Newark Elctrns.	217-787-9972
IL	Wood Dale, Nep Elctrns.	708-595-8500
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Mar Elctrns.	317-633-6699
IN	Indianapolis, Newark Elctrns.	317-872-7070
IN	Merrillville, Newark Elctrns.	312-768-5059
IA	Cedar Rapids, Newark Elctrns.	319-393-3800
IA	Des Moines, Newark Elctrns.	515-278-0670
IA	Eldridge, Klaus Radio	319-285-8484
IA	Marion, Brenneman & Assoc.	319-377-6394
KS	Overland Pk., Newark Elctrns.	913-677-0727
KS	Wichita, Newark Elctrns.	316-267-8755
KY	Lexington, Newark Elctrns.	606-255-4161
LA	Metairie, Newark Elctrns.	504-838-9771
MD	Annapolis, Powell Elctrns.	301-953-3435
MD	Beltsville, Newark Elctrns.	301-206-3300
MD	Columbia, Vantage Comps., Inc.	301-720-5100
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MD	Hanover, Newark Elctrns.	301-796-9092
MD	Rockville, All American	301-251-1205
MA	Boston, All American	617-846-2300
MA	Holliston, Goold Elctrns.	508-429-8154
MA	Milford, Car Lac Indl.	508-478-7797
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	W. Springfield, Newark Elctrns.	413-785-5851
MA	Westboro, In Stock Prods.	508-870-5750
MA	Westborough, Powell Elctrns.	508-366-6100
MA	Woburn, Newark Elctrns.	617-932-9040
MI	Ann Arbor, Wedemeyer Elctrn. Supp. Co.	313-665-8611
MI	Grand Rapids, Newark Elctrns.	616-455-9190
MI	Mt. Clemens, Spec Connector Corp.	313-465-3232
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Burnsville, Cassidy Elctrns.	612-895-9026
MN	Crystal, Newark Elctrns.	612-535-4280
MN	Minneapolis, All American	612-944-2151
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Vadnais Hts., N A A Connectron	612-481-0022
MO	Blue Springs, Newark Elctrns.	816-228-3170
MO	St. Louis, Beckwith Elctrns.	314-343-6463
MO	St. Louis, Newark Elctrns.	314-298-2505
MT	Helena, Newark Elctrns.	406-443-6192
NE	Omaha, Newark Elctrns.	402-392-1221
NV	Las Vegas, Newark Elctrns.	702-796-5090
NV	Reno, Newark Elctrns.	702-322-6090
NH	Goffstown, Key Comps.	603-626-1717
NH	Manchester, Yankee Elctrns.	603-625-9746
NH	Nashua, Newark Elctrns.	603-888-5790
NJ	Bellmawr, Mid-Atlantic	609-931-5303
NJ	Clifton, Vantage Comps.	201-777-4100
NJ	E. Hanover, State Elctrns.	201-887-2550
NJ	Englewood, Powell Elctrns.	201-894-0800
NJ	Pennsauken, Newark Elctrns.	609-663-9490
NJ	Rahway, R.S.R. Elctrns., Inc.	201-381-8777
NJ	Randolph, Mouser Elctrns.	201-328-3322
NJ	Union, Newark Elctrns.	908-851-2290
NM	Albuquerque, Bestech	505-298-0034
NM	Albuquerque, Betatron	505-821-1122
NM	Albuquerque, Connecting Comps.	505-345-8921
NM	Albuquerque, Newark Elctrns.	505-883-6181
NY	Bohemia, Car Lac Indl.	516-567-4200
NY	Bohemia, Key Comps.	516-567-7500
NY	Cheektowaga, Newark Elctrns.	716-862-9700
NY	Comack, Car Lac Indl.	516-493-0556
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Long Island, All American	516-981-3935
NY	Mt. Vernon, All American/QAR	914-699-2224
NY	Redcreek, Advacom	315-754-8796
NY	Smithtown, Vantage Comps.	516-543-2000
NY	Syracuse, Newark Elctrns.	315-437-6611
NY	Valley Stream, Newark Elctrns.	516-561-8400
NC	Cary, Powell Elctrns.	919-467-1212
NC	Greensboro, Newark Elctrns.	919-292-7240
NC	Raleigh, Component Distrs.	919-859-3391
NC	Raleigh, Newark Elctrns.	919-781-7677
OH	Bedford, Advacom	216-439-0321
OH	Cincinnati, Newark Elctrns.	513-771-9700
OH	Cleveland, Car Lac Indl.	216-881-0050
OH	Columbus, Wedemeyer Elctrns.	614-436-9600
OH	Warrensville Hgts., Newark Elctrns.	216-587-1700
OK	Oklahoma City, Newark Elctrns.	405-495-5000
OK	Tulsa, Newark Elctrns.	918-832-7004
OR	Eugene, Newark Elctrns.	503-484-2158
OR	Portland, Newark Elctrns.	503-257-0741
PA	Cornwall Hgts., Newark Elctrns.	215-245-7300
PA	Export, Advacom	412-733-5910
PA	Levittown, G.W. Elctrns.	215-547-7422
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Pittsburgh, Newark Elctrns.	412-788-4790
SC	Greenville, Newark Elctrns.	803-288-9610
SC	N. Charleston, Newark Elctrns.	803-764-3091
TN	Brentwood, Newark Elctrns.	615-371-1341
TN	Memphis, Newark Elctrns.	901-365-8060
TX	Allen, Prime Distrs.	214-231-0170
TX	Austin, Carlton Bates	512-458-1175
TX	Dallas, All American	214-231-5300
TX	Dallas, Component Distrs.	214-644-0373
TX	Dallas, Off The Shelf	214-247-0052
TX	Ft. Worth, Carlton Bates	817-831-0395
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Newark Elctrns.	713-270-4800
TX	Irving, Powell Elctrns.	214-550-0547
TX	Mansfield, Mouser Elctrns.	817-483-0165
TX	Richardson, Off The Shelf	214-238-0808
UT	Provo, Omega Elctrns.	801-375-4664
UT	Salt Lake City, Newark Elctrns.	801-484-8611
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VT	Burlington, Newark Elctrns.	802-860-1856
VA	Arlington, Newark Elctrns.	703-522-7552
VA	Richmond, Newark Elctrns.	804-282-5671
WA	Bellevue, Newark Elctrns.	206-641-9800
WA	Spokane, Newark Elctrns.	509-327-1935
WV	Dunbar, Newark Elctrns.	304-768-6872
WI	Green Bay, Newark Elctrns.	414-494-1660
WI	New Berlin, Nep Elctrns.	414-785-9100
WI	Wauwatosa, Newark Elctrns.	414-453-9100
Can	Dartmouth, NS, Arcom Elctrns.	902-464-1600
Can	Laval, PQ, Newark Elctrns.	514-681-6476
Can	London, Ont., Newark Elctrns.	519-685-4280
Can	Mississauga, Ont., Newark Elctrns.	416-673-5449
Can	Nepean, Ont., Carsten Elctrns.	613-725-9250
Can	New Westminster, BC, Newark Elctrns.	604-520-5721
Can	Scarborough, Ont., Carsten Elctrns.	416-495-7705
Can	St. Laurent, PQ, Carsten Elctrns.	514-334-8321
Can	St. Laurent, PQ, Newark Elctrns.	514-738-4488

CIRCUITECH, INC., Division of Heyco, Inc., 542 Industrial Way West, Eatontown, NJ 07724, Tel: 201-542-6550, FAX: 201-542-1612; Empl.: 80; *Sls. Mgr.:* Ron Calvo

CIRCUIT IMAGES, INC., 1600 NW 167th Pl, Ste. 345, Beaverton, OR 97006, Tel: 503-629-2133, FAX: 503-645-9857; Empl.: 5; *Sls. Mgr.:* Tom Stevenson

CIRCUIT SPECIALISTS, INC., 738 S. Perry Lane, Tempe, AZ 85281, Tel: 602-966-0764, FAX: 602-967-2539

CIR-Q-TEL MICROWAVE, INC., 6600 Virginia Manor Rd, Beltsville, MD 20705, Tel: 301-470-2900, FAX: 301-776-3882; FSC No.: 21377; Empl.: 17; *Sls. Mgr.:* Henry D. Nibbe

CIRRIS SYSTEMS CORP.

FAX: 801-973-4609

CIRRIS SYSTEMS CORP., 1991 Parkway, Salt Lake City, UT 84119, Tel: 801-973-4600, 800-441-9910, TELEX: 446786; Empl.: 30; *Sls. Mgr.:* Brent Stringham ..... **D•1235**

CIRRUS LOGIC, INC., 3100 West Warren Ave., Fremont, CA 94538, Tel: 415-623-8300, TELEX: 171918, FAX: 415-226-2180; Empl.: 420; *Sls. Mgr.:* William Caparelli; *Dist. Mgr.:* Frank Reynolds

CITIZEN BUSINESS MACHINES, See CBM America Corporation

CP Clare CORPORATION

FAX: 312-262-7819

C.P. CLARE CORP., 3101 W. Pratt Blvd., Chicago, IL 60645, Tel: 312-262-7700, TELEX: 210075; Empl.: 2400; *Sls. Mgr.:* Thomas Cunneen; *Dist. Mgr.:* William Sowa ..... **B•1396, 1430-1431**

Local Sales Offices & Reps

AL	Decatur, El Tech Inc.	205-353-7899
AL	Huntsville, El Tech Inc.	205-464-0599
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	El Toro, C.P. Clare Corp.	714-586-0650
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	San Diego, Gary Chilcote Assocs.	619-728-7678
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Broomfield, Western Region Mktg.	303-428-8088
CT	Stamford, Fran Bigoa	203-322-0240
FL	Altamonte Springs, Sls. Engrg. Concepts	407-682-4800
FL	Deerfield Beach, Sls. Engrg. Concepts	305-426-4601

GA Lilburn, El Tech Inc. 404-564-1236
IL Itasca, Beta Tech Sls., Inc. 708-250-9586
IN Indianapolis, Schank Elctrn. Mktg. 317-842-6204
IA Cedar Rapids, Delltron Co. Inc. 319-393-0075
KY Fort Wright, El Tech Inc. 606-331-3495
MD Baltimore, Advanced Tech Sle Inc. 301-323-3140
MA Tewksbury, Procomp Assoc. 508-858-0100
MI Farmington Hills, Schank Elctrn. Mktg. 313-626-2551
MN Eden Prairie, High Technlg. Sls. Assocs. 612-944-7274
MO Florissant, Delltron Co., Inc. 314-839-0033
MO Kansas City, Delltron Co., Inc. 816-436-6445
NJ Fort Lee, Nexus Technlg. Sls. 201-947-0151
NM Albuquerque, Summit Sls. 505-345-5003
NY Hicksville, C.P. Clare Corp. 516-933-3645
NY Rochester, Electra Sls. Corp. 716-427-7860
NY Syracuse, Electra Sls. Corp. 315-463-1248
NC Raleigh, Zucker Assocs. 919-782-8433
OH Cleveland, Baehr, Greenleaf & Assoc. 216-892-1770
OH Dayton, Baehr-Greenleaf & Assocs. 513-439-0724
OH Worthington, Baehr-Greenleaf & Assocs. 614-847-0220
OR Portland, Westmark Elctrns. Inc. 503-641-8780
PA Erdenheim, Omni Sls. 215-233-4600
PA Warrendale, Baehr-Greenleaf & Assocs. 412-934-3088
TX Austin, Norcom Inc. 512-451-2757
TX Dallas, Norcom Inc. 214-386-4888
TX Houston, Norcon Inc. 713-778-0392
UT Salt Lake City, Western Region Mktg. 801-268-9768
WI Milwaukee, Beta Tech Sls., Inc. 414-543-6609
WA Bellevue, Westmark Elctrns. Inc. 206-454-1944
Can Dorval, Que., John G. Weiss Co. Ltd. .. 514-685-6644
Can Mississauga, Ont., John G. Weiss Co. Ltd. 416-673-0011

CLARCOR TUBULAR PRODUCTS, Clarcor, Box 7007, Rockford, IL 61125, Tel: 815-962-8867, FAX: 815-962-0417; Empl.: 2000; *Sls. Mgr.:* Douglas W. Franklin

CLARKE-HESS COMMUNICATIONS RESEARCH CORP., 220 West 19th St, New York, NY 10011, Tel: 212-255-2940, TELEX: 238667-RAPID NYK, FAX: 212-691-8158; FSC No.: 34423; Empl.: 14 ..... **D•1236-1237**

Local Sales Offices & Reps

CT Manchester, ICS Assocs. 203-649-3765
IL Chicago, Pat Lind Elctrns. 312-726-3513
IN Indianapolis, Pat Lind Elctrns. 317-632-7444
MA Westford, ICS Assocs. 617-692-3545
MN Circle Pines, Pat Lind Elctrns. 612-786-5770
OR Wilsonville, Syntek 503-682-2750
WI Milwaukee, Pat Lind Elctrns. 414-224-0146



FAX: 603-742-0481

CLAROSTAT MFG. CO., INC., Hawker Siddeley, PLC., 1 Washington St., Dover, NH 03820-1507, Tel: 603-742-1120,800-872-0042, TELEX: MCI 6713344; FSC No.: 12697; Empl.: 900; *Sls. Mgr.:* Al Tapscott; *Dist. Mgr.:* Al Tapscott ..... **A•2030; B•1888**

Local Sales Offices & Reps

AL Huntsville, El Com 205-830-4001
AZ Phoenix, More Sls. 602-788-9181
AR Little Rock, J. Y. Schoonmaker 501-375-2168
CA Irvine, Gravley & Assocs. 714-852-9994
CO Englewood, Purdy Co. Assocs. 303-790-2230
CT Meriden, Delta Conn Corp. 203-238-1240
FL Coral Springs, HHP Assocs., Inc. 305-753-8389
FL Palm Bay, H H P Assocs. 407-951-9236
FL Tarpon Springs, H H P Assocs., Inc. ... 813-937-6099
FL Winter Park, HHP Assocs., Inc. 407-740-0320
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IL Rolling Meadows, Sumer, Inc. 708-991-8500
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IN Indianapolis, Needler Sls. 317-255-8056
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NY Manhasset, Win-Cor Elctr. Sls. 516-627-9474
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NC Raleigh, C-Tech Sls., Inc. 919-782-8100
OH Dayton, K.W. Elctrn. Sls. 513-890-2150
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NM Albuquerque, More Sls., Inc. 505-255-6265
OR Beaverton, Electronic Sources, Inc. ... 503-627-0838
PA Pittsburgh, K.W. Elctrn. Sls. 412-366-9396
TX Dallas, J. Y. Schoonmaker 214-349-1650
WA Bellevue, Elctrn. Sources, Inc. 206-451-3500
WI Brookfield, Sumer 414-784-6641

CLARY CORP., Precision Instrs. Div., 320 W. Clary Ave., San Gabriel, CA 91776, Tel: 818-287-6111, FAX: 818-286-7216; Empl.: 100ò; *Sls. Mgr.:* Stewart Nowak; *Dist. Mgr.:* Chris Dean

CLAUSS CUTLERY CO., Alco Industries, 223 N. Prospect St., Fremont, OH 43420, Tel: 419-332-7344, 800-225-2877, FAX: 419-332-8077; Empl.: 90; *Sls. Mgr.:* Thomas D. Reinert; *Dist. Mgr.:* Thomas D. Reinert

CLEAN ROOM PRODS., 1800 Ocean Ave., Ronkonkoma, NY 11779-6528, Tel: 516-588-7000, TELEX: 645151; Empl.: 110; *Sls. Mgr.:* Robert S. Kearton

CLEARPOINT RESEARCH CORP., 35 Parkwood Drive, Hopkinton, MA 01748, Tel: 508-435-2000, FAX: 508-435-7504; Empl.: 300; *Sls. Mgr.:* Dennis Kirshy

CLEVELAND CRYSTALS, Box 17157, Euclid, OH 44117, Tel: 216-486-6100, TWX: 810-421-8031, FAX: 216-486-6103; FSC No.: 8K400; Empl.: 46; *Sls. Mgr.:* P. D. Marlowe

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CA Ontario, Clifton Precision 714-983-9374
CA San Clemente, Clifton Precision 714-492-6904
CO Denver, Motion Technlg. 303-757-3003
FL Sorrento, Boetto Corp. 904-735-0077
KS Lenexa, Midtec Assoc., Inc. 913-541-0505
MA W. Newton, Larcom Inc. 617-244-2053
MI Grand Rapids, Midwest Meridian 616-698-7391
MN Eden Prairie, PWC, Inc. 612-934-1409
MO St. Louis, Midtec Assoc. Inc. 314-275-8666
NM Albuquerque, S. W. Sls., Inc. 505-899-9005
OH Lakewood, Midwest Meridian 216-228-8636
PA Clifton Heights, Eastern Sls. 215-622-1000
TX Garland, Cary, McMahill & Assocs. 214-681-1414

CLIMATRONICS, 140 Wilbur Pl., Bohemia, NY 11716, Tel: 516-567-7300, TELEX: 5101007669, FAX: 516-567-7585; Empl.: 46; *Sls. Mgr.:* David Gilmore

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MI Detroit, Bill Teplitz Associates 216-439-3265
OH Cincinatti, Teplitz Assocs. 513-481-1648
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Can Montreal, Metrone 514-483-2323,

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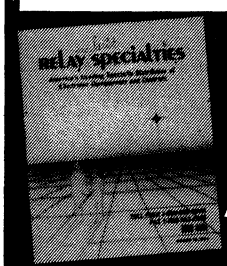

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CODY ELECTRONICS, INC., 2284-C Ringwood Ave., San Jose, CA 95131, Tel: 408-432-7570, FAX: 408-432-1891; Empl.: 30; *Sls. Mgr.:* Patrick Sargent

COGEBI, INC., 14 Farady Dr., Dover, NH 03820, Tel: 603-749-6896, FAX: 603-749-6958; Empl.: 20; *Sls. Mgr.:* M. Chaisson

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COILCRAFT, 1102 Silver Lake Rd., Cary, IL 60013, Tel: 708-639-2361, TELEX: 216378, FAX: 708-639-1469; Empl.: 1200; *Sls. Mgr.:* Larry Thompson ..... **A•1187-1192**

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MD	Silver Spring, Mid Atlantic Sls. Co.	301-593-7749
MA	Braintree, Coilcraft	617-848-9194
MI	Clark Lake, Dick Trull	517-529-9285
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NY	Rochester, Micro-Tech Mktg.	716-328-1420
NC	Matthews, Coilcraft	704-846-5422
TX	Richardson, Coilcraft	214-437-5597
WA	Kirkland, DMI, Inc.	206-823-4798
Can	Oakville, Ont., Haltronics	800-387-7955

COIL-Q CORP., 340 Bronxville Rd., Bronxville, NY 10708, Tel: 914-337-4775, FAX: 914-779-7109; FSC No.: 55940; Empl.: 12

COIL WINDING EQUIPMENT CO., R.R. Plaza, P.O. Box 660, Oyster Bay, NY 11771, Tel: 516-922-5660, TELEX: 14-3128, FAX: 516-922-5029; Empl.: 25; *Sls. Mgr.:* Joseph Pizzonia

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FAX: 201-371-0318

COLBER CORP., 26E Buffington St., Irvington, NJ 07111, Tel: 201-371-9500, TWX: 710-995-4416; Empl.: 50; *Sls. Mgr.:* Roberta Bryner ..... **A•1882-1883**

COLE-FLEX CORPORATION, 91 Cabot Street, West Babylon, NY 11704, Tel: 516-249-6150, TELEX: 358084, FAX: 516-249-6186; FSC No.: 56352; Empl.: 25; *Sls. Mgr.:* Western:Mr. Mike Steffen Midwestern:Joseph Emma

COLE HERSEE CO., 20 Old Colony Ave., Boston, MA 02127-2467, Tel: 617-268-2100, TELEX: 94-0901, FAX: 617-268-9490; *Sls. Mgr.:* E. Carl Price; *Dist. Mgr.:* John R. West

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FAX: 714-241-9061

COLE INSTRUMENT CORP., 2650 S. Croddy Way, Santa Ana, CA 92704, Tel: 714-556-3100; FSC No.: 31946; Empl.: 60; *Sls. Mgr.:* P. Hanson; *Dist. Mgr.:* B. Hendricks ..... **B•1660**

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AZ	Scottsdale, Advent Comps.	602-481-0044
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FL	Deerfield Bch., Brandel-Stephens	305-427-5441,
FL	Orlando, Brandel-Stephens	407-425-3202
CO	Denver, Advent Comps. Corp.	303-455-1985
IL	Elk Grove, Oasis Sls. Co.	708-640-1850
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792,
MD	Gaithersburg, Carwithen Assocs.	301-921-9545,
MA	Norwood, Tom Maguire & Assocs.	617-551-0500,
CT	Avon, Tom Maguire & Assocs.	203-673-0601
MN	Bloomington, Oasis Sls. Co.	612-941-1917
MO	St. Louis, Harris & Hanson	314-432-3611
NH	Windham, Tom Maguire & Assocs.	603-437-1245
NY	Hauppauge, Aurora Schmitt	516-343-1313
GA	Norcross, Brandel Stephens Co.	404-662-8330
NC	Greensboro, Brandel-Stephens	919-274-6952,
PA	West Chester, TCA	215-692-6853,
TX	Dallas, Control Components Inc.	214-458-8877
WA	Bellevue, Flightlines Intl.	206-454-2026
WI	Brookfield, Oasis Sls. Co.	414-782-6660
EXP	Rishon LeZion, Israel, Elimec Electromechanical Ltd.	972-3 965-1422
Can	Rexdale, Ont., Myelco, Inc.	416-674-1636

COLE-PARMER INSTRUMENT COMPANY, 7425 North Oak Park Avenue, Chicago, IL 60648, Tel: 708/647-7600, TELEX: 28-9405, FAX: 708-647-9660

COLLINS COMMERCIAL AVIONICS, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498, Tel: 319-395-1000, TELEX: 464-421, TWX: 910-525-1321; Empl.: 6,600; *Sls. Mgr.:* S.M. Murchison

Collmer Semiconductor, Inc.

FAX: 214-233-0481

COLLMER SEMICONDUCTOR, INC., 14368 Proton Rd., Dallas, TX 75244, Tel: 800-527-0251, 214-233-1589; Empl.: 85; *Sls. Mgr.:* Gene Uecker ... **A•2085; D•1659**

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CA	Playa Del Rey, Corcoran Assocs.	213-823-4589
TX	Dallas, Collmer Semiconductor Inc.	800-527-0251
GA	Alpharetta, Tec Rep Svcs. Inc.	404-664-0869
AZ	Scottsdale, Bill Earl Assoc. Inc.	602-994-3813
CO	Parker, TMA Colorado	305-841-3435
CA	San Jose, Comtech Mktg.	408-249-3330
MN	Minneapolis, Loren Green Assocs.	612-571-6666
MA	Burlington, Collmer Semiconductor	617-229-5822
IN	Frankfort, C-S Elctrn. Sls., Inc.	317-659-1874
NY	Franklin Square, Cooper Simon & Co., Inc.	516-489-0404
NY	Clark Mills, KLM Garner	315-853-6126
NY	Pittsford, KLM Garner	716-381-8350
NC	Cary, Tec Rep Svcs., Inc.	919-467-6444
NC	Charlotte, Tec Rep Svcs. Inc.	704-342-3900
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
PA	Hatboro, AQS Electro	215-674-4421
TN	Brentwood, Tec Rep Svcs. Inc.	615-832-0449
Can	Mississauga, Ont., Source Elctrns. Ltd.	416-676-0830
WI	Waukesha, Collmer Semiconductor, Inc.	414-547-0185
UT	Murray, TMA Colorado	801-483-1009
WA	Redmond, Elctrn. Engrg. Sls.	206-883-3374

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AZ	Tucson, Allied Elctrns.	602-797-8260
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CA	Irvine, Allied Elctrns.	714-727-3010
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CO	Englewood, Nep Elctrns.	303-799-9898
CO	Littleton, Indelco	303-795-3431
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FL	Largo, Allied Elctrns.	813-541-4660
FL	Pompano Bch., Allied Elctrns.	305-978-3008
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GA	Norcross, Milgray/Atlanta	404-446-9777
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IL	Wood Dale, Nep Elctrns.	312-595-8500
IN	Indianapolis, Allied Elctrns.	317-876-0448
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
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MI	Livonia, Allied Elctrns.	313-462-0190
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MN	Minneapolis, AEI Elctrns.	612-338-4754
MN	Minneapolis, Marsh Elctrns.	612-831-4840
MO	Earth City, Allied Elctrns.	314-291-7031
NE	Omaha, Allied Elctrns.	402-696-0038
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NJ	Parsippany, Milgray/New Jersey	201-335-1766
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NY	Mineola, Allied Elctrns.	516-248-2360
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IL Northfield, Feller Assocs. Inc. 800-776-7369
IA Cedar Rapids, Barnes Wes Tech Assoc. 319-393-9790
KS Overland Park, Barnes Midwest Sls. .. 913-469-9688
MD Kensington, Koebert Assocs. Inc. 301-493-8924
MA Randolph, Bengal 617-961-4120
OR Beaverton, L. D. Elctrns. 503-649-6177
PA Glenside, Koebert Assocs. Inc. 215-887-2310
TX Austin, Oeler & Menelaides 512-453-0275
TX Dallas, Oeler & Menelaides 214-361-8876
TX Houston, Oeler & Menelaides 713-682-7001
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WV Inwood, Koebert Assocs. Inc. 304-229-8401

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COLORGRAPHIC COMMUNICATIONS CORP., 30341 New Peachtree Rd./P.O. Box 30366, Atlanta, GA 30366, Tel: 404-455-3921, FAX: 404-458-0616; Empl.: 50; *Sls. Mgr.:* Elyse Mintz

COLT ELECTRONICS CO., INC., 15301 West 109th St., Lenexa, KS 66219, Tel: 913-888-1673, FAX: 913-888-3666; *Sls. Mgr.:* Michael S. Lynn

COLT TECHNOLOGY CORP., 15301 West 109th St., Lenexa, KS 66219, Tel: 913-888-1673, FAX: 913-888-3666; Empl.: 95; *Sls. Mgr.:* Jeffrey S. Lynn

COLUMBIA CHASE CORP., HUMISEAL DIV., See HumiSeal Div.

COLUMBIA COMPONENTS, 9 Division St., Sidney, NY 13838, Tel: 607-563-3520; FSC No.: 59178; Empl.: 12; *Sls. Mgr.:* Helen Montren

COLUMBIA ELCTRN. CABLES DIV., See Carol Cable Co., Inc., Columbia Elctrn. Cables Div.

COLUMBIA RESCH. LABS., Macdade Blvd. & Bullens La., Woodlyn, PA 19094, Tel: 215-872-3900, TWX: 510-669-3625, FAX: 215-872-3882; FSC No.: 07571; Empl.: 95; *Sls. Mgr.:* Robert R. Reymos

COLUMBUS INSTRUMENTS, 950 N. Hague Ave., Columbus, OH 43204, Tel: 614-488-6176, TELEX: 246514; *Sls. Mgr.:* Jan Czekajewski

COMAIR ROTRON, A KLI Company, 12 North Street, Saugerties, NY 12477, Tel: 914-246-3615, TELEX: 551496, TWX: 510-247-1941, FAX: 914-246-1176; FSC No.: 5Y921; Empl.: 800; *Dist. Mgr.:* Ralph R. Stevens

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Phoenix, Westrep 602-820-9932
CA Anaheim, Westrep 714-527-2822
CA San Diego, Hadden Assocs. 619-565-9444
CA Santa Clara, Westrep 408-988-8833
CO Littleton, Lange Sls., Inc. 303-795-3600
FL Altamonte Springs, Semtronics 407-831-8233
FL Clearwater, Semtronics 813-461-4675
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
IL (Northern), Sumer, Inc. 708-991-8500
IN Ft. Wayne, Frank J. Campisano Co. ... 219-486-6443
IN Indianapolis, Frank J. Compisano Co. 317-253-7651
IA Cedar Rapids, S & O Sls. 319-363-8878
MA Chelmsford, J.E. Boeing Co. 508-256-5800
MI Farmington Hills, Rathsburg Assocs., Inc. 313-489-1500
MN Mendota Hgts., G-II Sls., Inc. 612-454-3086
MO Bridgetown, Cen Tech, Inc. 314-291-4230
MO Raytown, Cen Tech, Inc. 816-358-8100
NJ Saugerties, Comair Rotron 201-227-7383
NY Saugerties, Comair Rotron, Inc. 914-246-3615
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Cincinnati, Frank J. Campisano Co. ... 513-574-7111
OH Cleveland, Components, Inc. 216-243-9200
OK Tulsa, Ammon & Rizos Co. 918-749-6116
PA Broomall, L. D. Lowery, Inc. 215-356-5300
TX Austin, Ammon & Rizos Co. 512-454-5131
TX Houston, Ammon & Rizos Co. 713-781-6240
TX Richardson, Ammon & Rizos Co. 214-644-5591
UT Salt Lake City, Lange Sls., Inc. 801-487-0843
WA Seattle, Jas. J. Backer Co. 206-285-1300
WI Brookfield, Sumer, Inc. 414-784-6641
PR Hato Rey, Semtronics 809-766-0700
Can Hamilton, Ont., Cartwright/Southall Assocs., Inc. 416-528-0294
Can Montreal, PQ, McIntyre Agencies Ltd. 514-731-9617
Can Vancouver, Arwin Tech. Sls. 604-980-4557

Local Distributors

CA Garden Grove, Richey/Impact Elctrns. 714-895-0060
CO Aurora, Capstone Elctrns 303-375-1300
IL Chicago, Newark Elctrns. 312-784-5100
MI Livonia, Chelsea/Rs Elctrns 313-525-1155
MN Minneapolis, Sterling Elctrns. 612-831-2666
NM Thief River Falls, Digi-Key Corp. 218-681-6674
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY Westbury, Schweber Elctrns. 516-334-7474
TX Dallas, Hall-Mark Elctrns. 214-343-5000
TX Ft. Worth, Allied Elctrns. 817-595-3500
WA Bellevue, Almac Elctrns. Corp. 206-643-9992
WA Seattle, Radar Elec. 206-282-2511
Can Don Mills, Ont., Saynor Varah, Inc. 416-445-0723
Can Scarborough, Ont., Carsten Elctrns. ... 416-495-7705
Can Willowdale, Ont., Electrosonic 416-494-1666

COMARK CORP., 93 West Street, Medfield, MA 02052, Tel: 508-359-8161, FAX: 508-359-2267; Empl.: 35

COMATEL USA, INC., 22 Eagle Rd., Commerce Pk., Danbury, CT 06810, Tel: 203-797-9445, TELEX: 643-011, FAX: 203-790-9298; Empl.: 10; *Sls. Mgr.:* Tim Papp

COMCAB, 8255 Black Run Rd., Nashport, OH 43830, Tel: 614-828-2468, FAX: 614-828-2796; Empl.: 40; *Sls. Mgr.:* Cheryl Mumma; *Dist. Mgr.:* Cheryl Mumma

COMCLOK, INC., 1142 N. Gilbert St., Anaheim, CA 92801, Tel: 714-991-1580, 800-333-9825, 213-836-9592(Tech. Asst.), FAX: 714-491-9825; Empl.: 30; *Sls. Mgr.:* Herb Plumhoff ..... **A•1323**

Local Sales Offices & Reps

CA Arcadia, HMC 818-447-0958
CA San Jose, Blue Elctrns. Sls. 408-248-4399
CO Denver, Electrophase 303-296-0443
TX Rockwall, Eatman Mfg. Rep. 214-771-1903

Local Distributors

CA Fountain Valley, Ecliptek 714-963-4009
CA Stanton, Inductive Comps. 714-828-3420
CA Sunnyvale, Target Elctrns. 408-734-5611

COMDATA CORP., 7900 N. Nagle Ave., Morton Grove, IL 60053, Tel: 708-470-9600

COMLINEAR CORP., 4800 Wheaton Drive, Fort Collins, CO 80525, Tel: 303-226-0500; FSC No.: 62839; Empl.: 160; *Sls. Mgr.:* John Perzow; *Dist. Mgr.:* Bill Henderson

COMM CON CONNECTORS INC., 4111 Ocean View Blvd., Montrose, CA 91020, Tel: 818-957-2018, FAX: 818-957-4851; Empl.: 13; *Sls. Mgr.:* Robert Farnum; *Dist. Mgr.:* James Orr ..... **C•1323**

Local Sales Offices & Reps

AL Huntsville, Effective Mktg. Force 205-233-2947
AZ Tempe, Elctrn. Tech. Sls. 602-921-7122
CA Montrose, Signal Entprs. 818-957-0640
CA Napa, Stewart/Fullerton Assoc. 707-258-1160
CT New Fairfield, Sales Engrg. 203-746-6905
GA Atlanta, Effective Mktg. Force 404-948-6023
IL Wheaton, CS Tech. Sls. 708-653-8126
NH Salem, Sales Engrg. 603-893-5521
NC Raleigh, Effective Mktg. Force 919-867-6221
OR Portland, Caruso & Assoc. 503-246-5439
PA Souderton, Intek Inc. 215-723-0433
TX Plano, Connector Specialists Inc. 214-517-1207
Can Markham, Matrix Technlg. Ltd. 416-477-4442

Local Distributors

AZ Phoenix, Be-Switched 602-275-4805
CA Fremont, KEA Elctrns. 415-651-2691
CA Gardena, Cal Switch 213-538-9830
CA Riverside, Elctrn Supp. 714-781-0453
CA Sunnyvale, PSC Elctrns. 408-737-1333
CT Danbury, Heilind Elctrns 203-797-8600
GA Norcross, Century Elctrns. 404-449-3424
IL Chicago, Leeds Electro Comps. 312-625-3800
MA Wilmington, Heilind Elctrns. 508-657-4870
MN Plymouth, Leeds Electro Comps. 612-557-1277
NC Raleigh, Century Elctrns. 919-782-2116
OK Tusla, Radio Inc. 918-587-9123
PA Norristown, Century Elctrns. 215-631-5400
TX Richardson, Duke Elctrns 214-680-3853
WA Vancouver, Interconnect Sls. 206-256-4085
WI Milwaukee, Progressive Image 414-321-4722

COMM/SCOPE, INC., Network Cable Div., P.O. Box 879, Claremont, NC 28610, Tel: 704-324-2200, 800-982-1708, TELEX: 802-166, FAX: 704-459-5099; *Sls. Mgr.:* Nita Hunsucker

FAX: 312-637-8564

COMMUNICATION COIL INC., 2839 N. Narragansett Ave., Chicago, IL 60634, Tel: 312-637-1333; FSC No.: 81815; Empl.: 75; *Sls. Mgr.:* E. Goldman ..... **A•1193, 1665, 2190**

Local Sales Offices & Reps

AZ Chandler, Lindberg & Co. 602-786-9115
CO Denver, Lindberg & Co. 303-758-9033
GA Maitland, E.I.R. Inc. 407-660-9600
IL Chicago, CCI 312-637-1333
MA Brookline, TPG Inc. 617-731-0858
NM Albuquerque, Lindberg & Co. 505-881-1006
OH Beavercreek, Electro-Com 513-427-2696
UT Salt Lake City, Lindberg & Co. 801-277-2643

COMMUNICATION DEVICES, INC., 1-130 McLevin Ave., Scarborough, Ont., CAN M1B3R6, Tel: 416-292-4463, TELEX: 065-25428, FAX: 416-292-4295; Empl.: 70

COMMUNICATIONS INSTRUMENTS, INC., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, Tel: 704-628-1711, TELEX: 577436, FAX: 704-628-1439; FSC No.: 58614; Empl.: 260; *Sls. Mgr.:* R. McClinton ..... **B•1432-1438**

Local Sales Offices & Reps

AL Huntsville, Dean Assocs. 205-534-2255
AZ Phoenix, CPS Assocs. 602-246-1097
CA Santa Clara, Ross Mktg. 408-988-8111
CO Denver, Con-Tek Mktg. 303-973-8490
CT Torrington, Phoenix Sls. 203-496-7709
FL Oviedo, Conley & Assocs. 305-365-3283
GA Atlanta, Dean Assocs. 205-534-2255
IL Arlington Hts., MB Sls. 312-392-9499
IN Kokomo, Schillinger Assocs. 317-455-2708
IA Cedar Rapids, C. H. Horn & Assocs. .. 319-393-8703
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MA Needham, Component Technlg., Inc. .. 617-449-8490
MI Grosse Pointe Park, Greiner Assocs., Inc. 313-499-0188
MN North Mankato, El Sls. 507-345-5786
NY Babylon, ASTROREP 516-422-2500
NY Syracuse, M. M. Hare Co. 315-457-6859
NC Raleigh, Godwin Assocs. 919-878-8000
OH Vandalia, Stegman Blaine 513-890-7975
PA Philadelphia, Tech. Sls. Assoc. 215-784-0170
WA Seattle, Eclipse Mktg. 206-885-6991
Can Montreal, Que., Empro Sls. Co. 514-341-6420
Can Richmond Hill, Ont., Renmark Elctrns., Ltd. (Off. No. 1) 416-881-8844

Local Distributors

AZ Tempe, Time Elctrns. 602-967-2000
CA Anaheim, Time Elctrns. 714-937-0911

CA	Chatsworth, Time Elctrns.	818-998-7200
CA	San Diego, Time Elctrns.	619-586-1331
CA	Santa Ana, Norstan Elctrns.	714-540-4165
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Englewood, Time Elctrns.	303-799-8851
FL	Orlando, T & T Prods., Inc.	305-857-2282
FL	Orlando, Time Elctrns.	305-841-6565
GA	Norcross, Time Elctrns.	404-448-4448
IL	Wood Dale, Time Elctrns.	312-350-0610
MD	Columbia, Time Elctrns.	301-964-3090
MA	Peabody, Time Elctrns.	617-532-6200
NJ	Pine Brook, Time Elctrns.	201-582-4611
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Centereach, Gemcap Comps.	516-736-0069
OH	Dublin, Time Elctrns.	614-761-1100
OR	Portland, Time Elctrns.	503-684-3780
PA	King of Prussia, Time Elctrns.	215-337-0900
TX	Carrolton, Time Elctrns.	214-241-7441
TX	Houston, Time Elctrns.	713-530-0800
UT	Salt Lake City, Time Elctrns.	801-973-8181
WA	Redmond, Time Elctrns.	206-882-1600

COMMUNICATIONS SYS. TECHNOLOGY, INC., 2018 Rhodes Street, Hermosa Beach, CA 90254, Tel: 213-374-3849; Empl.: 4; *Sls. Mgr.:* A.L. Perry

COMPAC™

FAX: 516-585-3534

COMPAC, 1320-13 Lincoln Ave., Holbrook, NY 11741, Tel: 516-585-3400; FSC No.: 62099; Empl.: 35; *Sls. Mgr.:* Peter C. Rao ..... **C•1021-1025**

Local Sales Offices & Reps

GA	Atlanta, EMA Inc.	404-448-1215
TX	Dallas, Talo Products	214-644-6010
SC	Greenville, EMA Inc.	803-233-4637
CA	Westlake Village, CAL-Rep.	818-991-1940
AL	Huntsville, EMA Inc.	205-837-7363
CA	Campbell, Senah	408-374-1031
MA	Haverill, L-K Assoc.	617-373-1313
MO	St. Louis, Abrams & Assocs.	314-569-0447
NC	Raliegh, EMA Inc.	919-847-8800
OR	Portland, Temper Tech Mktg.	503-292-8201
VA	Fairfax, Schibley Assocs.	703-591-3008

Local Distributors

CA	Cupertino, DC Elctrns.	408-996-8858

COMPACT POWER COMPANY, 17282 Orange Drive, Yorba Linda, CA 92686, Tel: 714-996-5826; *Sls. Mgr.:* Charles Lindberg ..... **D•2183**

COMPACT SOFTWARE, INC., 483 McLean Boulevard, Paterson, NJ 07504, Tel: 201-881-1200, TELEX: 130073, FAX: 201-881-8361; FSC No.: 43304; Empl.: 60; *Sls. Mgr.:* Ray Pengelly; *Dist. Mgr.:* Scott Wheelis

COMPAR, D.G.W. Electronics Corporation, 85 Spy Ct., Markham, Ontario, Canada L3R 4Z4, Tel: 416-475-8500, FAX: 416-475-4158; Empl.: 36; *Sls. Mgr.:* Rick Lewis

COMPAS, 100 Chimney Point Dr., Ogdensburg, NY 13669, Tel: 315-393-3573, FAX: 315-393-7638; Empl.: 350; *Sls. Mgr.:* James L. Clare

COMPEX CORP., Taunton Professional Park, 238 Taunton Blvd., Medford, NJ 08055, Tel: 609-596-9388, FAX: 609-596-3482; Empl.: 24

COMPIX, INC., 16195 SW 72nd St., Tigard, OR 97224, Tel: 503-639-8496; Empl.: 14; *Sls. Mgr.:* James G. Walcutt-VP Sls. Mktg.

COMPLIANCE DESIGN INC., 593 Massachusetts Ave., Boxboro, MA 01719, Tel: 508-264-4668, TWX: 317-632-DASH; *Sls. Mgr.:* Chip Digirolamo

COMPONENT GENERAL, INC., 2445 Success Dr., Odessa, FL 33556, Tel: 813-376-6655, FAX: 813-372-9096; Empl.: 30; *Sls. Mgr.:* Thomas Floridio

Local Sales Offices & Reps

CA	Santa Ana, Landa & Assocs., Inc.	714-543-7805
CA	Los Angeles, Landa & Assocs., Inc.	213-879-0770
CA	Mountain View, Bridge Mktg.	415-965-8045
DC	Washington, M. Lader Co.	1-800-442-3177
GA	Lawrenceville, M. Lader Co.	404-264-8111
MA	N. Andover, Bee Assoc.	508-475-2124
MN	Minneapolis, Comstrand	612-788-9234
MO	Grandview, R. R. Burton	816-763-5385
NY	Buffalo, Upstate Engrg. Sls.	716-632-0011
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
PA	Conshohocken, M. Lader Co.	215-825-3177, 1-800-442-3177
PA	Murrysville, Pittsburgh Sls. Assoc.	412-327-3268
TX	Austin, Allied Comps., Inc.	512-331-4494
TX	Dallas, Allied Comps., Inc.	214-238-0408
TX	Ft. Worth, Allied Comps., Inc.	817-589-0456
EXP	Odessa, FL, Comp. Gen. Inc.	813-376-6655

COMPONENT MFG. SVC., INC., 1 Component Park, W. Bridgewater, MA 02379, Tel: 508-580-0111, FAX: 508-559-9893; Empl.: 600; *Sls. Mgr.:* Scott Allen; *Dist. Mgr.:* Wayne Douglas

COMPONENT RESEARCH CO. INC., 1655-26 St., Santa Monica, CA 90404, Tel: 213-829-3615, FAX: 213-829-9584; FSC No.: 12517;Multiple; Empl.: 230; *Sls. Mgr.:* Sylvia Kellerman ..... **A•1022-1050**

Local Sales Offices & Peps

SC	Greenville, Walter Lamphier	803-232-4687

COMPONENTS CORP., 6 Kinsey Pl., Denville, NJ 07834, Tel: 201-627-0290, FAX: 201-361-5801; FSC No.: 26364; Empl.: 20; *Sls. Mgr.:* Fred Bielenberg

COMPONENTS ELECTRONICS CORP., 629A Lowther Rd., Lewisberry, PA 17339, Tel: 717-938-4151, FAX: 717-938-5910; Empl.: 45; *Sls. Mgr.:* J.Galli; *Dist. Mgr.:* J.Galli

COMPONENT SPECIALTIES CORP., 9143 E. La Rosa Dr., Temple City, CA 91780, Tel: 213-283-0015, FAX: 818-287-7189; FSC No.: 28984; Empl.: 45; *Sls. Mgr.:* D.R. Heins

COMPUCART, Versa Tec, P.O. Box 2095, Tampa, FL 33601-2095, Tel: 800-237-9024, 813-251-2431; Empl.: 25

COMPU-CRAFT FABRICATORS INC., 669 Mary St., Warminster, PA 18974, Tel: 215-443-7107, FAX: 215-443-7195; FSC No.: 76977; Empl.: 18; *Sls. Mgr.:* Stephen Dalton

COMPU-MECH INC., 2375 Dorr St., Toledo, OH 43607, Tel: 419-535-6702, TWX: 510-601-7362, FAX: 419-535-0805; *Sls. Mgr.:* John Stanley III

COMPUMOTOR DIVISION, Parker Hannifin Corp., 5500 Business Park Dr., Rohnert Park, CA 94928, Tel: 707-584-7558, FAX: 707-584-8015; Empl.: 150; *Sls. Mgr.:* K. McNicholas; *Dist. Mgr.:* A. Wales

COMPUTER AVIONICS, See CAC Microcircuits, Inc.

COMPUTER CABLE & PRODS., INC., Vertex Computer Cable & Products

COMPUTER COMPONENTS INC.

FAX: 914-738-6706

COMPUTER COMPONENTS, INC., 629 Fifth Ave., Pelham, NY 10803, Tel: 914-738-1611; FSC No.: 12965; Empl.: 25; *Sls. Mgr.:* John Hunsicker; *Dist. Mgr.:* John Hunsicker ..... **B•1399**

COMPUTER CONVERSIONS CORP., 6 Dunton Ct., E. Northport, NY 11731, Tel: 516-261-3300, FAX: 516-261-3308; FSC No.: 51086; Empl.: 100; *Sls. Mgr.:* S. J. Renard ..... **D•1150-1151**

Local Sales Offices & Reps

IN	Mishawaka, Engrd. Sls.	219-255-5111
WI	Delavan, Clawson Controls	414-728-8325
MA	Brookline, Technology Prod. Grp.	617-731-0858
MI	Newport, Industrial Sensors, Inc.	313-289-3374
NY	Moravia, Electrotech Sys.	315-497-1598
OH	Cincinnati, Rilco	513-271-0630
PA	Ingoma, Greye Glass	412-366-6664
TX	Lewisville, Automated Dynamics	214-221-0052

COMPUTER DEVICES, 34 Linnell Cir., Nutting Lake, MA 01865, Tel: 508-663-4980, TELEX: 949398; Empl.: 30; *Sls. Mgr.:* Sandra R. Clark

COMPUTER DOCTORS, 9204-B Baltimore Blvd., College Park, MD 20740, Tel: 1-800-RAM-STAR, 301-474-3095, FAX: 301-474-0805

COMPUTER DYNAMICS SALES, 107 S. Main St., Greer, SC 29650, Tel: 803-877-8700, FAX: 803-879-2030; *Sls. Mgr.:* Barry Steele

COMPUTER INSTRUMENTS CORP., 1000 Shames Drive, Westbury, NY 11590, Tel: 516-476-8400, FAX: 516-876-9153

COMPUTER INSTRUMENTS DIV., 100 Madison Ave., Hempstead, NY 11550, Tel: 516-483-8200, TWX: 510-222-4189, FAX: 516-483-8327; Empl.: 65; *Sls. Mgr.:* Cary Ratner

COMPUTERIZED COIL WINDERS, INC., 5 W. Kenosia Ave., Danbury, CT 06810, Tel: 203-744-6715, FAX: 203-798-7563; Empl.: 6

COMPUTER MAINTENANCE CORP., 405 Murray Hill Pkwy, East Rutherford, NJ 07073, Tel: 201-896-0707, FAX: 201-896-8503; Empl.: 105; *Sls. Mgr.:* Arthur Young

COMPUTER OPTICAL PRODUCTS, INC., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, Tel: 818-882-0424, TELEX: 18-33-73-UD, FAX: 818-882-0492; Empl.: 50; *Sls. Mgr.:* David Richards

COMPUTER PERIPHERALS INC., 667 Rancho Congo Blvd., Newbury Pk., CA 91320, Tel: 805-499-5751, 800-854-7600, TELEX: 759299CPI, FAX: 805-498-8848; Empl.: 100; *Sls. Mgr.:* Davius Antia; *Dist. Mgr.:* Mike Krunic

COMPUTER POWER INC., 124 W. Main St., High Bridge, NJ 08829, Tel: 908-638-8000, 800-526-5088, TELEX: 847481, FAX: 908-638-4931; FSC No.: 3643; Empl.: 170; *Sls. Mgr.:* John Deliman; *Dist. Mgr.:* Angela Anderson

COMPUTER PRODUCTS, INC., Measurement & Control Div., 2900 Gateway Dr., Pompano Beach, FL 33069, Tel: 305-974-5500, FAX: 305-979-7371; Empl.: 150; *Sls. Mgr.:* Gene Ackerman

COMPUTER PRODUCTS™ POWER CONVERSION

FAX: 510-683-6400

COMPUTER PRODUCTS INC., Power Conversion America, 3797 Spinnaker Ct. (P.O. Box 5102), Fremont, CA 94537-5102, Tel: 510-657-6700; FSC No.: 62125; Empl.: 1,200; *Sls. Mgr.:* Ken Clouther, VP, Sls.; *Dist. Mgr.:* Emilie Creager, Distbn. Mgr. ..... **D•1500, 1661-1679**

Local Sales Offices & Reps

AZ	Phoenix, C.T. Carlberg	602-488-0750
CA	Encinitas, Jones & McGeoy Sls.	619-753-6784
CA	San Diego, Jones & McGeoy Sls.	714-756-6269
CA	Santa Ana, Jones & McGeoy Sls.	714-547-6466
CA	Santa Clara, Criterion Sls.	408-988-6300
CO	Aurora, Electrodyne	303-695-8903
CT	New Milford, Alpha-Omega Sls.	203-354-2923
FL	Oviedo, Conley & Assocs.	407-365-3283
GA	Norcross, Mountain Electro Mktg.	404-448-5594
IL	Itasca, Janus, Inc.	708-250-9650
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-tronix, Inc.	913-339-6333
KS	Wichita, Dy-tronix, Inc.	316-838-0884
MD	Columbia, Third Wave Solutions, Inc.	301-290-5990
MA	North Reading, Alpha Omega Sls.	508-664-1118
MN	Minneapolis, Stan Clothier Co.	612-944-3456
MO	Bridgeton, Dy-tronix, Inc.	314-291-4777
NJ	Mt. Laurel, Paragon Sls. & Mktg.	609-778-1190
NM	Albuquerque, C.T. Carlberg	505-899-2155
NY	Binghamton, Empire Tech. Assocs.	607-772-0651
NY	Rochester, Empire Tech	719-381-8500
NY	Rockville Centre, S-J Assocs.	516-536-4242
NY	Skanealeles, Empire Tech	315-685-5703
NC	Raleigh, Zucker Assocs., Inc.	919-782-8433
OH	Cleveland, Elctrn. Salesmasters	216-831-9555
OK	Tulsa, Ammon & Rizos	918-749-6116
OR	Beaverton, Micro Sls., Inc.	503-645-2841
TX	Austin, Ammon & Rizos	512-454-5131
TX	Houston, Ammon & Rizos	713-781-6240
TX	Richardson, Ammon & Rizos	214-644-5591
UT	Salt Lake City, Electrodyne, Inc.	801-264-8050
WA	Bellevue, Micro Sls., Inc.	206-451-0568
WI	Waukesha, Janus, Inc.	414-542-7575
Can	Montreal, Electro Source	514-630-7486
Can	Ottawa, Ont., Electro Source	613-592-3214
Can	Toronto, Electro Source	416-675-4490
Can	W. Vancouver,B.C., Blakewood Elctrns. Sys., Inc.	604-273-9910

Local Distributors

AL Huntsville, Bell Inds. 205-837-1074
AL Huntsville, Lex Elctrns. 205-895-0480
AL Huntsville, Marshall Inds. 205-881-9235
AZ Phoenix, Lex Elctrns. 602-431-0030
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Tempe, Bell Inds. 602-966-7800
CA Canoga Park, Lex Elctrns. 818-999-4702
CA Chatsworth, Marshall Inds. 818-407-4100, 818-880-9680
CA El Monte, Marshall Inds. 818-307-6000
CA Fountain Valley, Bell Micro Products .. 714-963-0667
CA Garden Grove, Bell Inds. 714-895-7801
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Lex Elctrns. 714-587-0404,213-537-4321
CA Irvine, Marshall Inds. 714-458-5380
CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, Bell Micro Products 408-434-1150
CA Milpitas, Marshall Inds. 408-943-4600
CA N. Hollywood, B. J. Wolfe Entprs. 213-877-5518
CA Sacramento, Lex Elctrns. 916-929-9732
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Lex Elctrns. 619-495-0015
CA San Diego, Marshall Inds. 619-578-9600
CA San Jose, B.J. Wolfe Entprs. 408-371-3443
CA San Jose, Lex Elctrns. 408-432-7171
CA Sunnyvale, Bell Inds. 408-745-0400,408-773-1100
CA Thousand Oaks, Bell Inds. 805-499-6821
CO Englewood, Lex Elctrns. 303-799-0258
CO Thornton, Marshall Inds. 303-451-8383
CO Wheat Ridge, Bell Inds. 303-424-1985
CT Oxford, Lex Elctrns. 203-264-4700
CT Wallingford, Marshall Inds. 203-265-3822
FL Altamonte Springs, Lex Elctrns. 407-331-7555
FL Altamonte Springs, Marshall Inds. 407-767-8585
FL Deerfield Bch., Bell Inds. 305-421-1997
FL Deerfield Bch., Lex Elctrns. 305-977-7511
FL Ft. Lauderdale, Marshall Inds. 305-977-4880
FL Largo, Bell Inds. 813-541-4434
FL St Petersburg, Marshall Inds. 813-576-1399
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Lex Elctrns. 404-449-9170
GA Norcross, Marshall Inds. 404-923-5750
IL Elk Grove, Bell Inds. 312-640-1910
IL Schaumburg, Lex Elctrns. 708-330-2888
IL Schaumburg, Marshall Inds. 312-490-0155
IL Urbana, Bell Inds. 217-328-1077
IN Ft. Wayne, Bell Inds. 219-424-3422
IN Indianapolis, Bell Inds. .. 317-875-8200,317-299-5487
IN Indianapolis, Lex Elctrns. 317-843-1050
IN Indianapolis, Marshall Inds. 317-297-0483
IA Cedar Rapids, Bell Inds. 319-395-0730
IA Cedar Rapids, Lex Elctrns. 319-373-1417
KS Lexena, Marshall Inds. 913-492-3121
KS Overland Park, Lex Elctrns. 913-492-2922
MD Columbia, Lex Elctrns. 301-596-7800
MD Gaithersburg, Marshall Inds. 301-840-9450
MA Andover, Bell Inds. 508-474-8880
MA Teaksbury, Jaco Elctrns. 508-640-0010
MA Wilmington, Bell Micro Products 508-658-0222
MA Wilmington, Jaco Elctrns. 617-273-1860
MA Wilmington, Lex Elctrns. 508-694-9100
MA Wilmington, Marshall Inds. 617-658-0810
MI Ann Arbor, Bell Inds. 313-971-9093
MI Livonia, Lex Elctrns. 313-525-8100
MI Livonia, LWC Distrs. 313-464-7700
MI Livonia, Marshall Inds. 313-525-5850
MN Eden Prairie, Lex Elctrns. 612-941-5280
MN Plymouth, Marshall Inds. 612-559-2211
MO Bridgeton, Marshall Inds. 314-291-4650
NH Hudson, Bell Inds. 603-882-1133
NH Manchester, Lex Elctrns. 603-625-2250
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Mt. Laurel, Lex Elctrns. 609-274-7900
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NJ Pine Brook, Lex Elctrns. 201-227-7880
NM Albuquerque, Bell Inds. 505-292-2700
NY Farmingdale, Bell Inds. 516-752-9303
NY Hauppauge, Lex Elctrns. 516-231-2500
NY Hauppauge, Marshall Inds. 516-273-2424
NY Johnson City, Marshall Inds. 607-798-1611
NY Pittsford, Lex Elctrns. 716-383-8020
NY Rochester, Marshall Inds. 716-235-7620
NC Raleigh, Century Elctrns. 919-782-2116
NC Raleigh, Lex Elctrns. 919-876-0000
NC Raleigh, Marshall Inds. 919-878-9882
OH Beachwood, Lex Elctrns. 216-464-2970
OH Dayton, Bell Inds. 513-434-8231,513-435-8660
OH Dayton, Lex Elctrns. 513-439-1800
OH Dayton, Marshall Inds. 513-898-4480
OH Solon, Marshall Inds. 216-248-1788
OH Westerville, Marshall Inds. 614-891-7581
OK Tulsa, Lex Elctrns. 918-665-0277
OK Tulsa, Norvell Elctrns. 918-254-8606
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Marshall Inds. 503-644-5050
OR Lake Oswego, Bell Inds. 503-635-6500
PA Horsham, Lex Elctrns. 215-441-0600
PA Norristown, Century Elctrn. Comps. ... 215-631-5400
PA Pittsburg, Lex Elctrns. 412-963-6807
PA Pittsburgh, Marshall Inds. 412-963-0441
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Norvell Elctrns. 512-837-5555
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Lex Elctrns. 214-247-6300
TX Dallas, Norvell Elctrns. 214-233-0020
TX Houston, Lex Elctrns. 713-977-5383
TX Houston, Marshall Inds. 713-895-9200
TX Houston, Norvell Elctrns. 713-777-1666
TX Richardson, Bell Inds. 214-690-0466
UT Salt Lake City, Bell Inds. 801-255-2477
UT Salt Lake City, Marshall Inds. 801-485-1551
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bothell, Marshall Inds. 206-747-9100
WA Redmond, Bell Inds. 206-867-5410
WA Spokane, Almac Elctrns. 509-924-9500
WI New Berlin, Lex Elctrns. 414-784-9451
WI Waukesha, Bell Inds. 414-547-8879
WI Waukesha, Marshall Inds. 414-797-8400
Can Brampton, Ont., Zentronics 416-451-9600
Can Montreal, Que., Zentronics 514-737-9700
Can Richmond, B.C., Zentronics 604-273-5575
Can Saskatoon, Saskatchewan, Zentronics 306-955-2202
Can Winnipeg, Mani., Zentronics 204-694-1957

COMPUTER SYSTEM ASSOCS., 7564 Trade St, San Diego, CA 92121, Tel: 619-566-3911, TELEX: 333693, FAX: 619-566-0581; Empl.: 15; *Sls. Mgr.:* Bill Reed; *Dist. Mgr.:* Bill Reed

COMPUTER SYSTEM PRODUCTS, 14305 21st Ave. N., Minneapolis, MN 55447, Tel: 612-476-6866, 800-422-2537, FAX: 612-476-6966; Empl.: 50; *Sls. Mgr.:* Mick Maher; *Dist. Mgr.:* Tom Quanbeck

COMPUTER SYSTEMS TECHNICAL SUPPORT, 4015 E. Leaverton Ct., Anaheim, CA 92807, Tel: 714-632-1300, FAX: 714-632-1937; FSC No.: 9J740; Empl.: 13; *Sls. Mgr.:* Reuven Arad

COMPUTERWARE, INC., 8480-I Tyco Rd., Vienna, VA 22182-2266, Tel: 703-821-8200, FAX: 703-821-1746; Empl.: 18; *Sls. Mgr.:* John Dargo

COMPUTERWISE, 302 N. Winchester, Olathe, KS 66062, Tel: 913-829-0600, FAX: 913-829-0810; Empl.: 27; *Sls. Mgr.:* William W. Brown; *Dist. Mgr.:* William W. Brown

COMPUTROL:AN AEG CO., 239 Ethan Allen Hwy., Ridgefield, CT 06877, Tel: 203-431-2000, TELEX: 643358, FAX: 203-431-2090; Empl.: 45; *Sls. Mgr.:* C. R. Wolfe

COMPUTRON DISPLAY SYSTEMS, Xcel Corporation, 845 Bonnie Lane, Elk Grove Village, IL 60007, Tel: 708-952-8800, FAX: 708-952-0832; FSC No.: 07126; Empl.: 300; *Sls. Mgr.:* R. Van Horn; *Dist. Mgr.:* Kathy Privett ..... **B•1057**

COMSPEC DIGITAL PRODUCTS INC., 2313 W. Sam Houston Pkwy. N.S. 145, Houston, TX 77043, Tel: 713-461-4487, FAX: 713-461-8846; Empl.: 15; *Sls. Mgr.:* T. A. Paine; *Dist. Mgr.:* T. A. Paine

COMSTRON A DIV. OF AEROFLEX, 35 S. Service Road, Plainview, NY 11803, Tel: 516-752-2351, TWX: 310-497-3525, FAX: 516-694-6771; Empl.: 120; *Sls. Mgr.:* William J. Meditz

COMTECH MICROWAVE CORP., Comtech Corp., 63 Oser Ave., Hauppauge, NY 11788, Tel: 516-435-4646, TELEX: 221-234 CMTCH; FSC No.: 31196; *Sls. Mgr.:* J. Tardi

COM-2, INC., 1556 Woodland Dr., Saline, MI 48176, Tel: 313-429-9027, FAX: 313-429-1902; Empl.: 70; *Sls. Mgr.:* Robert Green

COMUS INTERNATIONAL, 263 Hillside Ave., Nutley, NJ 07110, Tel: 201-667-6200, FAX: 201-667-6837; *Sls. Mgr.:* Gene Moran ..... **B•1668**

Local Sales Offices & Reps

CA Milpitas, Maxim Elect. Sls. Co. 408-946-6001
CA Newport Beach, Forbes-Pacific 714-722-6174
IL Mundelein, Dynamic Elctrns. Co. 708-566-8350
MA Andover, Grassi Assocs. 508-475-3418
MN Savage, Comps. & Controls 612-890-3002
NJ Westfield, John Abruzzo 201-233-4321
PA Furlong, Avenir, Inc. 215-348-8290
TN Murfreesboro, Control Comps. 615-895-5175
Can Dawn Mills, Ontario, Control Comps. .. 416-447-2128

CONAP, INC., 1405 Buffalo St., Olean, NY 14760, Tel: 716-372-9650, FAX: 716-372-1594; Empl.: 135

CONAX BUFFALO CORPORATION, 2300 Walden Ave., Buffalo, NY 14225, Tel: 716-684-4500, FAX: 716-684-7433; FSC No.: 03688; Empl.: 190; *Sls. Mgr.:* R.C. Paluch

CONCORD ELECTRONICS CORPORATION, 30 Great Jones St., New York, NY 10012, Tel: 1-212-777-6571, TWX: 710-581-4930, FAX: 1-212-995-0161; FSC No.: MFR 18310; Empl.: 225; *Sls. Mgr.:* Josie Wheaton ..... **C•1324-1325, 1595**

Local Distributors

AL Huntsville, Century Fasteners 205-883-5344
AZ Tucson, PSN Distrbn. 602-623-9800
AR Little Rock, Carlton-Bates 501-562-9100
CA Mission Hills, Coast Air 818-898-2288
CA San Jose, Bisco 408-996-8420
CO Denver, CSID/Integrated 303-292-5538
CT Danbury, Heilind 208-797-8600
DE New Castle, Electronics Exchange 302-322-5401
FL Sanford, Electronic Fasteners 407-321-4000
GA Norcross, Atlanta Hardware Specialty 404-449-3000
HI AIEA, Newark Elctrns. 808-487-8951
ID Coeurd' Alene, A-I Consolidated 208-765-3280
IL Franklin Park, Bisco 312-451-1230
IN Indianapolis, Mar Elctrns. 317-633-6699
IA Cedar Rapids, Dee Elctrns. 319-365-7551
KS Wichita, RSC Elex 216-267-5213
KY Bowling Green, Crescent Elctrns. 502-842-2444
LA New Orleans, Radio Pts. 504-581-5959
MD Gaithersburg, MS Elctrns. 301-921-0200
MA Billerica, MS Inserts 508-670-5600
MI Farmington Hills, Advent Elctrns. 313-477-1650
MN New Brighton, Chris ELctrns. 612-631-2647
MS Jackson, Newark Elctrns. 601-956-3834
MO St. Charles, Finnegan Elctrns. 314-946-6201
NE Omaha, Omaha Elctrns. 402-341-3440
NV Reno, Richco 702-323-4939
NH Nashua, Brevan 603-889-7230
NJ Kenilworth, Federated Purchasers 201-272-0505
NM Albuquerque, Electronic Pts. 505-293-6161
NY Bohemia, Car-Lac 516-567-4200
NC Raleigh, Century Elec. Comp. 919-782-2116
OH Dayton, Stotts-Friedman 513-298-5555
OK Tulsa, Altair 918-252-5781
OR Beaverton, Comp. Resources 503-641-8488
PA Philadelphia, PEI Genesis 215-673-0400
RI Pawtucket, Major Edwards 401-725-7400
SC Charleston, Wholesale Indl. Elex 803-577-6388
TN Knoxville, Industrial Elect 615-573-7135
TX Richardson, Aero Glen 214-234-0984
UT Salt Lake City, Kimball Elctrns. 801-328-2075
VT Colchester, Hooker Elctrns. 802-864-0885
VA Springfield, Southern Fasteners 703-922-8048
WA Redmond, Olander 206-881-3488
WV Beckley, State Elec. 304-256-2219
WI Grafton, Lakeview Elex 414-377-8250
EXP Taipei, Taiwan, Gold-Tek Elec. Co. 20-717-2302
Can Mississauga, Ont., Rush Elctrns. 416-677-7280

The Condenser Products Corporation

FAX: 904-799-0221

CONDENSER PRODUCTS CORP., 2131 Broad St., Brooksville, FL 34609, Tel: 904-796-3561; FSC No.: 16727; Empl.: 30; *Sls. Mgr.:* David Bauerschmidt ..... **A•1051**

Local Sales Offices & Reps

TX Lewisville, Elctrn. Prod. Reps. 214-436-4772

CONDOR

FAX: 805-487-8911

CONDOR D.C. POWER SUPPLIES, INC., 2311 Statham Pkwy., Oxnard, CA 93033, Tel: 805-486-4565,; Empl.: 250; *Sls. Mgr.:* Michael F. Kirkowski, Exec. VP Mktg.; *Dist. Mgr.:* Deborah Perez ..... **D•1680-1689**

Local Sales Offices & Reps

AL Huntsville, Adams Elctrns. 205-882-2988
AL Huntsville, The John Todd Co. 205-828-0808
AZ Phoenix, Aztech-CPS Inc. 602-246-1097
AZ Scottsdale, Aztech-CPS Inc. 602-991-6300
CA Fremont, Telesis Sls. Grp. 415-657-8645
CA Glendale, TKI Sls. Co. 818-546-5010

CA Milpitas, Telesis Sls. Grp. 408-946-7300
CA Pasadena, A-F Sls. Engrg. 800-696-3442
CA Westlake Vlg., Elkins & Assoc. 818-597-1075
CO Denver, AKI Entprs. 303-388-4488
CT Madison, Focus Elctrns. Sls. 203-245-4314
FL Altamonte Springs, Semtronic Assoc. 407-831-8233
GA Lilburn, Adams Elctrns. 404-925-9115
IL Schaumberg, Engrg. Prods. Assoc. 708-882-7640
IN Indianapolis, Current Elctrns. Mktg. 317-257-1861
IA Cedar Rapids, C.H. Horn & Assocs. 319-393-8703
IA Cedar Rapids, Lorenz Sls., Inc. 319-377-4666
KS Overland Park, Lorenz Sls., Inc. 913-469-1312
KS Wichita, DLE Elctrns. 316-683-6400
MD Lutherville, J. A. Dougherty Sls. 301-321-7890
MA Taunton, Focus Elctrns. Sls., Inc. 508-824-3840
MI Bloomfield Hills, ENCO Mktg., Inc. 313-338-8600
MN Edina, Engrg. Prods. 612-835-9022
MN Minneapolis, Electric Comp. Sls. 612-933-2594
MO St. Louis, John G. Macke Co. 314-432-2830
MO St. Louis, Lorenz Sls., Inc. 314-997-4558
NE Lincoln, Lorenz Sls., Inc. 402-475-4660
NJ Marlton, BGR Assocs. 609-983-1020
NJ Medford, Comp. Consits. 609-654-5300
NY Pittsford, C. W. Beach Co. 716-586-3200
NY Yonkers, Sonkin Assocs. 914-968-8282
OH Gahanna, Manufacturers Direct Sales 614-476-3310
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
SC Lilburn, Adams Elctrns. 404-925-9115
TX Dallas, M Rep 214-484-5711
WA Redmond, Eclipse Mktg. Grp. 402-475-4660
Can Toronto, Ont., Duncan Instrs. 416-742-4448

Local Distributors

AL Huntsville, Allied Elctrns. 205-721-3500
AZ Phoenix, Aerospace S.W. 602-582-2779
CA Camarillo, Milgray 805-484-4055
CA Costa Mesa, FLW 714-751-7512
CA Fremont, FLW 415-651-6511
CA San Jose, Power & Data Tech. 408-629-3550
CA Santa Clara, Kent Elctrns. 408-727-9810
CO Broomfield, Future Elctrns. 303-421-0123
CT Milford, Milgray 203-878-5538
FL Ft. Lauderdale, Allied 305-973-7103
FL Orlando, Hammond Elctrns. 305-841-1010
FL Winter Pk., Milgray 407-647-5747
GA Norcross, Milgray 404-446-9777
IL Chicago, Dalec Distrs. 312-283-0300
IL Palatine, Milgray 708-202-1900
IL Schaumberg, Bortech Sls. 708-882-7640
IN Indianapolis, Allied Elctrns. 317-875-0448
KS Overland Pk., Milgray 913-236-8800
MD Columbia, Vantage 301-720-5100
MD Marlow Hgts., Allied 301-423-0161
MD Wheaton, Brimberg Sls. 301-946-2670
MA Billerica, Allied Elctrns. 617-667-7921
MA Westborough, Future Elctrns. 508-366-2400
MI Ann Arbor, McNaughton-McKay 313-995-9515
MI Madison Heights, McNaughton-McKay 313-399-7500
MN Eden Prairie, Allied Elctrns. 612-829-7554
MN Edina, Bortech Sls. 612-835-9036
MN Minneapolis, Aerospace Comp. Prod. 612-884-4725
MO St. Louis, Future Elctrns. 314-469-6805
NJ Marlton, Milgray 609-983-5010
NJ Mt. Laurel, Allied Elctrns. 609-234-7769
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NJ Parsippany, Milgray 201-335-1766
NY Elmsford, Kintronics 914-347-2530
NY Farmington, Milgray 516-391-9800
NY Mineola, Allied 516-248-2360
NY Rochester, Future Elctrns. 716-272-1120
NC Raleigh, Allied 919-876-5845
NC Raleigh, Milgray 919-790-8094
OH Cleveland, Milgray 216-447-1520
OR Portland, Eoff 503-222-9411
PA McKean, Advacom, Inc. 814-476-7774
PA Pittsburgh, Allied Elctrns. 412-367-4124
SC Greenville, Hammond Elctrns. 803-232-0872
TX Dallas, Cypress Elctrns. 214-869-1435
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Richardson, Future Elctrns. 214-437-2437
UT Salt Lake City, Future Elctrns. 801-972-8489
UT Salt Lake City, Milgray 801-272-4999
WA Seattle, Allied 206-547-2827
WA Vancouver, Eoff 206-694-7504
Can Toronto, Ont., Duncan Inst. Ltd. 416-742-4448

CONDOR PACIFIC INDS., INC., 8053 Deering Ave., Canoga Park, CA 91304, Tel: 818-347-8331, TELEX: 65-1442, FAX: 818-713-0162; FSC No.: 24321; Empl.: 110

CONDOR SYSTEMS, INC., 2133 Branham Lane, San Jose, CA 95124, Tel: 408-371-9580, FAX: 408-371-9589; FSC No.: 62065; Empl.: 270; *Sls. Mgr.:* Dave Klinger; *Dist. Mgr.:* Ed Brown

CONDUCTIVE RUBBER TECHNOLOGY, INC., 22125 17th Ave. S.E. Ste. 117, Bothell, WA 98021, Tel: 206-486-8559, FAX: 206-487-0945; Empl.: 30; *Sls. Mgr.:* K. Grant

CONDUCTIVE SYSTEM, INC., R.D. No. 1, Box 1040, Rte. 5 South, Amsterdam, NY 12010, Tel: 518-843-5740, FAX: 518-843-5829; Empl.: 25; *Sls. Mgr.:* Eivind Johansen

CONFORMING MATRIX, Box 5126, Pt. Pl. Sta., Toledo, OH 43611, Tel: 419-729-3777, FAX: 419-729-3779; Empl.: 35

CONKLIN INSTRUMENT CORP., West Rd., P.O. Box 650, Pleasant Valley, NY 12569, Tel: 914-635-2136, FAX: 914-635-2510; Empl.: 110; *Sls. Mgr.:* James Taffer

CONNECT-AIR INTERNATIONAL, INC., 50 37th St N.E., Auburn, WA 98002, Tel: 206-939-4880, FAX: 206-939-4882; Empl.: 50; *Sls. Mgr.:* Ron Jones

CONNECTICUT HARD RUBBER CO., See CHR Inds.

CONNECTICUT MICROWAVE CORP., 10 B Trackside Business Park, Cheshire, CT 06410, Tel: 203-250-9678, FAX: 203-250-9688; FSC No.: 50974; Empl.: 15; *Sls. Mgr.:* Joseph W. Raines

CONNECTOR ACCESSORIES, INC., See Mueller Elec. Co.

FAX: 312-539-3825

CONNECTOR CORP., 6025 N. Keystone Ave., Chicago, IL 60646, Tel: 312-539-3108, TWX: 910-221-6059; *Sls. Mgr.:* Bill Anthony ..... **C•1326-1327**

CONNECTOR INDUSTRIES OF AMERICA DIV., Microdot Mfg., 10340 Julian Dr., Cincinnati, OH 45215, Tel: 513-772-3680; FSC No.: 32076; Empl.: 60; *Sls. Mgr.:* Bob Cain

FAX: 419-537-0007

CONNECTRONICS CORP., 2745 Avondale Ave., Toledo, OH 43607, Tel: 419-537-0020; FSC No.: 0LE36; Empl.: 15; *Sls. Mgr.:* Thomas L. Ricketts ..... **C•1328**

Local Sales Offices & Reps

OH Toledo, Connectronics 419-537-0020
OH Troy, S-Tek 513-339-5882

Local Distributors

MI Ann Arbor, S-TEK 313-572-0516

FAX: 708-851-5040

CONNOR-WINFIELD CORP., 1865 Selmarten Rd., Aurora, IL 60505-1335, Tel: 708-851-4722, TELEX: 270244; FSC No.: 5955; Empl.: 35; *Sls. Mgr.:* Tom Grabowski; *Dist. Mgr.:* John Hoag ..... **A•1324-1327**

Local Sales Offices & Reps

AL Huntsville, Dean Assocs. 205-880-8200
AZ Scottsdale, Spectrum Mktg. Assoc. 602-890-9000
CA Campbell, Shur Sls. 408-374-5577
CA San Clemente, ATA 714-661-9700
CA San Diego, ATA 619-792-6079
CO Denver, Spectrum Mktg. Assoc. 303-480-9991
CT Cheshire, Scientific Comps. 203-272-2963
FL Boca Raton, Perrott Assocs. 407-362-0191
FL Casselberry, Perrott Assocs. 407-830-0094
FL Clearwater Beach, Perrott Assocs. 813-443-5414
FL Melbourne, Perrott Assocs. 407-676-0305
ID Boise, Q.R. Crown 208-344-9588
IN Ft. Wayne, R.O. Whitesell 219-432-5591
IN Indianapolis, R.O. Whitesell 317-359-9283
IN Kokomo, R.O. Whitesell 317-457-9127
KY Versailles, R.O. Whitesell 606-873-1182
MD Cockeysville, Koebert Assocs. 301-493-8924
MA Needham Hgts., Kanan Technlgs. 617-449-7400
MI Grand Blanc, R.O. Whitesell 313-695-0770
MI Grand Rapids, R.O. Whitesell 616-942-5420
MI Southfield, R.O. Whitesell 313-352-5454
MI St. Joseph, R.O. Whitesell 616-983-7337
NC Charlotte, Quantum Mktg. 704-523-8822
NC Raleigh, Quantum Mktg. 919-846-5728
OH Cincinnati, R.O. Whitesell 513-521-2290
OH Cleveland, R.O.Whitesell 216-447-9020
OH Columbus, R. O. Whitesell 614-888-9396
OH Dayton, R.O.Whitesell ..... 513—298-9546
OR Portland, Q.R. Crown 503-620-8320
PA Glenside, Koebert Assocs. 215-887-2310
PA Pittsburgh, R.O. Whitesell 412-963-6161
TX Austin, Synergistic Sls. 512-346-2122
TX Houston, Synergistic Sls. 713-937-1990
TX Richardson, Synergistic Sls. 214-644-3500
WA Bellevue, Q.R. Crown 206-453-5100
WV Inwood, Koebert Assocs. 304-229-8401
WI Oconomowoc, Artmor Ltd. 414-367-8789
Can Scarborough, Ont., Cantronics Ltd. 416-297-8668

CONRAC DISPLAY PRODUCTS, INC., 1724 S. Mountain Ave., Duarte, CA 91010, Tel: 818-303-0095, TELEX: 67-0437, TWX: 910-584-5913, FAX: 818-303-5484; Empl.: 109; *Sls. Mgr.:* G.L. Ives, Dir. Mktg. & Sls.

Consolidated electronic wire & cable

FAX: 708-455-8979

CONSOLIDATED ELECTRONIC WIRE & CABLE, 11044 King St., Franklin Park, IL 60131-1412, Tel: 708-455-8830; FSC No.: 73612; Empl.: 97; *Sls. Mgr.:* Karl Rankin; *Dist. Mgr.:* Steve Boynton ..... **C•1726-1743**

Local Sales Offices & Reps

CT Glastonbury, Liberty Electro Mktg. 203-657-8023
AZ Phoenix, Mercury Engrg. Sls. 602-265-0344
CA Montrose, Signal Entprs. Inc. 818-957-0640
MA Topsfield, Liberty Electro Mktg. 508-887-6655
CO Boulder, The Stratford Grp. 303-530-3194
FL Casselberry, T.Squared Mktg. 407-699-9992
IL Franklin Pk., Con. Elec. Wire & Cable 708-455-8830
IL Highland Pk., Bransky Sls. 708-433-2375
IN Carmel, Frank E. Kahsar, Sls. Inc. 317-844-9353
IA Cedar Rapids, R. W. Kunz & Assocs. .. 319-396-5386
KS Prairie Village, R. W. Kunz & Assocs. .. 913-648-3535
MD Walkersville, Jadelectronic Assocs. ... 301-845-6036
MI Warren, Frank E. Kahsar 313-795-3530
MN Eden Prairie, PWC Inc. 612-934-1409
MO St. Louis, R. W. Kunz & Assocs. 314-966-4977
NY Buffalo, NRM Mktg. Group 716-634-4300
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CORLUND ELECTRONICS CORP., 2330 Teller Rd., Newbury Park, CA 91320, Tel: 805-499-6877, FAX: 805-499-4072; Empl.: 60; *Sls. Mgr.:* Wayne Smith

CORMAN TECHNOLOGIES INC., 75 Bathurst Dr., Waterloo, Ontario, Canada N2V 1N2, Tel: 519-884-4430, FAX: 519-884-0204; *Sls. Mgr.:* Bill Lochead; *Dist. Mgr.:* Bill Lochead

CDE CORNELL DUBILIER

FAX: 508-996-3830

CORNELL-DUBILIER ELCTRNS. (INTL. SLS., DISTBN. WAREHOUSE), 1605 E. Rodney French Blvd., New Bedford, MA. 02744, MA 02741, Tel: 508-996-8561, TELEX: 929 419; Empl.: 5000; *Sls. Mgr.:* Anthony M. Cavuto, VP Sls. ..... **A•1052-1053; B•1439**

Local Sales Offices & Reps

CA	San Diego, CK Assocs.	619-279-0420
CA	Valencia, C & N Assocs.	805-254-5844
CO	Littleton, Megatronix	303-730-6262
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	St. Petersburg, QXI Inc.	813-894-4556
KS	Overland Park, Electri-Rep	913-649-2168
MD	Gaithersburg, Naudain Assoc. Southern, Inc.	301-258-5040
MI	Madison Heights, Pine Sales, Inc.	313-589-0350
MN	Eden Praire, PWC Incorporated	612-934-1409
MO	St. Louis, Electra-Rep	314-993-4421
NJ	Leonia, Peter E. Schmitt Co., Inc.	201-944-2806
NC	Raleigh, Prime Comps., Inc.	919-850-9866
OH	Richfield, The Lyons Corp.	216-659-9224
OR	Portland, Northwest Mktg. Assoc.	503-620-0441
SC	Easly, RA Sls.	803-859-1859
TN	Chattanooga, Indl. Mktg. & Sls., Inc.	615-894-2219
TX	Richardson, Comp. Partners, Inc.	214-644-1288
UT	Salt Lake City, Charles Fields & Assocs.	801-531-6177
WI	Waukesha, Eagle Tech. Sls.	414-896-0633
PR	San Juan, P.R., E.T.S. Inc.	809-798-1300
Can	Mississauga, Ont., Source Elctrns.	416-676-0830

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Compton, Harper Sid	213-979-5090
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Milpitas, California Capacitor	408-262-6000
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Tustin, Projections Unlimited	714-544-2700
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Palatine, OHM Elctrns.	708-359-5500
MA	Newton, The Greene-Shaw Co.	617-969-8900
MN	St. Paul, Shelley/Ragon	612-642-2828
NY	Central Islip, Semi Cap Elctrns.	516-582-4400

NY Hauppauge, JACO Elctrns. 516-273-5500
NY Mamaroneck, New Yorker Elctrns. 914-698-7600
NY Port Chester, Zeus Comps. 914-937-7400
NY Rome, Rome Elctrns. 315-337-5400
OH Cleveland, Pioneer-Standard 216-587-3600
PA No. Versailles, CMD Elctrns. 412-678-6020
TX Dallas, Hallmark Elctrns. 214-553-4300
TX Fort Worth, TTI, Inc. 817-740-9000
TX Houston, Sterling Elctrns. 713-627-9800
WI Milwaukee, Marsh Elctrns. 414-475-6000

CORNELL-DUBILIER ELCTRNS. (CORPORATE HEADQUARTERS), 1700 Route 23 North, Wayne, NJ 07470, Tel: 201-694-8600; Empl.: 1000; *Sls. Mgr.:* A. Cavuto ..... **A•1052-1053**

Local Sales Offices & Reps

CA San Diego, C & N Assocs. 619-279-0420
CA Valencia, C & N Assocs. 805-254-5844
CO Littleton, Megatronix 303-730-6262
CT Branford, Coakley, Boyd & Abbett 203-481-2218
FL St. Petersburg, QXI, Inc. 813-894-4556
KS Overland Park, Electri-Rep. 913-649-2168
MD Gaithersburg, Naudain Assoc. Southern, Inc. 301-258-5040
MI Madison Hgts., Pine Sls., Inc. 313-589-0350
MN Eden Prairie, PWC Inc. 612-934-1409
MO St. Louis, Electri-Rep 314-993-4421
NJ Leonia, Peter E. Schmitt Co., Inc. 201-944-2806
NC Raleigh, Prime Comps. Inc. 919-850-9866
OH Richfield, The Lyons Corp. 216-659-9224
OR Portland, Northwest Mktg. Assocs. 503-620-0441
SC Easly, RA Sls. 803-859-1859
TN Chattanooga, Indl. Mktg. & Sls., Inc. ... 615-894-2219
TX Richardson, Comps. Partners, Inc. 214-644-1288
UT Salt Lake City, Charles Fields & Assocs. 801-531-6177
WI Waukesha, Eagle Tech. Sls. 414-896-0633
PR San Juan, E.T.S. Inc. 809-798-1300
Can Mississauga, Ont., Source Elctrns. 416-676-0830

Local Distributors

AZ Phoenix, Arizona Comp. Co. 602-269-5655
CA Compton, Harper Sid 213-979-5090
CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, California Capacitor 408-262-6000
CA Sunnyvale, Capsco Sls. 408-734-3020
CA Tustin, Projection Unlimited 714-544-2700
CO Aurora, Capstone Elctrns. 303-375-1300
CO Denver, Integrated Elctrns. Corp. 303-292-5537
FL Boca Raton, NRC Elctrns. 407-241-8600
IL Chicago, Newark Elctrns. 312-784-5100
IL Chicago, Waldom Elctrns. 312-585-1212
IL Palatine, OHM Elctrns. 708-359-5500
MA Newton, Greene-Shaw, Co. 617-969-8900
MN St. Paul, Shelley-Ragon 612-642-2828
NY Central Islip, Semicap Elctrns. Corp. 516-582-4400
NY Hauppauge, Jaco Elctrns., Inc. 516-273-5500
NY Mamaroneck, New Yorker Elctrns. 914-698-7600
NY Port Chester, Zeus Comps. 914-937-7400
NY Rome, Rome Elctrns. 315-337-5400
OH Cleveland, Pioneer-Standard 216-587-3600
PA N. Versailles, CMD Elctrns. 412-678-6020
TX Dallas, Hallmark Electronics 214-553-4300
TX Ft. Worth, TTI, Inc. 817-740-9000
TX Houston, Sterling Elctrns. 713-627-9800
WI Milwaukee, Marsh Elctrns. 414-475-6000

CORNELL MANUFACTURING, An Elgin Co., 25 Ramland Road, Orangeburg, NY 10962, Tel: 914-365-0400, FAX: 914-359-6809; Empl.: 50; *Sls. Mgr.:* Lou Schnur; *Dist. Mgr.:* Lou Schnur

CORNING GLASS WORKS, Materials Business, Main Plant, MP 21-3, Corning, NY 14831, Tel: 607-974-7149, TELEX: 932498, FAX: 607-974-7618; *Sls. Mgr.:* Paul Marx; *Dist. Mgr.:* Dennis Naylor

Local Distributors

CA Los Angeles, Leed Plastics Corp. 213-746-5984
CA Santa Clara, San Jose Delta Assocs., Inc. 408-727-1448
IL Addison, Circle Fabrication, Inc. 708-543-4440
NJ Palisades Pk, Morgan Matroc Inc. 201-947-8313
NJ Washington, Accuratus Ceramic Corp. 201-689-0880
OH Cincinnati, Astro Met Assocs., Inc. 513-772-1242
TX Houston, EGC Corp. 713-447-8611
WI Hubertus, Tech. Prods., Inc. 414-628-2768
Can Ontario, Johns Scientific 416-699-1731

CORNING INCORPORATED, Opto-Electronics Group, MP-RO-03, Corning, NY 14831, Tel: 607-974-7914, FAX: 607-974-4914; Empl.: 26,000

CORTEC, INC., 15672 Chemical La., Huntington Bch., CA 92649, Tel: 714-897-2529, FAX: 714-897-2170; Empl.: 35

CORTRON DIV., See ITW Cortron,Illinois Tool Works

CORTRON INC., 1 Aegean Dr., Methuen, MA 01844, Tel: 508-975-5445, FAX: 508-975-0357; Empl.: 75; *Sls. Mgr.:* Philip P. Bodoni ..... **B•1803**

CORVUS MICROWAVE INC., 6075 E. Molloy Rd., Syracuse, NY 13211-2100, Tel: 315-437-4400, FAX: 315-437-8095; FSC No.: 26058; Empl.: 35; *Sls. Mgr.:* Diane L. Conklin

COSMO CORPORATION, 3239 W. 14th St., Cleveland, OH 44109, Tel: 216-861-5594, FAX: 216-861-0416; Empl.: 350; *Sls. Mgr.:* B. Gordon

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FAX: 401-942-0920

COTO WABASH, Kearney National Corporation, 55 DuPont Drive, Providence, RI 02907, Tel: 401-943-2686; Empl.: 300; *Sls. Mgr.:* John E. Beigel, Dir. Mktg. & Sls.; *Dist. Mgr.:* David MacRae, Natl. Sls. Mgr. ..... **B•1441-1445**

Local Sales Offices & Reps

AL Owens Cross Rds., cmrCross Assocs. 205-883-5991
AZ Phoenix, Spectrum Mktg. Assocs., Inc. 602-890-9000
CA Newport Bch., Forbes Pacific Inc. 714-722-6174
CA Saratoga, Testco Inc. 408-253-1900
CO Denver, Spectrum Sls. 303-480-9991
DE Hunt Valley, Eagle Sls. Corp. 301-666-3930
DC Hunt Valley, Eagle Sls. Corp. 301-666-3930
FL Orlando, Standard Mktg. 407-856-4140
FL Sunrise, Standard Mktg. 305-749-5557
FL Tampa, Standard Mktg. 813-933-5833
IL Arlington Hgts., M.J. Petersen & Assocs. 708-577-8200
IN Ft. Wayne, M/S Sls. & Assocs. 219-436-3023
IN Greenwood, M/S Sls. & Assocs. 317-881-0110
IA Cedar Rapids, Midwest Tech. Sls. Inc. 319-393-5115
KS Goddard, Midwest Tech. Sls. Inc. 316-794-8565
KS Lenexa, Midwest Tech. Sls. Inc. 913-888-5100
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MA Andover, Crawford Assocs. 508-470-2122
MN Roseville, TLC 612-483-2226
MO Earth City, Midwest Tech. Sls. Inc. 314-298-8787
NY Clifton Pk., Net Sls. 518-371-6864
NY Cortland, Net Sls. 607-756-6592
NY Great Neck, MOS Mktg. Assocs. 516-487-3966
NY Victor, Net Sls. 716-924-1844
NC Charlotte, Godwin Assocs. 704-549-8500
NC Raleigh, Godwin & Assoc. 919-878-8000
OR Oregon City, Halbar Pacific 503-656-3714
PA Trevose, Omega Elctrn. Sls. 215-244-4000
MA Swansea, Wm. Poisson & Assocs. 508-677-3655
TX Plano, Richmar Elctrns. 214-424-8388
TX Round Rock, Richmar Elctrns. 512-255-2551
UT Ogden, Spectrum Mktg. Assocs. Inc. .. 801-972-8552
WA Redmond, Halbar Pacific 206-882-0990
Can Pointe Claire, Que., A. R. Gray Assocs. 514-694-6378

Local Distributors

CA San Diego, Pyramid Elect. Supp. Inc. .. 619-271-5404
CA Santa Clara, Pyramid Elect. Supp. Inc. 408-727-9810
CA Santa Monica, Master Distrs. 213-452-1229
CA Saratoga, Testco Inc. 408-253-1900
CA Sunnyvale, Spirox 408-739-3334
CA Torrance, Pyramid Elect. Supp. Inc. 714-773-0781
CO Denver, Spectrum Distrbn. 303-480-9991
FL W. Melbourne, Astro Mktg. 407-727-8817
IL Bedsville, Voyager Elect. Corp. 708-860-1300
IL Elk Grove Village, Nu-Way Elect. Dist., Inc. 708-437-7120
MA Andover, Aved Elect. Inc. 508-688-3800
MA Sandwich, J.V. Elctrns. 508-833-0700
MN Fridley, Voyager Elect. Corp. 612-571-7766
NJ Oakland, Relay Specialties 201-337-1000
NY Buffalo, Summit Dist. 716-887-2800
NY Rochester, Masline Elect., Inc. 716-546-5373
OK Tulsa, Altair Co. 918-252-5781
CA Saratoga, Testco, Inc. 408-253-1900
PA Philadelphia, SHAP Elect. Co. 215-969-3300
TX Ft. Worth, Allied Elec. 817-595-3500
TX Austin, Altair Co. 512-837-4970
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
UT Ogden, Spectrum Mktg. Assocs., Inc. .. 801-972-8552
WA Redmond, Pyramid Elect. Supp., Inc. .. 206-883-7200

COTRONICS, 3379 Shore Pkwy., Brooklyn, NY 11235, Tel: 718-646-7996, FAX: 718-646-3028; Empl.: 15; *Sls. Mgr.:* Alan Marks

COUTANT LAMBDA LTD., Kingsley Ave., Ilfracombe, Devon, England EX34 8ES, Tel: (0271) 863781, TELEX: 46310, FAX: (0271)64894; Empl.: 330; *Sls. Mgr.:* Nigel Davies; *Dist. Mgr.:* Nigel Davies

COVER CRAFT CORP., See Amherst International Corp., Cover Craft Div.

COVID, INC., 2400 W. 10th Place, Tempe, AZ 85281, Tel: 602-966-2221, FAX: 602-966-6728; Empl.: 40; *Sls. Mgr.:* Suzanne Jones

COVOX, INC., 675 Conger St., Eugene, OR 97402, Tel: 503-342-1271, FAX: 503-342-1283; Empl.: 25; *Sls. Mgr.:* Larry Quateman

CPS, INC., 47341 Bayside Parkway, Fremont, CA 94538-6517, Tel: 415-657-6363, FAX: 415-657-7220; FSC No.: 31640; Empl.: 30; *Sls. Mgr.:* Clifford Gaw

CP TECHNOLOGY, INC., 21143 Christensen Drive, Cupertino, CA 95014, Tel: 408-996-8069, FAX: 408-986-8278; Empl.: 6

CRAFT DATA, INC., 27022 Cordero Lane, Mission Viejo, CA 92691, Tel: 714-582-8284, FAX: 714-248-2390; Empl.: 4

CRAIG SYSTEMS CORP., Eastern Technologies, Ltd., 10 Industrial Way, Amesbury, MA 01913-4848, Tel: 508-388-5662, TWX: 710-347-0590, FAX: 508-388-0845; FSC No.: 81902; Empl.: 150; *Sls. Mgr.:* Roger Chouinard

Cramer

FAX: 414-377-4028

CRAMER COIL & TRANSFORMER CO., INC., 401 Progress Dr., Saukville, WI 53080, Tel: 414-284-9425, 414-377-7040; Empl.: 110; *Sls. Mgr.:* Nicholas Hayes ..... **A•2191-2193**

Local Sales Offices & Reps

CA San Dimas, Dilectron 714-394-1356
CA Santa Clara, Fischer Assocs. 408-733-7350
CO Monument, Sunbird Inds. 303-481-2900
CT Bethany, The Reps. Corp. 203-393-0024
IL Palatine, Somers-Stanton 312-994-1108
IN Frankfort, C-S Elctrn. Sls. 317-659-1874
KS Overland Park, Q D C Inds. 913-341-2214
MA Wellesley, The Reps. Corp. 617-237-6476
MI Jackson, Norwood-Scroggs 517-750-1170
MN Eden Prairie, Hanna Lind 612-942-8554
NY Fulton, Carl Truax, Inc. 315-592-7184
NC Kernersville, Wallace Elctrns. Sls. 919-996-2742
TX Richardson, Barry Sls., Inc. 214-234-0255

CRAMER CO., 139 Mill Rock Road East, Old Saybrook, CT 06475, Tel: 800-247-6784, FAX: 203-388-9831; Empl.: 210; *Sls. Mgr.:* Joe Lenzo; *Dist. Mgr.:* E. Latourette

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CREARE INC., Etna Rd., P.O. Box 71, Hanover, NH 03755, Tel: 603-643-3800, FAX: 603-643-4657; FSC No.: 8A287; Empl.: 100

CREATIVE AUTOMATION CO., 11641 Pendleton St., Sun Valley, CA 91352, Tel: 818-767-6220, FAX: 818-767-0123; Empl.: 25; *Sls. Mgr.:* John Lee, Jr.

CREATIVE MICRO SYSTEMS, 3822 Cerritos Ave., Los Alamitos, CA 90720, Tel: 213-493-2484, FAX: 213-493-3553; Empl.: 15; *Sls. Mgr.:* Margaret E. Prossen

CRESTRONICS DIV., APPLIED ELECTRO TECHNLG., See STI-Crestronics Div.

CRISSMAN MANUFACTURING CO., 11004 Bakley St., Huntley, IL 60142, Tel: 708-669-3995, FAX: 708-699-5168

CRITERION INSTRS., LTD., 30 Progress Ave., Scarborough, Ont., CAN M1P4W8, Tel: 416-299-6666, FAX: 416-299-8398; Empl.: 16 ..... **D•1238-1239, 1694**

Local Sales Offices & Reps

IL	Chicago, Rock Sls. Inc.	708-351-9903
MI	Troy, Satullo Assocs. Inc.	313-585-4811
NC	Selma, Shalltronix Corp.	919-965-6346
OH	Cleveland, Abitec, Inc.	216-531-9122
PA	Abitec, Inc.	216-531-9122
TX	Lewisville, E.P.R.	214-436-4772
Can	Calgary, Al., Landel Controls	403-250-3553
Can	Montreal, Que., Projean Inst.	514-273-8331
Can	Richmond, B.C., John McMillan	604-273-1747
Can	Saskatchewan, Landel Controls	403-250-3553

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FAX: 515-573-1342

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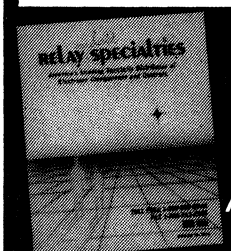
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AL	Huntsville, Southeast Tech. Grp.	205-534-2376
AZ	Tucson, Clemick & Assocs.	602-749-4003
CA	Santa Fe Springs, Bell Inds.	213-826-3975
CA	Gardena, CAL Switch	213-770-2330
CA	Pleasanton, Moulthrop Sls., Inc.	415-463-0450
CA	Sun Valley, Richey Western Elctrns.	714-895-0060
CA	Valencia, C & N Assocs., Inc.	805-254-5844
CO	Englewood, Quorum 3	303-799-8100
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Ft. Lauderdale, Panamtech	305-587-3769
FL	Oviedo, Panamtech	407-679-5506
GA	Lawrenceville, Southeast Tech. Grp.	404-979-2055
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Merriam, Lorenz Sls., Inc.	913-384-6556
KS	Wichita, Lorenz Sls.	316-721-0500
MA	Framingham, Coakley, Boyd, & Abbett, Inc.	508-820-0800
MA	Hingham, Sager Elctrl. Supp.	617-749-6700
MI	Grand Haven, Hilltronics, Inc.	616-847-1010
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Minneapolis, Electric Comp. Sls., Inc.	612-933-2594
MS	Meridian, Southeast Tech. Grp.	601-485-7055
MO	St. Louis, Lorenz Sls., Inc.	314-997-4558
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660
NJ	Englewood Cliffs, Ed Glass Assocs.	201-592-0200
NY	E. Rochester, Empire Tech. Assocs.,Inc.	716-381-8500
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Skaneateles, Empire Tech. Assoc.	315-685-5703
NC	Charlotte, RG Sls. Co., Inc.	704-531-0096
OH	Cleveland, Arthur H. Baier Co.	216-461-6161
OH	Dayton, Arthur H. Baier Co.	513-276-4128
OH	Dayton, Stotts Friedman Co.	513-298-5555
OH	West Chester, Arthur H. Baier	513-779-2395
OH	Worthington, Arthur H. Baier Co.	614-764-1144
OK	Tulsa, DJ Sls. & Assocs.	918-663-8155
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Narberth, Bresson Assocs.	215-664-6460
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	Pittsburgh, Arthur H. Baier	412-367-7799
TX	Austin, D.J. Sls & Assocs.	512-258-3002
TX	Dallas, DJ Sls. & Assocs.	214-783-8876
TX	Dallas, Hall-Mark Elctrns.	214-343-5000
UT	Salt Lake City, Quorum 3	801-943-9227
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Pickering, Ont., McHugh Elctrns.	416-831-4773
Can	Vancouver, B.C., Arwin Tech. Sls.	604-980-4557

CR MAGNETICS, INC. (FORMERLY CURRENT RING CO., INC.), 304 Axminster Dr., Fenton, MO 63026, Tel: 314-343-8518, FAX: 314-343-5119; Empl.: 5 ..... **A•2194**

Local Sales Offices & Reps

MO	Fenton, CR Magnetics, Inc.	314-343-8518

Local Distributors

MO	St. Louis, ISL Corp.	314-423-3141,800-325-8653

CROMPTON METERMASTER INC., 2507 W. Erie Dr., Tempe, AZ 85282, Tel: 602-431-0015, FAX: 602-431-1836; *Sls. Mgr.:* Steve Alexander

CROMPTON MODUTEC, 920 Candia Rd., Manchester, NH 03103, Tel: 603-669-5121, 800-METERS-1, FAX: 603-622-2690,603-641-2620; FSC No.: 53498; Empl.: 450

CROSS ELECTRONICS, 100 Commonwealth Dr., Warrendale, PA 15086, Tel: 412-776-1591, FAX: 412-776-1596; Empl.: 35; *Sls. Mgr.:* L. R. Craig

CROSSPOINT, Div. of Info-Lite Corp., 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455, FAX: 201-941-4919; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli ... **B•1673**

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Local Sales Offices & Reps

AZ	Scottsdale, FLEXTEC	602-585-3353
CA	San Ramon, C. F. M. Sls.	415-735-3601
CO	Denver, Ralph R. Pence & Assocs.	303-778-0484
FL	Lakeland, Munday Sls. Co.	813-858-5606
GA	Atlanta, Levine Lectronics	404-446-9326
IN	Indianapolis, Emsco Sls. & Engrg. Co.	317-251-7074
IA	Bettendorf, Custom Controls Ltd.	319-355-4787
MA	Beverly, Electro-Kinetics	508-921-1560
MA	Wellesley, Electro Kinetics	617-235-9415
MN	Albertville, J & B Assocs.	612-497-4660
MS	Jackson, Doby Assocs.	601-981-1138
MO	St. Louis, Control Tech. Sls. II, Inc.	314-469-6004
NY	Fairport, Tac Sls.	716-377-2250
NY	Plainview, Motion Control Sls.	516-756-5656
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
PA	Horsham, Jacobsen & Assocs.	215-674-2937
TX	Dallas, Blackburn & Assoc.	214-750-8484
UT	Salt Lake City, Advanced Control Equip.	801-485-0305
WA	Redmond, S.E.A., Inc.	206-883-4999
WA	Vancouver, Sea Inc.	206-573-5161
Can	Downsview, Ont., Tienkay Inc.	416-665-9546
Can	Longueuil, Que., Decofer	514-651-0285

Local Distributors

CA	Los Angeles, Master Distr.	213-452-1229
CA	San Carlos, Western Comp. Sls. N.	415-594-1222
CO	Colorado Springs, Summit Fasteners & Elec. Hdwe.	303-593-7700
FL	Davie, M.P. Assocs.	305-370-1317
FL	Lakeland, A. A. Elec.	813-665-6941
GA	Smyrna, Waffles Elec.	404-433-8377
IL	Chicago, Excel Elec.	312-421-7220
IL	Chicago, MC Master-Carr	312-834-9600
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-634-8202
IN	Indianapolis, Control Des. Supp.	317-788-4559
IN	Indianapolis, Vonnegut Indl. Prods.	317-899-8800/8877
IA	Bettendorf, Custom Controls Ltd.	319-335-4787
MA	Norwell, Electro-Mechanical Distr.	617-826-9714
MI	Comstock Park, Mor Elec.	616-784-1121
MI	Grand Rapids, S-F Electronics	616-459-0216
MI	Royal Oak, George Instr. Co.	313-280-1111
MI	Saginaw, Fischer-Flack	517-752-4181
MN	St. Paul, Powermation	612-645-0781
NE	Omaha, Lakeland Engrg.	402-734-2600
NJ	Edison, Howman Applied Control Prods.	201-797-3313
NJ	Fair Lawn, Relay Specialties	201-797-3313
NC	Asheville, Electric Supply Co.	704-255-8899
NC	Gastonia, J.M.T. Elctrn. Supp.	704-867-4401
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinatti, Hughes-Peters.	513-351-2000
OH	Cleveland, Reserve Motion Control Sys.	216-826-0290
OH	Columbus, Hughes-Peters.	614-294-5351
OH	Dayton, Duellman Elctrns.	513-461-5010
OK	Tulsa, Radio Inc.	918-587-9123
PA	Allentown, P. A. Peters.	215-434-5237
SC	Greenville, Holder Elec. Supp.	803-271-7111
TX	Ft. Worth, Swieco.	817-335-6521
WA	Kent, Motors & Controls Corp.	206-872-8010
WA	Seattle, Eicher-Richards Co.	206-523-7888
WI	Waukesha, Powermation	414-542-2868
Can	St. Hubert, Que., Decofer	514-678-2252
Can	Willowdale, Ont., PS Comps.	416-498-0214

CROVEN CRYSTALS, 500 Beech St., Whitby, ON, Canada L1N 5S5, Tel: 416-668-3324, FAX: 416-668-5003; FSC No.: 00809; Empl.: 250; *Sls. Mgr.:* R. McCormick

CROZIER METROLOGY LAB, 529 N. Wolf Rd., Wheeling, IL 60090, Tel: 708-520-9085, FAX: 708-520-9150; Empl.: 5; *Sls. Mgr.:* Richard D. Crozier

CRYDOM COMPANY

FAX: 213-865-3318

CRYDOM COMPANY, P.O. Box 3699, Lakewood, CA 90711-3699, Tel: 213-865-3536, TWX: 910-250-5756; Empl.: 365; *Sls. Mgr.:* James L. Jensen; *Dist. Mgr.:* James L. Jensen ..... **A•2086-2092; B•1450-1455**

CRYOMAGNETICS, INC., 739 Emory Valley Rd., Oak Ridge, TN 37830, Tel: 615-482-9551, TELEX: 883 945, FAX: 615-483-1253; *Sls. Mgr.:* D. Michael Coffey

CRYSTAL ENGINEERING CORP., 1119 Los Olivos, Los Osos, CA 93402, Tel: 805-528-2155, 800-444-1850, FAX: 805-528-3113; Empl.: 10; *Sls. Mgr.:* Wayne Hamari; *Dist. Mgr.:* Wayne Hamari

CRYSTALOID ELECTRONICS, 5282 Hudson Dr., Hudson, OH 44236, Tel: 216-655-2429, FAX: 216-655-2176; Empl.: 100

CSB/TAIWAN KOBE BATTERY CO., LTD., 3201 Alta Mere, Ft. Worth, TX 76116, Tel: 817-732-2258, FAX: 817-732-2019; *Sls. Mgr.:* Gregg Hubbard ..... **D•1437**

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AL Huntsville, Electro Mech 205-880-0592
CA Arcadia, Van Gott & Assocs. 818-445-9728
CA Los Altos, Frauman Assocs. 415-941-0660
FL Deerfield Bch., Sls. Engrg. Concepts .. 305-426-4601
GA Norcross, Electro Mech 404-447-6478
IL Palatine, Technlg. Sls., Inc. 708-991-6600
IN Granger, Wolff Sls., Inc. 219-272-4388
MA Seekonk, Rudolph Mktg. Assocs. 508-399-6270
MI Grand Rapids, Stiles & Assocs. 616-531-7759
NY Franklin Sq., Cooper-Simon & Co., Inc. 516-489-0404
NC Raleigh, Electro Mech 919-790-9300
OH Lima, T.C. Co. 419-226-6952
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211
TX Dallas, Exel Technlgs., Inc. 214-239-3935
WA Redmond, Halbar PNW, Inc. 206-882-0990
WI Milwaukee, Technlg. Sls., Inc. 414-964-5015

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CA San Diego, Tauber Elctrns. 619-274-7242
FL Tampa, Micro Precision 813-854-2061
GA Doraville, Lighting Plastic Suppliers ... 404-448-9373
GA Smyrna, ERC Parts, Inc. 404-352-1626
TX Dallas, Sabayrae Power 214-637-5052

CSD INDUSTRIES, INC., dba C Enterprises , 310-110 Via Vera Cruz, San Marcos, CA 92069, Tel: 619-744-8182, 800-334-3815, 800-423-3345, TELEX: 6502969639MCI, FAX: 619-744-1659; Empl.: 37; *Sls. Mgr.:* Steve Rosoff, VP Sls.; *Dist. Mgr.:* Steve Yamasaki

C-S ELECTRONIC SALES, INC., 259 E. Walnut St., Frankfort, IN 46041, Tel: 317-659-1874, FAX: 317-659-4185; Empl.: 4

CSI Capacitors

FAX: 619-743-5094

CSI CAPACITORS, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, Tel: 619-747-4000, TELEX: 697832; FSC No.: 10026; Empl.: 50 .... **A•1055**

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AZ Paradise Valley, Astrocom Mktg. 602-991-6646
CA San Jose, Comtech Mktg. 408-249-3330
FL Orlando, SAM Rep., Inc. 407-869-9565
IL Chicago, Esco Assocs. 312-298-5310
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MD Middletown, ST/Woolard 301-371-4500
MA Canton, New England Elctrn. Sls. 617-828-4835
NM Albuquerque, Cleveland Entprs. 505-265-7893
NY Cazenovia, S. T. Woolard 315-655-8145
OH Dayton, K. W. Elctrn. Sls. 513-890-2150
OR Tigard, Components West 503-684-1671
PA Allison Pk., KW Elctrn. Sls. 412-487-4300
SC Pickens, S.T. Woolard 803-878-3830
VA Lynchburg, ST/Woolard 804-528-5421
WA Redmond, Components West 206-885-5880
Can Richmond, BC, Macom Agencies 604-271-2661

CSTS, 4015 E. Leaverton Ct., Anaheim, CA 92807-1610, Tel: 714-632-1300, FAX: 714-632-1937; Empl.: 14

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CTI ELECTRONICS, 200 Benton Street, Stratford, CT 06497, Tel: 203-386-9779, TWX: 710-465-6349, FAX: 203-378-4986; Empl.: 19 ..... **D•1085**

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FL New Port Richey, Spinney Assocs. 813-848-0333
GA Marietta, Minerva Automation, Inc. 404-565-4528
MN Burnsville, TECHREP 612-891-4841
NH Manchester, Northeast Comps. 603-267-7702
NY New Hartford, PDQ Assocs. 315-793-3666
NY Northport, R.P. Luce & Co., Inc. 516-754-5064
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VA Mechanicsville, R.B. Marsland Assoc., Inc. 804-746-5770

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AZ Phoenix, Compass Mktg. & Sls., Inc. 602-996-0635, FAX:602-996-0586
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CA Calabasas, Centaur Corp. 818-704-1655, FAX:818-704-7479
CA Irvine, Centaur Corp. 714-261-2123, FAX:714-261-2905
CA Los Altos, Ewing-Foley, Inc. 415-941-4525, FAX:415-941-5109
CA San Diego, Centaur Corp. 619-278-4950, FAX:619-278-0649
CO Denver, ELCOM, Inc. 303-337-2300, FAX:303-745-0462
CT Brookfield, CTS Corp. 203-740-9755, FAX:203-740-9747
CT Yalesville, CompRep Assocs. Inc. 203-269-1145, FAX:203-269-2819
FL Boca Raton, R.O. Whitesell & Assocs. 407-393-6193,FAX:407-393-6072
FL Longwood, R.O. Whitesell & Assocs. 407-682-6662,FAX:407-682-7038
FL Palm Harbor, R.O. Whitesell & Assocs. 813-787-0898,FAX:813-787-0987
GA Norcross, R.O. Whitesell & Associates 404-449-9190,FAX:404-449-9197
IL Northbrook, Dolin Sls. Co., Inc. 708-498-6770, FAX:708-498-4885
IN Huntington, Elctrn. Reps., Inc. 219-356-3513, FAX:219-356-0337
IN Indianapolis, Elctrn. Reps., Inc. 317-894-1414, FAX:317-894-1216
IN Kokomo, R.O. Whitesell & Assocs. 317-457-9127
IA Cedar Rapids, Seltec Sls. Corp. 319-364-7660, FAX:319-364-7906
KS Olathe, Advanced Tech. Sls., Inc. 913-782-8702, FAX:913-782-8641
MD Lutherville, DGR, Inc. 301-583-1360, FAX:301-825-5579
MA Westwood, CompRep Assocs., Inc. 617-329-3454:FAX:617-329-6395
MI Farmington Hills, J. L. Montgomery Assocs., Inc. 313-489-0099,FAX:313-489-0189
MN Minneapolis, Robert W. Marshall Co., Inc. 612-929-0457,FAX:612-929-8307
MN Minneapolis, S & R Comp. Sls., Inc. 612-559-3090, FAX:612-559-3153
MO Bridgeton, Advanced Tech. Sls., Inc. 314-291-5033, FAX:314-291-7958
NM Albuquerque, Compass Mktg. & Sls., Inc. 505-344-9990,FAX:505-345-4848
NY E. Syracuse, Nycom, Inc. 315-437-8343, FAX:315-437-1208
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NC Raleigh, Zucker Assocs., Inc. 919-782-8433, FAX:919-782-8476
OH Columbus, Baehr, Greenleaf & Assocs., Inc. 614-847-0220,FAX:614-847-0233
OH Dayton, Baehr, Greenleaf & Assocs., Inc. 513-439-0724,FAX:513-439-0387
OH Westlake, Baehr, Greenleaf & Assocs., Inc. 216-892-1770,FAX:216-892-1771
OR Tigard, Vantage Corp. 503-620-3280, FAX:503-684-0676
PA Trevose, P.S.A. Inc. 215-245-0513, FAX:215-245-4817
PA Warrendale, Baehr, Greenleaf & Assocs. 412-934-3088,FAX:412-934-3990
TN Knoxville, R.O. Whitesell & Associates 615-694-9476,FAX:615-691-9693
TX Austin, Southern States Mktg., Inc. 512-835-5822, FAX:512-835-1404
TX Houston, Southern States Mktg., Inc. 713-789-2426:FAX:713-789-3202
TX Richardson, Southern States Mktg., Inc. 214-238-7500,FAX:214-231-7662
UT Murray, ELCOM, Inc. 801-262-2400, FAX:801-262-2583
WA Bellevue, Vantage Corp. 206-455-3460, FAX:206-455-9419
WI Glendale, Dolin Sls. Co., Inc. 414-482-1111, FAX:414-351-4142
PR Caguas, CompRep Assocs., Inc. 809-746-6550
Can Calgary, Alb., Longman Sls., Inc. 403-228-8719, FAX:403-295-6329
Can Kirkland, Que., Longman Sls., Inc. 514-694-3911, FAX:514-695-4414
Can Mississauga. Ont., Longman Sls., Inc. 416-670-8100,FAX:416-670-1384
Can Nepean, Ont., Longman Sls., Inc. 613-564-0100, FAX:613-596-9019

CTS CORPORATION, Microelectronics business unit., 9210 Science Center Dr., New Hope, MN 55428, Tel: 612-533-3533, FAX: 612-533-3037; FSC No.: 16512; Empl.: 300; *Sls. Mgr.:* Steve Otto

Refer to CTS Corp., Elkhart, IN, for sales offices & representative listings.

CTS CORP.,ELECTROCOMPONENTS BUSINESS UNIT (FORMERLY ELKHART DIV.), 1142 W. Beardsley Ave., Elkhart, IN 46514, Tel: 219-295-3575, FAX: 219-295-3580 ..... **B•1676-1677; D•1030**

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CTS CORP., FREQUENCY CONTROLS BUSINESS UNIT, (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, Tel: 815-786-8411, TWX: 910-642-0860, FAX: 815-786-9743; Empl.: 450; *Sls. Mgr.:* Rich Henry Sls. Mgr. ..... **A•1328-1351**

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CTS CORPORATION, Microelectronics business unit., 1201 Cumberland Ave., W. Lafayette, IN 47906, Tel: 317-463-2565, TWX: 810-342-1882, FAX: 317-497-5399; Empl.: 505; *Sls. Mgr.:* Dick Kramer

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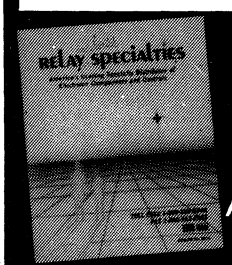

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CUBIT, Div. of Proteus Industries. Inc., 340 Pioneer Way, Mountain View, CA 94041, Tel: 415-962-8237, FAX: 415-965-9355; Empl.: 30; *Sls. Mgr.:* Jon Heiner

CUESTA SYSTEMS CORPORATION, 3440 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-4160, 800-332-3440, TELEX: 4949381 CUESTA; *Sls. Mgr.:* Dee Libin

CUI STACK INC., 9640 S.W. Sunshine Ct., Beaverton, OR 97005, Tel: 503-643-4899, FAX: 503-643-6129; Empl.: 11; *Sls. Mgr.:* Jim Seiler; *Dist. Mgr.:* T. Dougan K. Porter ..... **A•2195; D•1031, 1695**

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MN	Thief River Falls, Digi-Ker Corp.	218-681-6674
NJ	Newfoundland, Hosica Labs.	201-697-6111
NY	Great Neck, The Instr. Mart	516-487-7430
OR	Beaverton, Norvac Elctrns.	503-644-1052

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CURTIS INDUSTRIES, P.O. Box 19910, Milwaukee, WI 53219-0910, Tel: 414-649-4200, TWX: 910-262-3035, FAX: 414-649-4279; FSC No.: 73631; Empl.: 110; *Sls. Mgr.:* W.M. Tennie; *Dist. Mgr.:* Al Hungsberg

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AZ	Astrocom Mktg.	602-991-6646
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CA	Seal Beach, Texel Engrg.	213-596-9411
CO	Littleton, J.F. Hurlbut Co.	303-279-7796
FL	Longwood, NSL Assocs.	407-629-5226
GA	L & D, Inc.	404-395-7079
IL	La Grange Park, Bierhaus Sls.	312-751-8088
MD	Advanced Tech. Sls.	301-323-3140
MA	Brookline, Harman Assocs.	617-232-6687
MN	Minnetonka, S.J. Collins & Assoc.	612-933-7661
MO	Acorn Elctrns.	314-421-1751
NY	Smith Tech. Sls.	716-223-5656
NY	Manhasset, WinCor Elctrn. Sls. Corp.	516-627-9474
OH	Chagrin Falls, T.E. Murphy Co.	513-692-8713
PA	W. Reeves Assocs.	215-356-7500
TX	Lektron	214-416-4585
WA	Seattle, Evergreen Mktg.	206-485-8063

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MO	St. Louis, Acorn Elctrns. Inc.	314-644-2510
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TX	Carrollton, Lektron	817-464-7784

CUSTOM BOBBIN WINDINGS, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369, Tel: 614-452-6973, FAX: 614-452-4156; Empl.: 16

CUSTOM CABLE CORP., 242 Butler St., Westbury, NY 11590, Tel: 516-334-3600, TELEX: 269301, FAX: 516-334-3989; Empl.: 20; *Sls. Mgr.:* J. Michelman; *Dist. Mgr.:* D. Pollack

CUSTOM COILS INC., Box 338, Alcester, SD 57001, Tel: 605-934-2460, FAX: 605-934-2440; FSC No.: 34808; Empl.: 75; *Sls. Mgr.:* Randy Larson ..... **A•2197**

Local Sales Offices & Reps

CA	Santa Clara, Rodgers Assocs.	408-984-8110
CO	Englewood, Krebill Comp. Sls.	303-771-0955
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
MN	Edina, M F I	612-832-9017

CUSTOM CONNECTOR, 1738 E. 30th St., Cleveland, OH 44114, Tel: 216-241-1679, FAX: 216-241-1734; Empl.: 24; *Sls. Mgr.:* Larry Weider

CUSTOM CONTROL SENSORS, INC., 21111 Plummer Street, Chatsworth, CA 91313-2516, Tel: 818-341-4610, FAX: 818-709-0426; Empl.: 350; *Sls. Mgr.:* Charles Ritner

CUSTOM ELECTRONICS, Browne St., Oneonta, NY 13820, Tel: 607-432-3880, FAX: 607-432-3913; FSC No.: 23280; Empl.: 130; *Sls. Mgr.:* D. Hathaway

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CUSTOM POWER SYSTEMS, 33 Comac Loop, Ronkonkoma, NY 11779-9998, Tel: 516-467-5328; Empl.: 15 ..... **D•1697**

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CW INDUSTRIES

FAX: 215-355-1088

CW INDUSTRIES, 130 James Way, Southhampton, PA 18966, Tel: 215-355-7080; FSC No.: 79727; Empl.: 450; *Sls. Mgr.:* Michael Klakis .... **B•1010-1011, 1678-1679; C•1332-1333**

Local Sales Offices & Reps

AL	Madison, Lamons Sls.	205-461-7871
AZ	Tempe, Westrep	602-820-9932
AR	Little Rock, Erickson Sls.	501-455-0618
CA	Garden Grove, ELSCO Elctrns.	714-892-4621
CA	Napa, Stewart-Fullerton	707-258-1160
CO	Englewood, Purdy Co. Assoc.	303-790-2211
CT	Guilford, Tynik, Inc.	203-453-1613
FL	Tampa, Standard Mktg.	813-933-5833
GA	Norcross, Lamons Sls.	404-242-2610
IL	Park Ridge, G. Mcl. Cole Co.	312-692-6040
IN	Greenfield, France Entprs.	317-462-6098
IN	Greenwood, Liberty Sls.	317-888-8396
MD	Columbia, Delta III Assocs.	301-730-4700
MD	Newton, Greene-Shaw Co.	617-969-8900
MA	Taunton, Focus Elctrn. Sls.	617-824-3840
MI	Holland, Mackinaw Sls, Inc.	616-399-4665
MN	Minneapolis, Robt. Marshall Co.	612-929-0457
MO	Kansas City, Ruffolo & Assocs.	816-471-5701
NJ	Englewood Cliffs, Ed Glass Assocs.	201-592-0200
NY	Buffalo, NRM Mktg. Grp.	716-634-4367
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Akron, Augnat Assocs.	216-273-1211
OR	Tigard, Eltech Inc.	503-684-3458
PA	Hatboro, A Q S	215-674-3562
TN	Greeneville, Lamons Sls. Co.	615-639-8711
TX	Dallas, Erickson Sls. Inc.	214-739-5833
WA	Bellevue, Eltech	206-643-4330
Can	Rexdale, True North Tech. Ltd.	416-744-2233

Local Distributors

AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Canoga Park, Acort Inds., Inc.	818-700-2991
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Santa Ana, BDS Elctrns., Inc.	714-662-1050
CA	Santa Ana, El-Com/Cabletek	714-432-6630
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Sunnyvale, Bell Inds.	408-745-0400
CA	Torrance, Kent Elctrns.	213-320-2700
CO	Arvada, Denver Wintronics	303-431-7161
CT	South Windsor, Car-Lac Elctrns.	203-282-0631
DE	Wilimington, Wholesale Elctrns., Inc.	302-652-3222
FL	Stuart, Microwave Comps., Inc.	407-286-4455
IL	Crystal Lake, Sub-Sem Inc.	312-459-4139
IL	Wheeling, Hawk Elctrns., Inc.	312-459-4030
IN	Indianapolis, Bell Inds.	317-634-8202
MD	Beltsville, Petricko Sls., Inc.	301-937-4960
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MA	Milford, Car-Lac Elctrns.	617-478-7797
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Norwood, Emtel Elctrns.	617-769-9500
MI	St. Clair Shores, Spemco	313-771-2700
MN	New Brighton, Chris Elctrns.	612-631-2647
MN	Thief River Falls, Digi-Key Corp.	800-346-5144
NJ	Roselle, Lectron Inds.	201-245-5858
NJ	Voorhees Township, PAR-TEC Comps. Co.	609-795-4884
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Baldwinsville, Scibetta Distrs.	315-622-3993
NY	Bohemia, Car-Lac Elctrns.	800-645-1192
NY	Farmingdale, Pride Elctrns.	516-293-4020
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Englewood, Argent Inds., Inc.	513-836-8633
OH	Solon, Reh-Electra	216-248-1636
PA	Bristol, AIM Elctrns.	215-785-3500
TX	Carrollton, Connec Tek, Inc.	214-245-1266
TX	Mansfield, Edison Elctrns.	817-473-3322
WA	Redmond, Pyramid Elctrns.	206-883-7200
WA	Seattle, Preibe Elctrns.	206-575-1050

CYBERPAK CO., 251 S. Frontage Rd., Ste. 23, Burr Ridge, IL 60521, Tel: 708-654-3999, FAX: 708-654-4027; Empl.: 5; *Sls. Mgr.:* R. Weinbrenner

CYBER SYS., INC., 2570 E. Cerritos Ave, Anaheim, CA 92806, Tel: 714-722-2051, 714-634-2800, FAX: 714-937-1955; Empl.: 35

CYBRID INCORPORATED, 10 Woodcrest Drive, Woodcliff Lake, NJ 07675, Tel: 201-307-0426, FAX: 201-391-7112; Empl.: 9

CYCLO-TRONICS, INC., 1345 N. Old Rand Rd., Wauconda, IL 60084, Tel: 708-526-0800, FAX: 708-526-0803; Empl.: 10

THE CYLIX CORPORATION, 2637 Townsgate Rd., Ste. 200, Westlake Vl, CA 91361, Tel: 805-379-3155, FAX: 805-379-4551; FSC No.: 59; Empl.: 15; *Sls. Mgr.:* William J. Purcell; *Dist. Mgr.:* Peter Norman

CYPRESS MAGNETICS, INC., 8751 1/2 Industrial Lane, Rancho Cucamonga, CA 91730, Tel: 714-987-3570, FAX: 714-980-2009; FSC No.: 59791; Empl.: 15; *Sls. Mgr.:* Robert C. Greenwood

CYTEC CORP.

FAX: 716-381-0475

CYTEC CORP., 2555 Baird Road, Penfield, NY 14526, Tel: 716-381-4740, 800-346-3117; Empl.: 20; *Sls. Mgr.:* Harry Turner ..... **D•1240**

Local Sales Offices & Reps

OR	Portland, Westcon, Inc.	503-283-0132
WA	Kent, Westcon, Inc.	206-824-8922

DABURN

FAX: 201-768-9642

DABURN ELECTRONICS & CABLE CORP., 225 Pegasus Ave., Northvale, NJ 07647, Tel: 201-768-5400; FSC No.: 25706; *Sls. Mgr.:* Ed Rothenstein ..... **C•1745-1751**

Local Sales Offices & Reps

AZ	Tucson, Clemick & Assocs.	602-749-4003
CA	Mountain View, Bridge Mktg.	415-965-8045
CA	Newport Beach, SPA Elctrns.	714-863-1193
CO	Denver, Mountain Reps	303-623-0972
FL	Tampa, SRT	813-884-4805
IL	Elgin, Markar Sls.	708-888-2207
IN	Indianapolis, STB & Assocs.	317-844-9227
LA	Kenner, Assoc. Mktg. Grp.	504-443-5072
MD	Bel Air, Freedman Malta Assocs.	301-879-3848
MA	No. Scituate, W. A. Hendrickson	617-545-0652
MN	Minneapolis, R. K. Sls.	612-571-1001
MO	Blue Springs, KKB & Co.	816-229-0001
MO	St. Louis, KKB & Co.	314-647-2400
NJ	Whippany, Robert Smith Assocs.	201-540-0204
NY	E. Syracuse, Liberty Elec.	315-437-8100
NY	Plainview, Robt. Smith Assocs.	516-681-3155
PA	Pittsburgh, Catalzst Sls.	412-733-5450
OR	Hillsboro, Turn-A-Round Sls.	503-640-4641
PA	King of Prussia, Freedman-Malta	215-337-9211
TX	Ft.Worth, Reynolds Assoc.	817-429-8207
WA	Kirkland, Turn-A-Round Sls.	206-822-4634
WI	Menomonee Falls, Voss-Dent Assocs.	414-781-0555
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

Local Distributors

CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Carlos, Logan Elctrns.	415-594-0700
CA	San Diego, Shanks & Wright	619-239-0176
CT	New Haven, Hatry	203-787-5921
CT	West Hartford, Signal Ctr.	203-233-8551
FL	Miami, Small Parts	305-751-0856
GA	Atlanta, ACK Radio Supp.	404-351-6340
IA	Marion, Brenneman & Assoc.	319-377-6394
LA	Harahan, Elctrn. Parts & Supp.	504-734-0641
MD	Gaithersburg, M S Elctrns.	301-921-0200
MA	Needham, YDI Electronics	617-449-1005
MA	Woburn, Pacer	617-935-8330
NJ	Beachwood, Berkley Indl.	201-341-9366
NJ	Cranford, GSI Elctrns.	201-272-6400
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Moorestown, Marlac	908-234-4200
NY	Albany, E. E. Taylor	518-438-7811
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Hauppauge, Broadline	516-231-4100
NY	Rochester, Simcona	716-328-3230
PA	Allentown, Federated Purchaser	215-437-4481
PA	Philadelphia, AC Radio	215-462-9379
WA	Seattle, Westlake Elctrns.	206-622-6600
WI	Fond Du Lac, Fedco	414-922-6490
Can	Markham, Ont., Arma	416-475-2024

DADEN ASSOCIATES, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653, Tel: 714-770-1522, TWX: 910-596-1324, FAX: 714-472-0805; FSC No.: 57032; Empl.: 49; *Sls. Mgr.:* Dennis Hook

DAEDAL, Sandyhill Road, Harrison City, PA 15636, Tel: 412-744-4451, FAX: 412-744-7626; *Sls. Mgr.:* R. Mitchell; *Dist. Mgr.:* R. Mitchell

DAGE-MTI, 701-N. Roeske Ave., Michigan City, IN 46360, Tel: 219-872-5514, ESYLNK: 532521, FAX: 219-872-5559; Empl.: 51; *Sls. Mgr.:* Paul Thomas

DAGE PRECISION INDUSTRIES, INC., 46701 Fremont Blvd., Fremont, CA 94538, Tel: 415-683-3930, TELEX: 4990512, FAX: 415-683-3935; Empl.: 10; *Sls. Mgr.:* Joseph M. Tosta

DAHLSTROM OF CANADA LTD., 7 Copeland Street, Toronto, Ontario, Canada M4G 37E, Tel: 416-421-5900, FAX: 414-421-3728; Empl.: 44

DAICO INDUSTRIES, INC., 2453 East Del Amo Blvd., Compton, CA 90220; Tel: 213-631-1143, FAX: 213-631-8078; FSC No.: 28983; Empl.: 200; *Sls. Mgr.:* Kevin Townsend; *Dist. Mgr.:* Diane Felando

DAIDO CORP., Sumtak Electronics Division

DAITRON, INC., 7150 S.W. Hampton, Suite 130, Tigard, OR 97223, Tel: 503-620-2879, TELEX: 910-240-4863, FAX: 503-620-2942; Empl.: 10; *Dist. Mgr.:* Karen Sempert

DALE ELECTRONICS, INC., Columbus Div., 1122 23rd Street, Columbus, NE 68601-3647, Tel: 402-563-6506, FAX: 402-563-6418; FSC No.: 91637; Empl.: 2800; *Sls. Mgr.:* Darrell Smejkal; *Dist. Mgr.:* Jon Trabert ..... **A•1194-1200, 1352-1355, 1886-1908, 2032-2037, 2198-2199; B•1046-1048, 1839-1841; C•1335**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Tempe, Dale Elctrns. Sls.	602-967-7874
CA	Fremont, Telesis Sls. Grp.	415-713-7300
CA	Redwood City, J. S. Heaton Co.	415-367-9000
CA	San Diego, Vishay EC Sls. Office	619-690-5112
CA	Tustin, Vishay EC Sls. Office	714-544-7024
CO	Colorado Springs, Vishay EC Rocky Mountains	719-593-7529
CO	Grand Junction, Vishay EC Rocky Mtns.	303-241-0150
CO	Loveland, Vishay EC Rocky Mountains	303-667-7500
CT	Riverside, Howard C. Jappe, Co.	914-937-4845
FL	Altamonte Springs, Semtronic Assocs.,Inc.	407-831-8233
FL	Clearwater, Semtronic Assocs.,Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.,Inc.	305-731-2484
GA	Roswell, JWL Assocs.	404-993-0100
IL	Skokie, Indl. Reps.	708-967-8430
IN	Fort Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
KS	Olathe, Tech. Sls. Assocs.	913-829-2800
MD	Glen Burnie, Tri-Mark	410-761-6000
MA	Wakefield, Howard C. Jappe Co.	617-245-9359
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Bloomington, Industrial Reps., Inc.	612-854-8027
NJ	Flanders, K & R Engrg.	201-584-5235
NY	East Rochester, L-Mar Assocs.,Inc.	716-381-9100
MO	Ferguson, Tech. Sls. Assocs.	314-521-2044
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns., Inc.	513-294-0539
OH	Westerville, Scott Elctrns.	614-882-6100
OR	Beaverton, LD Elctrns.	503-684-8221
PA	Horsham, TMI	215-441-4300
TX	Dallas, E. F. Aymond Co.	214-349-4014
TX	Houston, E. F. Aymond Co.	713-943-3149
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Brookfield, Indl. Reps.	414-789-9393

Local Distributors

AL	Huntsville, Hamilton/Avnet	205-837-7210
AL	Huntsville, Pioneer Technlgs.	205-837-9300
AZ	Chandler, Hamilton/Avnet	602-961-6400
AZ	Chandler, Hamilton/Avnet	602-961-6613
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Tempe, Acacia Elctrns.	602-894-2874
AZ	Tempe, Shelley-Ragon, Inc.	602-894-2058
AZ	Tempe, T.T.I. Inc.	602-431-1191
CA	Chatsworth, Shelley-Ragon, Inc.	818-998-3333
CA	Costa Mesa, Hamilton Electro Sls.	714-754-6030
CA	Culver City, Hamilton/Avnet	213-558-2111
CA	Fremont, Acacia	415-623-7500
CA	Gardena, Hamilton Electro Sls.	213-217-6750
CA	Gardena, Hamilton/Avnet	213-217-6700
CA	Inglewood, Newark Elctrns.	213-671-7377
CA	Irvine, Acacia Elctrns.	213-971-2428
CA	Milpitas, T. T. I, Inc.	408-946-5577
CA	Mission Hills, T.T.I,Inc.	818-891-8885
CA	Roseville, Hamilton/Avnet	916-920-3150
CA	San Diego, Acacia Elctrns.	619-597-0577
CA	San Diego, Hamilton/Avnet	619-571-7536
CA	San Diego, Shelley-Ragon, Inc.	619-453-7133
CA	San Diego, T.T.I., Inc.	619-748-2025
CA	San Jose, Shelley-Ragon, Inc.	408-432-0600
CA	Santa Ana, T.T.I., Inc.	714-641-9393

CA Sunnyvale, Hamilton/Avnet 408-743-3358
CA Woodland Hills, Hamilton/Avnet 818-594-8224
CO Commerce City, Waco Elctrns. 303-289-4743
CO Denver, Newark Elctrns. 303-757-8531
CO Denver, T.T.I. Inc. 303-429-6806
CO Englewood, Hamilton/Avnet 303-799-7815
CO Englewood, Shelley-Ragon, Inc. 303-762-0670
CO Lakewood, Acacia/Deanco Elctrns. 303-232-2882
CT Danbury, Hamilton/Avnet 203-797-2854
CT Norwalk, Pioneer Std. 203-853-1515
CT Wallingford, Sterling Elctrns. 203-265-9535
CT Wallingford, T.T.I., Inc. 203-284-7474
FL Altamonte Springs, Pioneer Technlgs. 407-834-9090
FL Deerfield Beach, Pioneer Technlgs. 305-428-8877
FL Ft. Lauderdale, Hamilton/Avnet 305-971-2900
FL Orlando, T.T.I., Inc. 407-859-1000
FL St. Petersburg, Hamilton/Avnet 813-573-3930
FL Tampa, Reptron Elctrns. 813-854-2351
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
FL Winter Park, Hamilton/Avnet 407-628-3888
GA Duluth, Hamilton/Avnet 404-447-7523
GA Norcross, Pioneer Technlgs. 404-448-1711
GA Norcross, T.T.I., Inc. 404-662-0911
IL Addison, Pioneer Standard 312-495-9680
IL Bensenville, Hamilton/Avnet 708-860-7780
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove Village, Bell Ind. 708-640-1910
IL Glendale Heights, Shelley-Ragon, Inc. 708-529-9977
IL Palatine, Ohm Elctrns. 708-359-5500
IN Carmel, Hamilton/Avnet 317-844-9333
IN Ft. Wayne, Bell Ind.,Graham Div. 219-423-3422
IN Indianapolis, Bell Ind., Graham Div. 317-875-8200
IN Indianapolis, Pioneer Std. 317-573-0880
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
IA Cedar Rapids, Shelley Ragon, Inc 319-373-0525
KS Lenexa, Hamilton/Avnet 913-888-8900
KY Lexington, Hamilton/Avnet 606-259-1475
MD Baltimore, RESCO 410-931-8200
MD Beltsville, RESCO 301-937-9100
MD Columbia, Hamilton/Avnet 410-995-3526
MD Columbia, T. T. I, Inc. 410-995-1331
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
MA Billerica, Mayer Co. 617-229-2255
MA Chelmsford, Shelley-Ragon, Inc. 508-250-9666
MA Lexington, Pioneer Std. 617-861-9200
MA Peabody, Hamilton/Avnet 508-532-9861
MA Springfield, C & D Elctrns. 413-781-1776
MA Wilmington, T.T.I. Inc. 508-658-4700
MA Woburn, Sterling Elctrns. 617-938-6200
MI Grand Rapids, Pioneer Std. 616-698-1800
MI Grand Rapids, S-F Elctrn. Supp. 616-459-0216
MI Grandville, Hamilton/Avnet 616-531-0345
MI Livonia, Pioneer Std. 313-525-1800
MI Livonia, R-S Elctrns. 313-525-1155
MI Livonia, Reptron Elctrns. 313-525-2700
MI Novi, Hamilton/Avnet 313-347-4270
MI Oak Pk., Newark Elctrns. 313-967-1570
MA Springfield, C & D Electronics, Inc. 413-781-1776
MN Eden Prairie, Pioneer-Std. 612-944-3355
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minnetonka, Hamilton/Avnet 612-932-0674
MN Minnetonka, T.T.I., Inc. 612-933-8555
MN St. Paul, Shelley-Ragon, Inc. 612-642-2828
MO Chesterfield, Hamilton/Avnet 314-537-4265
MO Independence, Shelley-Ragon, Inc. 816-254-3410
MO Hazelwood, Shelley-Ragon, Inc. 314-895-1515
NJ Cherry Hill, Hamilton/Avnet 609-424-0117
NJ Cranford, G.S.I. Elec. 201-272-6400
NJ Fairfield, Hamilton/Avnet 201-575-3490
NJ Fairfield, Pioneer-Standard 201-575-3510
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Mount Laurel, T.T.I., Inc. 609-234-6400
NM Albuquerque, Hamilton/Avnet 505-345-0001
NY Binghampton, Pioneer Std. 607-722-9300
NY Bohemia, March Elctrns. 516-563-6000
NY Buffalo, Summit Distr. 716-887-2800
NY Endwell, A.S.I. Elctrns. 607-754-3823
NY Fairport, Pioneer Std. 716-381-7070
NY Farmingdale, Command Elctrns. 516-293-1212
NY Hauppauge, Fairmont 516-231-3313
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Medford, L.I., Shelley-Ragon, Inc. 516-447-2000
NY Rochester, Hamilton/Avnet 716-272-2704
NY Rome, Rome Elctrns. 315-337-5400
NY Ronkonkoma, T.T.I., Inc. 516-737-2000
NY Syracuse, Hamilton/Avnet 315-437-2641
NY Valley Stream, L.I., L&S Elctrns. 516-561-2474
NY Woodbury, Pioneer Std. 516-921-8700
NC Charlotte, T.T.I., Inc. 704-522-0277
NC Durham, Pioneer Technlgs. 919-544-5400
NC Raleigh, Hamilton/Avnet 919-878-0819
NC Raleigh, RESCO 919-781-5700
OH Cleveland, Pioneer Standard 216-587-3600
OH Columbus, Hamilton/Avnet 614-882-7004
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Bell Inds., Military Div. 513-434-8231
OH Dayton, Hamilton/Avnet 513-439-6730
OH Dayton, Hamilton/Avnet 513-439-6700
OH Dayton, Pioneer Standard 513-236-9900
OH Dayton, Stotts-Friedman Co. 513-298-5555
OH Solon, Hamilton/Avnet 216-349-5100
OH Valley View, Newark Elctrns. 216-447-8860
OH Worthington, T.T.I. Inc. 614-848-5770
OK Tulsa, Hamilton/Avnet 918-252-7297
OK Tulsa, Radio, Inc. 918-587-9123
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Acacia Electronics 503-646-3377
OR Beaverton, Hamilton/Avnet 503-526-6209
OR Portland, Radar Elec. 503-232-3404
PA Horsham, Pioneer Technlgs. 215-674-4000
PA Mars, Hamilton/Avnet 412-281-4151
PA McKean, Advacom 814-476-7774
PA Pittsburgh, Pioneer Std. 412-782-2300
PA Trevose, Almo Elctrns. 215-953-2800
PA York, E.C.I., Inc. 717-846-5334
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Pioneer-Standard 512-835-4000
TX Austin, Sterling Elctrns. 512-836-1341
TX Carrollton, Sterling Electronics 214-243-1600
TX Dallas, Hamilton/Avnet 214-308-8111
TX Dallas, Pioneer Std. 214-386-7300
TX Ft. Worth, T.T.I., Inc. 817-595-3100
TX Ft. Worth, T.T.I., Inc. 817-831-8300
TX Ft. Worth, T.T.I.,Inc. 817-847-6666
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Newark Elctrns. 713-783-1629
TX Houston, Pioneer Std. 713-495-4700
TX Houston, Sterling Elctrns. 713-627-9800
TX Stafford, Hamilton/Avnet 713-274-9336
UT Salt Lake City, Hamilton/Avnet 801-974-9649
WA Redmond, Acacia Elctrns. 206-881-5566
WA Redmond, Hamilton/Avnet 206-867-0149
WA Redmond, Shelley-Ragon Inc. 206-883-2220
WA Redmond, T.T.I. Inc. 206-882-0291
WA Seattle, Radar Elec. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000

DALE ELECTRONICS, INC., El Paso Div., P.O. Box 26728, El Paso, TX 79926-6728, Tel: 915-592-3253; FSC No.: 91637; Empl.: 272; *Sls. Mgr.:* Bill Buchanan; *Dist. Mgr.:* Jon Trabert ..... **B•1839-1841**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701-2242, Tel: 402-371-0080; FSC No.: 91637; Empl.: 1200; *Sls. Mgr.:* Eldon Engel; *Dist. Mgr.:* Jon Trabert ..... **A•1891-1899**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282-1883, Tel: 602-967-7874; FSC No.: 22929; Empl.: 139; *Sls. Mgr.:* Mike Brown; *Dist. Mgr.:* Jon Trabert ..... **A•1352-1355, 2032-2035**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078-0180, Tel: 605-665-9301; FSC No.: 09969; Empl.: 400; *Sls. Mgr.:* John Elliot; *Dist. Mgr.:* Jon Trabert ..... **A•1194-1196, 1198-1199, 2198; C•1334-1335**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE WESTERN THERMISTOR DIVISION, See Dale Norfolk Division

DALLAS SEMICONDUCTOR, 4401 South Beltwood Pkwy., Dallas, TX 75067, Tel: 214-450-0400, FAX: 214-450-0470; Empl.: 720; *Sls. Mgr.:* John Mattis ..... **A•1529-1531**

Local Sales Offices & Reps
AL Huntsville, Glen White & Assocs. 205-882-6751
AZ Scottsdale, Haas & Assocs. 602-998-7195
AR Tusla, West Assocs. 918-665-3465
CA San Diego, Harvey King, Inc. 619-587-9300
CA Santa Clara, I Squared 408-988-3400
CO Wheat Ridge, Waugaman Assoc. 303-423-1020
CT Wallingford, Technology Sls. Inc. 203-269-8853
FL Ft. Lauderdale, Semtronic Assoc., Inc. 305-731-2484
GA Norcross, Glen White & Assocs. 404-441-1447
IL Rolling Meadows, Sumer, Inc. 708-991-8500
IN Indianapolis, Elctrn. Sls. & Eng. 317-849-4260
IA Cedar Rapids, Cahill, Schmitz & Howe 319-377-8219
KS Stanley, West Assocs. 913-897-6366
MA Woburn, Mill-Bern Assocs. 617-932-3311
MI Livonia, Geisting & Assocs. 313-478-8106
MN St. Paul, Cahill, Schmitz & Cahill 612-646-7217
MO St. Louis, Technical Sls. Assoc. 314-521-2044
NJ Haddonfield, Sunday O'Brien Inc. 609-429-4013
NJ Mt. Laurel, S-J Assocs. 609-866-1234
NY Rockville Centre, S-J Assocs. 516-536-4242
NC Huntersville, Glen & White Assoc. 704-875-3777
NC Raleigh, H & A Sls. 919-846-0082
OH Cincinnati, Geisting & Assocs. 513-385-1105
OK Tusla, West Assocs. 918-665-3465
OR Beaverton, Western Tech. Sls. 503-644-8860
TN Gray, Glen White & Assoc. 615-477-8850
TX Houston, West Assocs. 713-621-5983
UT Salt Lake City, Waugaman Assocs. 801-261-0802
VA Falls Church, S-J Chesapeake 703-533-2233
WA Bellevue, Western Tech. Sls. 206-641-3900
WA Spokane, Western Tech. Sls. 509-922-7600
WI Brookfield, Sumer, Inc. 414-784-6641
Can Kanata, Electro-Source Inc. 613-592-3214

Local Distributors
AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AZ Phoenix, Hall-Mark Elctrns. 602-437-1200
CA Irvine, Insight Elctrns. 714-727-2111
CO Wheat Ridge, Added Value Elect. Dist. 303-422-1701
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Winter Park, Milgray-Elctrns. 407-647-5747
GA Duluth, Hall-Mark Elctrns. 404-623-4400
IL Arlington Heights, Milgray Elctrns. 708-253-1212
IN Indianapolis, Added Value Elect. Dist. 317-872-4910
IA Cedar Rapids, Added Value Elect. Dist. 319-363-0221
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
MA Wilmington, Milgray Elctrns. 508-657-5900
MI Livonia, Hall-Mark Elctrns. 313-462-1205
MN Minneapolis, Sterling Elctrns. 612-831-2666
NJ Marlton, Milgray Elctrns. 609-983-5010
NY Farmingdale, Milgray Elctrns. 516-391-3000
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
OH Solon, Hall-Mark Elctrns. 216-349-4632
OK Tusla, Sterling Elctrns. 918-663-2410
OR Beaverton, Anthem Elctrns. 503-643-1114
TX Richardson, Anthem Elctrns. 214-238-1700
UT Salt Lake City, Anthem Elctrns. 801-973-8555
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Almac Elctrns. 206-643-9992
Can Ville St. Laurent, Que., ITT Multicomponents 514-335-7697

DALSA INC., 605 McMurray Road, Waterloo, Ont., Canada N2V 2E9, Tel: 519-886-6000, FAX: 519-886-8023; *Sls. Mgr.:* Dan Blacklock

DANCER COMMUNICATIONS, INC., 162 Saxer Ave., Media, PA 19064-2334, Tel: 215-543-8066, FAX: 215-543-2151; *Sls. Mgr.:* Barbara Gordon

Local Sales Offices & Reps
CO Littleton, Base Technlgs. Co. 303-979-3392

Local Distributors
WI Milwaukee, Nuvisco, Inc. 414-445-9206

D & B POWER, INC.

FAX: 516-586-5952

D & B POWER, INC., 204 N. Fehr Way, P.O. Box 40M, Bayshore, NY 11706, Tel: 516-586-5955; FSC No.: 54337; Empl.: 25; *Sls. Mgr.:* Gordon Best; *Dist. Mgr.:* Dan Hall ..... **D•1698-1699**

Local Sales Offices & Reps
CA Pasadena, Electro Mecha. Instrs. 818-795-7193
MD Hunt Valley, Eagle Sls. 301-666-3930
CA Santa Clara, Veer Mktg. 408-986-1610

D & P MFG. INC., 32 Hamilton St., Chalfont, PA 18914, Tel: 215-997-1200, FAX: 215-997-1200; Empl.: 7

DMC DANIELS MANUFACTURING CORPORATION

FAX: 407-855-6884

DANIELS MANUFACTURING CORP., 526 Thorpe Rd., Orlando, FL 32824, Tel: 407-855-6161, TELEX: 564321; FSC No.: 11851; Empl.: 180; *Sls. Mgr.:* Don Malinovsky; *Dist. Mgr.:* Don Malinovsky ..... **C•1703**

Local Sales Offices & Reps
CA El Toro, DMC Western Reg. 714-588-8090

DAN-L INC., 229 Laurel Rd., E. Northport, NY 11731, Tel: 516-757-8000; FSC No.: 28327; Empl.: 22

DANMAR INDS., 11952 Challenger Court, Moorpark, CA 93021, Tel: 1-805-529-3788,1-800-666-6268, FAX: 805-529-3837; FSC No.: 31690; Empl.: 10; *Sls. Mgr.:* Mukund Patel

DANTEL, 2991 N. Argyle Ave., Fresno, CA 93727, Tel: 209-292-1111, TELEX: 35-5457, FAX: 209-292-9355; FSC No.: 56960; Empl.: 205; *Sls. Mgr.:* Bob Long

DANTRONICS, INC., 3175 Hafner Ct., St. Paul, MN 55126, Tel: 612-484-2108; Empl.: 22

DARE ELECTRONICS, INC., 3245 S. County Rd., 25A, Troy, OH 45373, Tel: 513-335-0031; FSC No.: 55901; Empl.: 20; *Sls. Mgr.:* Paul J. Gilmore

DATA, INC., 7702 Emerald Ave., Box 2071, Ft. Collins, CO 80525, Tel: 303-493-1222; Empl.: 3; *Sls. Mgr.:* Sharon Shilling; *Dist. Mgr.:* Sharon Shilling

D.A.T.A. BUSINESS PUBLISHING, Information Handling Services, 15 Inverness Way East, P.O. Box 6510, Englewood, CO 80155-6510, Tel: 303-799-0381, TELEX: 530606; Empl.: 30; *Sls. Mgr.:* Tom Littman; *Dist. Mgr.:* Ray Coakes

DATA CHECK CORPORATION, 9918 Via Pasar, San Diego, CA 92126, Tel: 619-578-0101, FAX: 619-578-9215; FSC No.: 55792; Empl.: 45; *Sls. Mgr.:* Bill Acosta

DATACHRON INC., 1150 E. Stanford Court, Anaheim, CA 92805, Tel: 714-385-1705, FAX: 714-978-2514; FSC No.: 56259; Empl.: 19; *Sls. Mgr.:* Clyde Davis

DATA CIRCUITS, COMPUTER LOGICS LTD., 6380 Viscount Rd., Mississauga, Ont., Canada L4V 1H3, Tel: 416-672-3833, TELEX: 416-672-3869; Empl.: 80; *Sls. Mgr.:* Rick Way; *Dist. Mgr.:* Rick Way

DATACOM, INC., Box 278, Ft. Walton Beach, FL 32549, Tel: 904-244-6121, FAX: 904-244-6344; FSC No.: 32365; Empl.: 50

DATACON, INC., Interconnect Sub-Systems, 60 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-5800, FAX: 617-273-4809; Empl.: 350; *Dist. Mgr.:* Lonise M. Evelyn

DATACUBE, INC., 4 Dearborn Rd., Peabody, MA 01960, Tel: 508-535-6644, TELEX: 6817540, FAX: 508-535-5643; Empl.: 130; *Sls. Mgr.:* Denny Maher

FAX: 201-773-9672

DATA DELAY DEVICES, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, Tel: 201-773-2299 ..... **A•1532-1548**

Local Sales Offices & Reps
AL Huntsville, Hughes Assocs. 205-533-9108
AZ Phoenix, Tech Sls., Inc. 602-246-1614
AR R-Squared 713-820-3210
CA Mission Viejo, Jay Mktg. Assocs. 714-768-7519
CA Mountain View, Weseloh/Swanson & Assocs. 415-961-0565
CT Dynamic Sls., Inc. 617-272-5676
DE Jack McCoy Assocs. 215-363-0350
FL Pensacola, Hughes Assocs.,Inc. 904-433-1787
GA Norcross, Hughes Assocs., Inc. 404-662-1587
IN J. M. Finnegan & Co. 216-238-5905
KY J. M. Finnegan & Co. 216-238-5905
LA R-Squared 713-820-3210
ME Dynamic Sls., Inc. 617-272-5676
MA Burlington, Dynamic Sls., Inc. 617-272-5676
MI Grand Rapids, Jim Finnegan & Co. 616-245-4621
MS Corinth, Hughes Assocs., Inc. 601-287-2915
NH Dynamic Sls., Inc. 617-272-5676
NJ Medford, Jack McCoy Assocs. 609-953-0770
NY Pittsford, James E. Zimmmerman Sls. 716-381-3186
NC Raleigh, Hughes Assocs., Inc. 919-467-7029
OH Dayton, Jim Finnegan & Co. 513-890-8322
OK R-Squared 713-820-3210
PA Downingtown, Jack McCoy, Inc. 215-363-0350
PA Pittsburgh, Jim Finnegan & Co. 412-823-5400
RI Dynamic Sls., Inc. 617-272-5676
SC Hughes Assocs., Inc. 919-467-7029
TN Morristown, Hughes Assocs., Inc. 615-587-2433
TX Houston, R-Squared 713-820-3210
VT Dynamic Sls., Inc. 617-272-5676
VA Jim Finnegan & Co. 216-238-5905
Can Ont., Source Elctrns. 416-676-0830

Local Distributors
CA Sunnyvale, Target Elctrns. 408-734-5611
TX Dallas, Omni Pro 214-233-0500

DATA-DESIGN LABS., P.O. Box 711, 7925 Center Ave., Cucamonga, CA 91730, Tel: 714-987-2511; Empl.: 1200

DATA DEVICE CORP., See ILC Data Device Corp.

FAX: 213-640-7639

DATA DISPLAY PRODUCTS, 445 So. Douglas St., El Segundo, CA 90245-4630, Tel: 213-640-0442, 800-421-6815; FSC No.: 15513; Empl.: 40; *Sls. Mgr.:* Anthony Toniolo; *Dist. Mgr.:* Anthony Toniolo ..... **B•1142-1144**

DATA ENGINEERING, INC., 2515 N. State Rd. 7 Ste. 207, Margate, FL 33063-3206, Tel: 305-971-0400; *Sls. Mgr.:* Mario M. Martinez

DATA ENVIRONMENT, INC., Box 91511, Beaverton, OR 97291, Tel: 503-643-4292

DATA INSTRUMENTS, INC., 100 Discovery Way, Acton, MA 01720, Tel: 508-264-9550, TELEX: 200081, FAX: 508-263-0630; Empl.: 300; *Sls. Mgr.:* Ernest C. Lutfy ..... **B•1891**

Local Sales Offices & Reps
AL Huntsville, FLW Southeast, Inc. 205-536-6207
AL Mobile, FLW S.W. 205-990-8989
AZ Scottsdale, Williams Assocs. 602-494-0790
CA Laguna Hills, Elotek Sys., Inc. 714-830-4856
CA Santa Clara, Johnson Assoc. 408-984-4626
CO Highlands Ranch, Valcomp Elctrns., Inc. 303-791-0330
FL Orlando, FLW Southeast, Inc. 407-894-9671
GA Marietta, FLW Southeast, Inc. 404-424-1731
IL Bridgeview, Finn & Conway, Inc. 708-599-0103
IA Cedar Rapids, Delltron Co. 319-393-0075
MD Forest Hill, Dick Pfeffer 301-557-9167
MA Acton, Data Instrs., Inc. 617-264-9550
MA Acton, Dave Hannon 617-264-9550
MI Sterling Hgts., Geotronix, Inc. 313-254-0520
MO Florissant, Delltron Co. 314-839-0033
MO Kansas City, Delltron Co. 816-436-6445
NM Albuquerque, Williams Assocs. 505-255-1638
NY Albany, Expert Indl. Sys., Inc. 518-869-3355
NY Buffalo, Expert Indl. Sys., Inc. 716-827-1111
NY Rochester, Expert Indl. Sys., Inc. 716-323-1305
NY Syracuse, Expert Indl. Sys., Inc. 315-455-2469
NC Charlotte, Emco, Inc. 704-372-8281
OH Richfield, Geotronix, Inc. 216-659-6100
OH Trotwood, Geotronix Inc. 513-854-5939
OK Oklahoma City, Bauman Instr. Corp. 405-631-8080
OK Tulsa, Bauman Instr. Corp. 918-492-8086
PA Allison Park, Geotronix, Inc. 412-487-1770
PA Richboro, Technical Dvcs. Inc. 215-953-1595
TN Memphis, FLW Southeast, Inc. 901-345-3563
TX Grand Prairie, Collingsystems, Corp. 214-647-3569
TX Houston, Collinsystems, Corp. 713-464-9460
WA Redmond, S.E.A. Sls. 206-883-4999
WA Vancouver, S.E.A. Sls. 206-573-5161
WI Brookfield, Finn & Conway Inc. 414-784-3300
Can Richmond, BC, Maxwell Morton Assocs. 604-273-1337
Can Woodbridge, Ont., Technel Engrg. Inc. 416-851-4244

Local Distributors
CA Milpitas, A. Biederman, Inc. 408-435-0209
CO Lafayette, Big Horn Instrmn. 303-665-4054
CT Meriden, Meriden Cooper 203-237-8448
GA Norcross, AA Elec. Inc. 404-449-8670
IN Indianapolis, C & E Sls., Inc. 317-844-9799
MD Baltimore, Bevier 301-242-8800
MA Billerica, Tanyx Meas. Inc. 508-671-0183
MI Taylor, North Cen. Engrg., Inc. 313-942-0900
MN St. Paul, Power/mation 612-645-0781
MS Jackson, B&B Controls 601-354-0405
MO St. Louis, ISL Corp. 314-423-3141
NJ Newark, Norman Bragar Co., Inc. 201-344-1100
NY Buffalo, KOM Lamb Inc. 716-874-3530
NC Charlotte, EMCO 704-372-8281
OH Cincinnati, J.N. Fauver Co., Inc. 513-891-8400
OH Twinsburg, The Stanley M. Proctor Co. 216-425-7814
OR Portland, Branom Instr. 503-283-2555
TX Dallas, Butler and Land 214-343-8800
TX Sugar Land, Alpha Process Sls. 713-240-4505
UT Salt Lake City, Rust Automation Equip. 801-486-9865
VA Richmond, Meter Metrics Div., Fidus Corp. 804-275-1431
WA Seattle, Branom Instr. 206-762-6050
WI Waukesha, Power/mation 414-542-2868
Can Don Mills, Ont., Intertechnology, Inc. 416-445-5500
Can Montreal, Que., Emaco(Canada) Ltd./Ltee 514-331-0551

DATA I/O CORP., 10525 Willows Rd. N.E., Redmond, WA 98073-9746, Tel: 206-881-6444, TELEX: 15-2167; Empl.: 550

DATAK CORP., 55 Freeport Blvd., No. 23, Sparks, NV 89431, Tel: 702-359-7474, FAX: 702-359-7494; *Sls. Mgr.:* Barry Brown ..... **C•1583, 1685**

Local Sales Offices & Reps
AL Huntsville, DHR Mktg., Inc. 205-722-0440
CA Foster City, Polach & Bensinger 415-578-8200
CA Gardena, Ungar Sls. Assocs. 213-532-6837
CT Lebanon, Adams McGregor Sales 203-537-5737
FL Hollywood, Mel Yarish & Assoc. 305-985-5605
GA Duluth, DHR Mktg., Inc. 404-564-0529
IL Sugar Grove, Manx Co. 708-466-4200
IN Indianapolis, Current Elec. Mktg. 317-257-3858
KS Overland Park, M.I.N.K. Associates 913-341-8309
MD Silver Spring, Mid-Atlantic Sls. 301-593-7749
MI Grand Blanc, Inter-Comm, Inc. 313-695-0665
MO Bridgeton, M.I.N.K. Assocs. 314-291-5454
NC Raleigh, DHR Mktg., Inc. 919-829-1970
OH Chagrin Falls, L.W. Bennett & Assoc. 216-247-2174
OR Portland, Jos. V. Belusko 503-222-4279
PA Philadelphia, Instrmn. Specialties 215-742-0898
RI Coventry, Adams McGregor 401-726-1300
SC Greenville, DHR Marketing Inc. 803-235-3594
TN Nashville, DHR Marketing Inc. 615-331-2745
TX Dallas, J & J Sls. Co. 214-328-9739
VA Charlottesville, Mid Atlantic Sales 804-973-8099
Can Montreal, Cantronics Ltd./Cantronics Intl. Ltd. 514-848-7132
Can Scarborough, Ont., Cantronics Ltd./Cantronics Intl. Ltd. 416-297-8668,FAX:416-297-0107

Local Distributors
AL Birmingham, ACK Radio Supply Co. 205-322-0588
AZ Phoenix, Dalis Elctrns. 602-275-2885
AZ Scottsdale, D.C. Elctrns. 602-945-7736
CA Canoga Pk., Sandys Elctrns. 818-346-8353
CA Milpitas, Zack Elctrns. 408-942-5432
CA San Jose, Quement Elctrns. 408-998-5900
CA Sunnyvale, Fry's Elctrns. 408-733-1770
CA Thousand Oaks, Pace Elctrns. 805-497-7515
CA Van Nuys, All Elctrns. 818-333-8009
CO Denver, Fistell Micro 303-393-6000
CT Greenwich, Wise Comps. 203-531-4880
DE New Castle, Electronics Exch. 302-322-5401
FL Miami, Elctrn. Equip. 305-871-3500
FL Orlando, Orlando Frame & Art 305-898-6271
GA Atlanta, Ack Radio Supply 404-351-6340
ID Boise, Kimball Elctrns. 208-232-2201
IL Berwyn, B-B & W, Inc. 312-749-1710
IL Mt. Prospect, Tri-State Elec. 312-255-0600
IL Niles, Joseph Elec. 312-297-4200
IL S. Holland, Union Elctrns. 708-333-4100
IN Ft. Wayne, Warren Radio 219-426-5344
KY Louisville, Peerless Elec. 502-637-7674
LA Lafayette, Ralph's 318-233-0105
MD Aberdeen, Harco Elctrns. 301-838-7990
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Needham, You-Do-It Elctrns. 617-449-1005
MA Norwood, Gerber Elec. 617-769-6000
MI Flint, Shand Elctrns. 313-743-8940
MI Livonia, Norwest Elctrns. 313-261-4551
MN Minneapolis, AEI/Acme Elctrn Parts. 612-338-4754
MO Kansas City, Elctrn. Supp. 816-931-0250
MO St. Louis, Gateway Elec. 314-427-6116
MO St. Louis, Van Sickle 314-621-5000
NE Lincoln, Scott Elec. Supp. 402-466-8221
NV Las Vegas, Hurley Elec. 702-384-5666
NV Reno, Elect. Distr. Co. 702-323-2766
NJ Greenbrook, Greenbrook Elctrns. 201-968-3500
NJ Kenilworth, Federated Purchasers, Inc. 201-272-0505
NM La Cruces, Elctrn. Parts Co. 505-523-4578
NY Buffalo, Summit Distr. 716-887-2800
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Plainview, Kelvin Elctrns. 516-349-7620
NY Rochester, Summit Elec. 716-334-8110
OH Warren, REM Elctrns. Supply 216-373-1300

OK	Oklahoma City, Radio Supp.	405-232-6127
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Philadelphia, A.C. Radio	215-462-9379
PA	Reading, Barbey Elctrns.	215-376-7451
RI	Pawtucket, Jabbour Electronic Supply	401-728-4600
RI	Providence, W. Dandreta & Co.	401-861-2800
SC	Charleston, Wholesale Inds. Elctrns.	803-722-2634
TN	Memphis, W & W Distbg.	901-527-4627
TX	Houston, Elctrn. Parts Outlet	713-784-0140
TX	Richardson, Off The Shelf Comps.	214-238-0808
UT	Salt Lake City, Kimball Elec.	801-328-2075
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Annadale, Arcade Elctrns.	703-256-4610
VA	Norfolk, Priest Elctrns.	804-855-0105
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WI	Milwaukee, Indl. Elctrns.	414-276-1212
WI	Wausau, Electronics Inc.	715-845-4671

DATAKEY, INC., 407 W. Travelers Trail, Burnsville, MN 55337, Tel: 612-890-6850, FAX: 612-890-2726; FSC No.: 7025; Empl.: 44; *Sls. Mgr.:* Jerry Korsbon

DATALUX

FAX: 703-662-1682

DATALUX CORP., 2836 Cessna Dr., Winchester, VA 22601, Tel: 703-662-1500; Empl.: 25; *Sls. Mgr.:* R.H. Twyford ..... **B•1804**

Local Sales Offices & Reps

CA	San Jose, Peter Luiten	408-496-8578
IL	Buffalo Grove, Key Mktg.	708-459-6900
MA	Brookline, Technlg. Prods.	617-731-0858
NY	Hauppauge, Sticom	516-366-4221
TX	Richardson, R. F. Kimball	241-231-3447
WA	Renton, Jensen Sls.	206-277-2772

Local Distributors

IL	Wheeling, Hawk Elctrns., Inc.	718-459-4030
NY	Elmsford, Kintronics, Inc.	914-347-2530

DATAMEDIA CORPORATION, 11 Trafalgar Square, Nashua, NH 03063, Tel: 603-886-1570; Empl.: 300; *Sls. Mgr.:* Dan Caldwell

DATA MEGA INC.

FAX: 708-860-3672

DATA MEGA INC., Mega Data, 790 Maple Lane, Bensenville, IL 60106, Tel: 708-860-6501 ..... **D•1087-1089**

DATA POWER, See Beaver Labs

DATAPROBE, 170 Coolidge Ave., Englewood, NJ 07631, Tel: 201-569-6464, TELEX: 200679-PROB-UR, FAX: 201-894-0939; Empl.: 30; *Sls. Mgr.:* D. Weiss; *Dist. Mgr.:* S. Weiss

DATAPRODUCTS CORPORATION, 6200 Canoga Ave., Woodland Hills, CA 91367-2499, Tel: 818-888-4014, TELEX: 67-4734, FAX: 818-887-4789; Empl.: 3500; *Sls. Mgr.:* Paul Depa; *Dist. Mgr.:* John Thorse

DATAPRODUCTS NEW ENGLAND, INC., 50 Barnes Park North, Wallingford, CT 06492, Tel: 203-265-7151, FAX: 203-265-7801; FSC No.: 96238; Empl.: 300; *Sls. Mgr.:* Robert Griffith

DATAQ INSTRUMENTS, INC., 825 Sweitzer Ave., Akron, OH 44311, Tel: 216-434-4284 , 800-553-9006, TELEX: 6502817028, FAX: 216-434-5551

DATA RACE, INC., 11550 IM-10 West, Ste. 395, San Antonio, TX 78230, Tel: 512-558-1900, FAX: 512-558-1929; Empl.: 50; *Sls. Mgr.:* Garrick C. Colwell

DATARAM CORP., P. O. Box 7528, Princeton, NJ 08543-7528, Tel: 609-799-0071, 800-822-0071, TWX: 510-685-2542, FAX: 609-799-6734; Empl.: 120; *Sls. Mgr.:* Carl Anderson, Sls. V.P.

DATA RAY

FAX: 303-451-1143

DATA RAY CORP., 12300 Pecos, Westminster, CO 80234, Tel: 1-800-926-5556, 303-451-1300; Empl.: 100; *Sls. Mgr.:* A. Woodley ..... **B•1050-1053**

Local Sales Offices & Reps

CA	Seal Bch., Texel	213-596-9411
OR	Beaverton, Olson Tech. Sls.	503-643-9488
WA	Bellevue, Olson Tech. Sls.	206-883-7792
Can	Vancouver, Olsen Tech. Sls.	604-980-5801

DATA SET CABLE CO., INC., 748 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-9684, TWX: 710-467-0668, FAX: 203-431-4657; Empl.: 70; *Sls. Mgr.:* T. Busch

DATASOUTH COMPUTER CORP., 4216 Stuart Andrew, P.O. Box 240947, Charlotte, NC 28217, Tel: 704-523-8500, TELEX: 6843018, FAX: 704-523-9298; Empl.: 140; *Dist. Mgr.:* Ann Vetas, National Accounts Mgr.

DATA SPECIALTIES, INC., See Zebra Technologies Corp.

DATA TECH, DIV. OF PENRIL CORP., See Moisture Register Products Div., Aqua Measure Instrument Co.

DATA TECHNOLOGY, INC., 4 Gill St., Woburn, MA 01811, Tel: 617-935-8820, FAX: 617-935-9656; Empl.: 45; *Sls. Mgr.:* L. Rizzo

DATATRAN CORP., 355 Yuma St., Denver, CO 80223, Tel: 303-778-0870, FAX: 303-778-0877; Empl.: 17; *Sls. Mgr.:* Cindi L. Kemper; *Dist. Mgr.:* Cindi L. Kemper

DATA TRANSLATION, INC., 100 Locke Dr., Marlboro, MA 01752, Tel: 508-481-3700, TELEX: 951646, FAX: 617-481-8620; FSC No.: 61867; Empl.: 270; *Sls. Mgr.:* Pam Nelson; *Dist. Mgr.:* Lori Dustin

DATATRONICS, INC., 28151 Highway 74, Romoland, CA 92380, Tel: 714-928-7700, FAX: 714-928-7701

For all States not listed, please contact factory in Romoland,CA 714-928-7700 For all states not listed, please contact factory in Romoland, CA 714-928-7700

DATATRONIC SYSTEMS CORP., Computer Sciences Div., Bx 44128 EEM/NMR, Panorama City, CA 91412-0128, Tel: 818-988-5290; Empl.: 150

DATAWARE ELECTRONICS INC., 8227 44th Ave. West, Mukilteo, WA 98275, Tel: 206-742-8577, FAX: 206-742-8900

DATAWRAP, INC., 37 Water St., Wakefield, MA 01880, Tel: 617-246-5757, FAX: 617-246-5758; Empl.: 16; *Sls. Mgr.:* Tony Lockwood

Local Sales Offices & Reps

FL	Melbourne, R REP	407-242-9800
NY	Great Neck (East), F & F Metro	516-482-4080
OH	Mount Orab, Benjenn Engrg.	513-444-3175
NY	Syracuse (West), Labtronics	315-455-7314

DA-TECH CORP., 141 Railroad Drive, Ivyland, PA 18974, Tel: 215-322-9410, FAX: 215-322-9730; Empl.: 110; *Sls. Mgr.:* Bradford W. Bentz

DATEL

FAX: 508-339-6356

DATEL, INC., 11 Cabot Blvd., Mansfield, MA 02048-1194, Tel: 508-339-3000, TELEX: 174388; Empl.: 550; *Sls. Mgr.:* A. Risley ..... **D•1158-1162**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs. Inc.	205-533-9108
AZ	Phoenix, Tech. Sls.	602-246-1614
CA	San Diego, Bestronics of San Diego	619-693-1111
CA	Santa Clara, W. J. Electrns.	408-982-9222
CO	Denver, Elcom, Inc.	303-337-2300
CT	Hamden, Datcom	203-288-7005
CA	La Mirada, Select Elctrns.	213-921-5159
FL	Largo, Q-Rep	813-397-8431
GA	Norcross, Hughes Assocs. Inc.	404-662-1587
IL	Inverness, Carvel Engrg. & Sls.	708-934-9600
IN	Indianapolis, Wilson Tech. Sales	317-872-2513
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Burtonsville, Chesapeake Technlg., Inc.	301-236-0530
MA	Waltham, Datcom	617-891-4600
MI	W. Bloomfield, Infinity, Inc.	313-932-1179
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Haddenfield, G. L. Williams Assocs.	609-428-6060
NY	Clark Mills, KLM-Garner	315-853-6126
NY	Elmont, Crane & Egert	516-872-0800
NC	Cary, Hughes Assocs., Inc.	919-467-7029
OH	Cincinnati, Arthur Baier Co.	513-779-2395
OH	Cleveland, Arthur Baier Co.	216-461-6161
OH	Columbus, Arthur Baier Co.	614-764-1144
OH	Dayton, Arthur Baier Co.	513-276-4128
PA	Pittsburgh, Arthur Baier Co.	412-367-7799
TN	Knoxville, Hughes Assocs, Inc.	615-558-0283
TX	Carrollton, Tech. Mktg., Inc.	214-387-3601
TX	Houston, Technical Mktg, Inc.	713-783-4497
TX	Round Rock, Technical Mktg, Inc	512-244-2291
UT	Murray, Elcom, Inc.	801-262-2400
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945
WA	Spokane, Advanced Power Comps.	206-928-7959
WA	Vancouver, Advanced Power Comps.	206-896-4239
WI	New Berlin, Carvel Engrg. & Sls.	414-784-7007
Can	Calgary, Alb., Future Elctrns.	403-250-5550
Can	Downsview, Ont., Future Elctrns.	416-638-4771
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710
Can	Winnipeg, Man., Future Elctrns.	204-786-7711

DATRICON, Scientific Technologies, Inc., 31069 Genstar Rd., Hayward, CA 94544, Tel: 415-471-9717, FAX: 415-471-9752; Empl.: 42

DATRON INSTRUMENTS, A Wavetek Company, Hurricane Way, Norwich, England, United Kingdom NR6 6JB, Tel: 603-404824, TELEX: 851975173, FAX: 603-483670

DATRON SYSTEMS, INC., 200 West Los Angeles Ave., Simi Valley, CA 93065-1650, Tel: 805-584-1717, TWX: 910-494-2787, FAX: 805-526-0885; FSC No.: 32255; Empl.: 175; *Sls. Mgr.:* Chester Rowley

FAX: 714-533-6345

DATUM TIMING, Datum Inc., 1363 S. State College Blvd., Anaheim, CA 92806-5790, Tel: 714-533-6333, ESYLNK: 714-533-6345; FSC No.: 31160; Empl.: 280; *Sls. Mgr.:* Charles Neumann ..... **D•1067, 1120, 1164-1167**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs. Ltd.	205-534-6020
AK	Anchorage, Dryden Instrmn.	907-344-4995
CA	Anaheim, Datum	714-533-6333
CA	San Diego, M. Ficken	619-292-9392
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Littleton, Vic Meyers Assocs. Inc.	303-730-7313
CT	Mt. Carmel, Scientific Dvcs.- Connecticut	203-248-9361
FL	Longwood, Southern Mktg. Assocs. Ltd.	407-682-7317
FL	Satellite, Southern Mktg. Assocs. Ltd.	407-777-3587
GA	Marietta, Southern Mktg. Assocs. Ltd.	404-565-0603
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Brownsburg, Marsland Assoc.	317-852-8688
IA	Marion, Marsland	319-373-0566
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MA	Waltham, Scientific Devices-New England	617-890-2252
WI	New Berlin, Marsland	414-786-6611
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NJ	Union, Friedman Assocs., Inc.	201-964-6200
NM	Albuquerque, Vic Meyers Assocs. Inc.	505-884-6878
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
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OH Dublin, Micro Sls. Corp. 614-792-9117
TX Austin, Data Mktg. Assocs. 512-338-4701
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-579-2995
TX San Antonio, Data Mktg. Assocs. 512-342-3031
UT Salt Lake City, Vic Meyers Assocs. Inc. 801-581-1760
MD Columbia, Creative Mktg. Assocs. 301-880-4161
WA Seattle, Comptronics 206-284-4842

DAVIDGE CORPORATION, 94 Commerce Dr., Buellton, CA 93427, Tel: 805-688-9598, FAX: 805-688-3306; Empl.: 6; *Sls. Mgr.:* Dean Davidge

DAVIES, HARRY, MOLDING CO., 4920 Bloomingdale Ave., Chicago, IL 60639, Tel: 312-622-8966; FSC No.: 72512; Empl.: 113; *Sls. Mgr.:* Leo A. Sera; *Dist. Mgr.:* Leo A. Sera

DAVIS INSTRUMENTS MFG. CO., INC., 4701 Mt. Hope Drive, Baltimore, MD 21215, Tel: 800-368-2516, FAX: 301-358-0252

DAYCO PRODUCTS, INC., P.O. Box 1004, Dayton, OH 45401-1004, Tel: 513-226-5926, TELEX: 288219, TWX: 810-459-1822; Empl.: 6000

DAYTRONIC CORP., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342, Tel: 513-866-3300, TWX: 810-473-2978, FAX: 513-866-3327; Empl.: 180; *Sls. Mgr.:* Ronald J. Toke

DBA SYSTEMS, INC., P.O. Drawer 550, Melbourne, FL 32902-0550, Tel: 305-727-0660, TELEX: 56-4383; Empl.: 740

DCI

FAX: 913-782-5766

DCI INC., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66062, Tel: 913-782-5672; FSC No.: 58677; Empl.: 35; *Sls. Mgr.:* Larry Shelton ..... **B•1054; D•1342**

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FL Sarasota, REP USA 813-923-2897
MA Pembroke, R.G. Assocs., Inc. 617-293-5233
MA Lowell, R.G. Assocs., Inc. 508-458-9802
NY Pittsford, L-Tron 716-383-0050
WA Seattle, Brett Assocs., Inc. 206-328-6900

Panel Meters

AZ Phoenix, J.Smith & Assoc. 602-267-0981
CA Los Angeles, Power Partners 213-215-0800
CA Mtn. View, XEL 415-969-1222
CO Colorado Springs, J. Smith & Assoc. .. 719-597-5343
CT Tolland, R.G. Assoc. 203-875-4201
FL Sarasota, REP USA 813-923-2897
IL Chicago, Commodore I 312-394-5441
IL Rolling Meadows, Commodore I-Inc. .. 708-394-5441
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MN Minneapolis, Trask Engrg. 612-537-2434
NJ Manchester, Vertec 314-394-6242
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NJ Cherry Hill, Analectro, Inc. 800-795-6676
NM Albuquerque, J. Smith & Assoc. Inc. ... 505-345-6501
NM Albuquerque, Jim Smith & Assocs., Inc. 505-345-6501
NC Charlotte, Zelco Assocs. Inc. 704-541-6122
NC Charlotte, Zelco Assocs., Inc. 704-541-6122
MI Clarkston, Bradcor Elctrns. 313-325-0941
OH Cleveland, Bradcor Elctrns. 216-671-1200
TX Dallas, Meas., Inc. 214-661-8292
TX Dallas, Measurements, Inc. 214-661-8292
Can Montreal, Que., Morrison & Force Dvcs. 514-737-0072

Displays

FL Longwood, CBC Elctrns. 407-831-5380
GA Norcross, The Novus Grp. 404-263-0320
IL Elmhurst, Utronix Sls. Inc. 312-834-1100
KS Olathe 913-829-2800
MI Clarkston, Bradcor Elctrns. 313-325-0941
MO Manchester 314-394-6242
MO St. Louis, Technical Sls. Assocs. 314-521-2044
NV Las vegas 702-798-5053
NJ Cherry Hill, Analectro, Inc. 800-247-3581
NY Pittsford, L-Tron Corp. 716-383-0050
NC Gary, The Novus Grp. 919-460-7771
OH Cleveland, Bradcor Elctrns. 216-671-1200
OR Portland 503-241-9776
RI Warwick, Ertronics, Inc. 401-732-3567
TX Dallas, Kay Todd Assocs. 214-458-8833
Can St.Laurent, Que., Componetics 514-331-9930

DDI INC., 5 Dodge St., Ste. 310, Beverly, MA 01915-1703, Tel: 508-927-7976, FAX: 508-921-6388; Empl.: 4; *Sls. Mgr.:* Erik Valeur; *Dist. Mgr.:* Erik Valeur

DDK

FAX: 416-470-1479

DDK ELECTRONICS, INC., 401 Bentley Street , Markham, Ont., Canada L3R 9T2, Tel: 416-470-1346; Empl.: 25; *Sls. Mgr.:* Steven Norton ..... **C•1337-1345**

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CA Fremont, DDK Elctrns., Inc. 415-226-0400
CA Laguna Hills, DDK Elctrns., Inc. 714-455-9874
CT Guilford, DDK Elctrns. 203-458-2563
NC Cary, DDK Elctrns., Inc. 919-460-8577
TX Dallas, DDK Elctrns., Inc. 214-480-1346
Can Markham, DDK Elctrns. 416-470-1346

Local Distributors

IL Bensenville, Voyager Elctrns. 708-860-1300
MN Fridley, Voyager Elctrns. 708-860-1300
OH Akron, AESCO 216-762-8818
TX Richardson, Altair 214-231-5166
UT Salt Lake City, Kimball Elctrns. 801-328-2075
Can Montreal, Elctrn. Wholesalers 514-769-8851

DEAK TECHNOLOGY, INC., See Elpaz Instruments, Inc.

DE ANZA MFG. SVCS. INC., 310 E. Caribbean Dr., Sunnyvale, CA 94089, Tel: 408-734-2020, FAX: 408-734-2580; FSC No.: 5935 & 5965; Empl.: 100; *Sls. Mgr.:* Michael A. Takahara

DEARBORN WIRE & CABLE, INC., 250 W. Carpenter, Wheeling, IL 60090, Tel: 708-459-1000, 800-323-0198, FAX: 708-459-0170; FSC No.: 28105; Empl.: 135; *Sls. Mgr.:* Ray Grabowski; *Dist. Mgr.:* Donna Kudlicki

DE COURSEY ENGINEERING LABORATORY, 11828 W. Jefferson, Culver City, CA 90230, Tel: 213-EX7-9668; Empl.: 7

DEGUSSA CORP., Temperature Sensing Products, 104 New Era Drive, So. Plainfield, NJ 07080, TELEX: 4754247, FAX: 908-757-8561; FSC No.: 630673043; *Sls. Mgr.:* Ron Fichter

DEI, 230 N. Market Pl., Escondido, CA 92029, Tel: 619-743-8344, FAX: 619-743-5297; Empl.: 30; *Sls. Mgr.:* Matt Pedote

DEK, INC., 3840 Swenson Drive, St. Charles, IL 60174, Tel: 708-377-2575, FAX: 708-377-0372; Empl.: 115; *Sls. Mgr.:* Mark N. Cohen

DELBERT BLINN CO., Box 2007, Pomona, CA 91769, Tel: 714-629-3900, FAX: 714-622-6218; Empl.: 6

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FAX: 914-699-4005

DEL ELCTRNS. CORP., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000, TWX: 710-562-0130; FSC No.: 01378; Empl.: 95 .. **A•1056-1057, 2200; D•1700-1705**

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CA Alhambra (So. CA), M.W.Riedel & Co. 213-283-7694
CA Santa Clara (N.CA), Sourcetronics, Inc. 408-988-8801
MA Burlington, Tritek Inc. 617-272-4550
PA Glenside, Koebert Assoc. 215-887-2310
WV Inwood, Koebert Assoc. 304-229-8401
MD Kensington, Koebert Assoc. 301-493-8924

DELEVAN DIV., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052-0449, Tel: 716-652-3600, FAX: 716-652-4814; FSC No.: 99800; Empl.: 300; *Sls. Mgr.:* Denis Kohlhagen ..... **A•1202-1205**

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AL Decatur, El Tech 205-353-7899
AZ Phoenix, Toward Engrg. 602-955-3193
CA Chatsworth, First Rep. of S. CA 818-718-6155
CA Milpitas, Advanced Technlg. Sls. 408-946-4111
CA Solana Bch, Cerco 619-792-5555
CO Parker, TMA 303-841-3435
FL Deerfield Bch., Electro Comp. 305-429-0802
IL Downers Grove, Momak Sls. 312-963-6400
IN Fort Wayne, Liberty Sls. 317-888-8396
IN New Albany, Liberty Sls. 317-888-8396
IA Cedar Rapids, C. Horn & Asst. 319-393-8703
KS Parker, S. W. Wollard 913-898-6552
MD Lutherville, D. A. Dougherty Sls. Co. ... 301-321-7890
MA Sterling, Compatible Comps. 508-422-3327
MN Mendota Hgts., G-II Sls. 612-454-3086
NJ Morrestown, TAI 609-778-5353
NJ Ridgewood, Ballou 201-444-6990
NY Manhassett, Ballou, Inc. 516-627-1151
NY Mendon, Tech-Mark 716-624-3840
NY Utica, Tech-Mark 315-733-0575
NC Raleigh, Godwin 919-878-8000
OH Mason, S-Tek 513-398-5843
TX Irving, Kite Elctrn. Sls. Co. 214-986-0321
WA Bellevue, N.R. Schultz 206-746-1890
Can Mississauga, J. G. Weiss Co. Ltd. 416-673-0011
Can Nepean, J. G. Weiss Co. Ltd. 613-825-0545
Can St. Laurent, J. G. Weiss Co. Ltd. 514-337-5022
Can Vancouver, J. G. Weiss Co. Ltd. 604-873-1112
Can Winnipeg, J. G. Weiss Co. Ltd. 204-783-4387

Local Distributors

CA Fountain Valley, Ecliptek 714-963-4009
CA Garden Grove, National Elctrns. 714-892-7749
CA Irvine, ITT Multicomponents 714-727-4001
CA San Diego, Neumann 619-695-3005
CA Santa Clara, Trinity Elctrns. 408-980-9014
CA Stanton, Inductive Comps. 716-828-3420
FL Ft. Lauderdale, Bros. Elec. of Fl 800-342-6700
MD Savage, Pyttronics Ind. 301-792-0708
MA Sterling, Compatible Comps. 617-422-6762
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ Fairfield, Micross Comps. 201-227-8007
NY Bohemia, Car-Lac 516-567-4200
NY Buffalo, Summit Distrs. 716-887-2800
NY Farmingdale, Milgray/New York 800-645-4729
NY Plainview, ACI Elctrns. 516-293-6630
PA Norristown, Century Elctrn. Comp. 215-631-5400
TX Fort Worth, Patco Supply 817-429-8596
Can Burnaby B.C., R-A-E Indl. Elctrns. Ltd. 604-291-8866
Can Don Mills, Ontario, Saynor Varah Elctrns. 416-445-2347
Can Montreal, Quebec, Prelco Elctrns. Ltd. 514-389-8051
Can Pointe-Claire Quebec, Future Elctrn. .. 514-694-7710
Can Willowdale, Ont., Milgray Elctrns. 416-756-4481

DELTA CONTROLS CORP., 585 Fortson St., Shreveport, LA 71107, Tel: 318-424-8471, TELEX: 784554, FAX: 318-425-2421; Empl.: 32; *Sls. Mgr.:* Howard Entwistle, V.P. Sls.

DELTA WIRE & CABLE CO., 2550 Commonwealth Ave., P.O. Box 833, North Chicago, IL 60064, Tel: 708-473-4990, FAX: 708-473-2425; Empl.: 12; *Sls. Mgr.:* Perry Stein

DELTA ELECTRONICS MFG. CORP., 416 Cabot St., Beverly, MA 01915, Tel: 508-927-1060, TELEX: 710-347-0631, FAX: 508-922-6430; FSC No.: 00795; Empl.: 108; *Sls. Mgr.:* Colleen Lassiter; *Dist. Mgr.:* Colleen Lassiter

DELTA M CORPORATION, 525 Warehouse Rd., Oak Ridge, TN 37830, Tel: 615-483-1569, FAX: 615-483-1142; Empl.: 18; *Sls. Mgr.:* Robert Cline

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DELTA PRODUCTS CORPORATION, 3823 Spinnaker Ct., Fremont, CA 94538, Tel: 415-770-0660; Empl.: 3000; *Dist. Mgr.:* Karen McMillan ..... **A•1612-1613; C•1346, 1610-1611; D•1706-1707**

Local Sales Offices & Reps

AL Huntsville, Electra-Mark 205-830-4400
CA Newport Bch., Elkins, Assocs. 714-646-6475
CA San Diego, Falcon Sls., Technlg. 619-591-0504
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
CT North Haven, Kitchen & Kutchen 203-239-0212
CO Denver, Moss Mkt. 303-340-8535
IL Rolling Meadow, Eagle Tech. Sls. 708-991-0700

IL Wheeling, United Prods. Co. 312-459-1222
MA Burlington, Kitchen & Kutchen 617-229-2660
MN Edina, Hanna Lind Ltd. 612-925-5700
NJ Berkley Hgts., Cambridge & Allen Assocs. 201-464-0203
OH Shaker Hgts., Omega Sls., Inc. 513-434-5507
OH University Hgts., Omega Sls.-Cleveland 216-751-9600
OK Tulsa, Advance Tech. Sls. 918-664-0482
OR Portland, Turn Around Sls. 503-640-4641
PR San Juan, Elctrn. Tech. Sls. 809-720-1300

Local Distributors

AL Huntsville, Hammond Elctrns. 205-830-4764
AZ Phoenix, Future Elctrns. 602-968-7140
CA Buena Park, Cypress Elctrns. 714-521-5230
CA Fullerton, Kent Elctrns. 714-773-0781
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Jose, Compass Comp. 408-432-7575
CA San Jose, Sierra West 408-435-7477
CA Santa Clara, Cypress Elctrns. 408-980-2500
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OH Cincinnati, Schuster 216-425-8134
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TX Allen, Prime Distrbg. Co. 800-526-7478
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WA Bothell, Cypress Elctrns. 206-483-1144
WA Kent, Kent Elctrns. 206-872-5800
Can Montreal, Future Elctrns. 514-389-8051

DELTA DESIGN, 5775 Kearny Villa Rd., San Diego, CA 92123-1111, Tel: 619-292-5000, TWX: 910-335-1215, FAX: 619-277-7884; Empl.: 198; *Sls. Mgr.:* Bob Williams

DELTEC CO., 13065 H Tom White Way, Norwalk, CA 90650, Tel: 213-926-2304, FAX: 213-926-8536; Empl.: 7; *Sls. Mgr.:* Dennis Orman

DELTEC, 2727 Kurtz St., San Diego, CA 92110, Tel: 619-291-4211, 800-854-2658, TELEX: 910-335-1241, FAX: 619-299-6124; FSC No.: 52297; Empl.: 250; *Sls. Mgr.:* Jeff Frank; *Dist. Mgr.:* Gary Page

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FAX: 414-671-6809

DELTROL CONTROLS, 2745 S. 19th St., Milwaukee, WI 53215, Tel: 414-671-6800, TELEX: 26871; Empl.: 250; *Sls. Mgr.:* Frank Stadler; *Dist. Mgr.:* Frank Stadler ..... **B•1456-1457, 1616-1619**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs. 205-883-1712
AZ Tucson, Earl Clemick & Assocs. 602-749-4003
CA Canago Park, C & W Comp. Sls. 818-700-2684
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
CT Waterbury, Cannon Assocs., Inc. 203-597-0240
FL Deerfield Bch., Jack Krutek & Assocs. 305-427-4202
GA Roswell, JWL Assoc. 404-518-8500
IL Elk Grove Village, Tristar Group 708-593-0200
IN Ft. Wayne, Nationwide Comps. 219-423-9535
MA Chelmsford, Cannon Assocs., Inc. 508-649-3809
MN St. Paul, Kencotronics, Inc. 612-645-7717
MO Chesterfield, Weisler & Assocs. 314-537-0010
NY Pt. Washington, Ashtec Inc. 516-767-0336
NY Rochester, Omni Sls. 716-248-0340
NC Charlotte, JWL Assocs. 704-541-5750
OH Willoughby, Nationwide Comps. 216-946-3226
PA Valley Forge, Providence Mktg. 215-935-3300
RI Warwick, Cannon Assoc. 401-732-1570
TX Houston, Weisler & Assocs. 713-467-1862
WA Redmond, Halbar-PNW, Inc. 206-882-0990
Can Pointe Claire, Nobel-Teck Inc. 514-695-7498

Local Distributors

AL Birmingham, American Elctrn. Supp. 205-942-4656
AL Montgomery, Southern Controls 205-277-5030
AZ Tempe, Control Design 602-829-7981
AR Little Rock, Carlton-Bates Co. 501-562-9100
CA Anaheim, Control Design 714-821-1516
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CA San Jose, Consolidated Parts 408-435-1200
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CA Van Nuys, Wes-Garde Comps. 213-873-4802
CO Denver, Integrated Elctrns. 303-292-6121
CT Hartford, Hatry Elctrns. 203-527-1881
CT Waterbury, Century Elec. 203-755-0405
FL Altamonte Springs, Control Des. 407-788-3220
FL Ft. Lauderdale, SE Elctrns. 305-563-4131
FL Lakeland, Wes-Garde Comps. 813-644-7564
FL Orlando, EMSCO 407-849-6362
GA Stone Mountain, Control Des. 404-979-3500
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IL Geneva, Melvin Elctrns. 708-232-7300
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IA Dubuque, Miller Elec. Supp. 319-588-1469
IA Marion, Control Des. 319-373-2923
IA West Des Moines, Ramco Co. 515-225-6933
KS Kansas City, Kornfield Thorp Elec. 913-321-7070
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MA Westborough, In Stock Prods. 508-870-5750
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MI Madison Hgts., Galco Indl. Elctrns. 313-542-9090
MN Minneapolis, Control Design 612-721-6555
MO St. Louis, Wes-Garde Comps. 314-567-7776
NH Keene, Tradesmen Elctrl. Supp. 603-352-1205
NJ Oakland, Relay Specialties 201-337-1000
NJ Raritan, Masters Elctrn. 201-725-3533
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Hempstead, Davis Elctrns. 516-483-9200
NY Rochester, Masline Elctrns. 716-546-5373
NY Vestal, Wholesale Elec. Supp. 607-729-1526
ND Fargo, WESCO 701-232-4446
ND Minot, J.I. Company 801-852-4466
OH Akron, AESCO Elctrns. 216-762-8818
OH Willoughby, Gateway Megatech 216-953-0333
OK Ardmore, Ardmore Elec. Supp. 405-223-3571
OK Tulsa, Radio, Inc. 918-587-9123
OR Portland, Dunn Elec. 503-285-0214
PA Erie, Rem Elctrns. 814-453-5626
PA Malvern, Control Design 215-296-0150
PA Philadelphia, Lindley Elec. 215-329-7005
TX Dallas, Control Design 214-358-1441
TX Lubbock, R & R Elec. Co. 806-765-7727
TX San Antonio, Blackburn Drives Controls 512-349-2621
UT Salt Lake City, Kimball Elctrns. 801-328-2075
VA Glen Allen, Hermitage Distrs. 804-550-3030
VA Staunton, Southern Elec. 703-886-6218
WI Manitowoc, Englewood Elec. 414-684-6653
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Control Design 414-784-1015

DELTRON, INC., 290 Wissahickon Ave., N. Wales, PA 19454-9990, Tel: 215-699-9261, FAX: 215-699-2310; Empl.: 175-180

DEL-TRON PRECISION, 5 Trowbridge Drive, Bethel, CT 06801, Tel: 800-245-5013, FAX: 203-778-2721; Empl.: 50; *Sls. Mgr.:* Emil Melvin

DENNIS CHEMICAL, 2700 Papin St., St. Louis, MO 63103, Tel: 314-771-1800, FAX: 314-771-8399; Empl.: 70; *Sls. Mgr.:* Charles F. Seger III; *Dist. Mgr.:* Charles F. Seger III

DENNISON MFG. CO., 300 Howard St., Framingham, MA 01701, Tel: 508-879-0511, TELEX: 948-478; FSC No.: 5975;2310; Empl.: 8000; *Sls. Mgr.:* George Curtis; *Dist. Mgr.:* Mike Conners

DENSEPAC MICROSYSTEMS, INC., 7321 Lincoln Way, Garden Grove, CA 92641-1428, Tel: 714-898-0007, 800-64-CHIPS, FAX: 714-897-1772; FSC No.: 66847; Empl.: 50; *Sls. Mgr.:* Norman Taylor

DC DENSITRON CORPORATION

FAX: 213-534-8419

DENSITRON CORPORATION, Densitron International, 3425 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-530-3530, TWX: 910-349-6200; FSC No.: 62483; Empl.: 42; *Sls. Mgr.:* Richard Driscoll; *Dist. Mgr.:* Richard Driscoll ..... **B•1055**

Local Sales Offices & Reps

AL Huntsville, E.M.A. 205-536-3044
AL Huntsville, Elctrn. Mktg., Inc. 205-837-7363
AZ Phoenix, Chaparral Elctrn., Inc. 602-996-5909
CA Irvine, Comp. Mktg. Assocs. 714-727-0688
CA Milpitas, Comp. Mktg. Assocs. (Telesis) 408-946-7300
CO Englewood, Comp. Sls. 303-779-8060
CT W. Hartford, Nova Assocs. (M-R Tech. Sls.) 203-521-2101
FL Margate, E.P.M. Corp. 305-977-0331
FL Orlando, EPM Corp. 407-425-6149
GA Acworth, E.A.B., Inc. 404-975-3660
IL Northbrook, H. Benjamin & Assoc. 312-272-2900
IN Ft. Wayne, R.L. Bontempo Assocs. 219-478-1057
IN Indianapolis, R.L. Bontempo Assocs. 317-299-6270
KS Lenexa, Midtech Assoc. 913-541-0505
MA Braintree, Nova Assocs. 617-848-9330
MI Southfield, R. C. Nordstrom & Co. 313-559-7373
MN Minneapolis, Electro-Serv 612-338-3475
MO St. Louis, Midtech Assocs. 314-275-8666
NY Marcellus, J. G. Welch Assocs. 315-673-1009
NY Patchogue, Optimum Sls. 516-758-0644
NY Rochester, J. G. Welch Assocs. 716-244-1100

NY Rochester, Mullahy-Welch Sls. 716-266-2798
NC Raleigh, C-Tech Sls. 919-782-8100
OH Auroa, Engrg. Mktg. Assocs. 216-562-6104
OH Centerville, Engrg. Mktg. Assocs. 513-433-2800
OH Worthington, Engrg. Mktg. Assocs. 614-436-9452
OK Tulsa, Delta Comp, Inc. 918-592-7711
PA Wynnewood, Metz-Benham Assocs., Inc. 215-896-7300
TX Seagoville, Delta Comp., Inc. 214-287-6333
UT Salt Lake City, Wasatau/Prorep Mktg. 801-268-3434
VA Sterling, Beacon-North 703-478-2480
WA Seattle, J. J. Assocs., Inc. 206-246-6619
Can Mississauga, Ont., IntelaTech 416-629-0082

DEPAC CORP., 201 Mill St, Rome, NY 13440, Tel: 315-339-1265; Empl.: 3

DERINGER MFG. CO., 1250 Townline Road, Mundelein, IL 60060, Tel: 708-566-4100, TWX: 910-685-4231; *Sls. Mgr.:* W. Johnston

DESIGNATRONICS, INC., See Automatic Coil Corp., Sub. Designatronics, Inc.

DESIGN AUTOMATION, INC., 809 Massachusetts Ave., Lexington, MA 02173-3992, Tel: 617-862-8998, FAX: 617-862-3769; FSC No.: 4D417; Empl.: 8

DESIGN COMPONENTS, INC., 1 Kenwood Circle, Franklin, MA 02038, Tel: 508-528-7300, 800-341-4811, FAX: 508-520-1424; Empl.: 60

DESIGN TECHNOLOGY, 1050-R Pioneer Way, El Cajon, CA 92020, Tel: 619-440-7666, FAX: 619-440-8048; FSC No.: 619-440-8048; Empl.: 50; *Sls. Mgr.:* Jeff Jonas; *Dist. Mgr.:* Sherry Golden

DESPATCH INDUSTRIES, 63 St. Anthony Parkway, P.O. Box 1320, Minneapolis, MN 55418, Tel: 612-781-5363, TELEX: 29-0704, TWX: 6288-5512; Empl.: 360; *Sls. Mgr.:* P. Olson

DETORONICS CORPORATION, 10660 E. Rush St, S. El Monte, CA 91733, Tel: 818-579-7130, TWX: 910-587-3436, FAX: 818-579-1936; FSC No.: 29867; Empl.: 45

DETROIT COIL CO., 2435 Hilton Rd., Ferndale, MI 48220, Tel: 313-398-5600, FAX: 313-398-0481; Empl.: 120; *Sls. Mgr.:* T. Dougherty ..... **B•1620**

Local Sales Offices & Reps

CT Bristol, M.L. Assocs. 203-589-2856
GA Decatur, Austin Brown Assocs. 404-370-7500
MA Wayland, M. L. Assocs. 508-358-5540
MI Ferndale, Detroit Coil Co. 313-398-5600
MN Little Canada, Assured Sls. 612-482-1309
NJ Morristown, Andrews & Andrews 201-569-8800
NY Glen Head, Andrews & Andrews 516-692-8686
PA Tamaqua, Loman Co. 609-796-0055
WA Kent, C. B. Parsons Co. 206-762-7373

DETROIT TESTING LABORATORY, INC., 7111 E. Eleven Mile, P.O. Box 869, Warren, MI 48090-0869, Tel: 313-754-9000, FAX: 313-754-9045; FSC No.: 0739; Empl.: 100

DEVAR, INC., 706 Bostwick Ave., Bridgeport, CT 06605, Tel: 203-368-6751, TELEX: 96-4234, FAX: 203-368-3747; Empl.: 80; *Sls. Mgr.:* T. W. Tomasko

DEVELCO, INC., 175 Nortech Pkwy., San Jose, CA 95134-2306, Tel: 408-945-6500, TWX: 910-339-9295, FAX: 408-945-6504; Empl.: 50; *Sls. Mgr.:* W. J. Baker

DEXTER RESEARCH CTR., INC., 7300 Huron River Dr., Dexter, MI 48130, Tel: 313-426-3921, TELEX: 757075 DEXTER RES UD; Empl.: 22; *Sls. Mgr.:* Robert Toth Jr.

DEXTER SCIENTIFIC, 308 Benham St, Palatka, FL 32177, Tel: 904-328-2450; Empl.: 1

DE YOUNG MFG., INC., 12920 N.E. 125th Way, Kirkland, WA 98034, Tel: 206-823-4798, FAX: 206-821-8633; FSC No.: 54937; Empl.: 70; *Sls. Mgr.:* Ted Johnson

DGH CORPORATION, P. O. Box 5638, Manchester, NH 03108, Tel: 603-622-0452, FAX: 603-622-0487; Empl.: 10

DH PRINT, DIV. OF DH TECHNOLOGY, Technical Research Park, Riverton, WY 82501, Tel: 307-856-4821, FAX: 307-856-0412; Empl.: 230; *Sls. Mgr.:* Rich Phillips; *Dist. Mgr.:* Rich Phillips

DIAGOSTIC INSTRUMENT CORP., 4 Copeland Dr., Box J, Ayer, MA 01432, Tel: 508-772-4572, FAX: 508-772-5210; Empl.: 125; *Sls. Mgr.:* Brad Barone

DIALIGHT CORPORATION, 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 908-223-9400, FAX: 908-223-8788; Empl.: 400; *Sls. Mgr.:* W. Moore ... **B•1145-1150**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean 205-830-1540
AZ Phoenix, Shefler-Kahn Co. 602-581-0884
CA Los Angeles, Landa & Assocs. 213-879-0770
CA Pleasanton, Moulthrop Sls. 415-463-0450
CA Santa Ana, Landa & Assocs. 714-543-7805
CO Boulder, Comp. Prods. Sls. 303-530-2800
FL Ft. Lauderdale, Panamtech, Inc. 305-587-3769
FL Oviedo, Panamtech Inc. 407-679-5506
GA Norcross, Cartwright & Bean 404-368-0160
IN Indianapolis, Elctrn. Reps. 317-894-1414
IA Cedar Rapids, Lowell-Kangas & Assoc. 319-362-9290
KS Shawnee, Lowell Kangas & Assocs. .. 913-631-3515
LA Covington, Cartwright & Bean 504-892-1780
MA Chelmsford, John E. Boeing Co., Inc. .. 508-256-5800
MI Royal Oak, Hilltronics 313-435-0920
MN Minneapolis, Professional Sales For Ind. 612-944-8545
MS Jackson, Cartwright & Bean 601-981-1170
MO St. Louis, Lowell Kangas & Assocs. 314-821-4050
NY Liverpool, Gen-Tech 315-451-3480
NY Melville, Parallax 516-351-1000
NC Charlotte, Cartwright & Bean 704-536-0303
NC Raleigh, Cartwright & Bean 919-876-4130
OH Dayton, Baehr, Greenleaf & Assocs. .. 513-439-0724
OH Westlake, Baehr, Greenleaf & Assocs. 216-892-1770
OH Worthington, Baehr, Greenleaf & Assocs. 614-847-0220
OR Tigard, Earl & Brown Assocs. 503-639-2100
PA Broomall, L.D. Lowery 215-356-5300
PA Warrendale, Baehr, Greenleaf & Assocs. 412-934-3088
TN Knoxville, Cartwright & Bean 615-693-7450
TN Nashville, Cartwright & Bean 901-362-8345
TX Austin, Tesco 512-834-8374
TX Dallas, Tesco 214-553-1200
TX Houston, Tesco, Inc. 713-690-4909
VA Earlysville, L.D. Lowery, Inc. 804-973-6672
WA Redmond, Earl & Brown Assocs. 206-885-5064
Can Kirkland, PQ, Longman Sls., Inc. 514-694-3911
Can Mississauga, Ont., Longman Sls., Inc. 416-670-8100
Can Vancouver, B.C., Arwin Tech. Ltd. 604-980-4557

Local Distributors

AR Little Rock, Carlton Bates 501-562-9100
CA Garden Grove, Richey Impact, Inc. 714-895-0060
CA Gardena, California Switch 213-770-2330
CA Los Angeles, Bell Inds. 213-826-6778
CA Santa Clara, Cypress Elctrns. 408-980-8400
CO Denver, CSID 303-292-9594
FL Orlando, EMSCO 407-849-6362
FL Orlando, Hammond Elctrns. 407-849-6060
GA Norcross, Dow Elctrns. 404-448-4004
IL Chicago, Newark Elctrns. 312-784-5100
IL Palatine, Ohm Elctrns. 708-359-5500
IL Peoria, Klaus Radio, Inc. 309-691-4840
LA Lafayette, Ralph's of Lafayette 318-233-0105
LA New Orleans, Southern Radio 504-524-2343
MD Baltimore, Resco 301-931-8200
MA Hingham, Sager Elctrns. 617-749-6700
MA Norwood, Gerber Elctrns. 617-769-6000
MI Livonia, Chelsea Ind/RS Elec. 313-525-1155
MN St. Paul, Gopher Elctrns. 612-483-3322
MO Kansas City, Walters Indl. 816-531-7015
MO Maryland Hts., L Comp 314-291-6200
NJ Kenilworth, Federated Purchaser 908-272-0505
NY Buffalo, Summit Distrs. 716-887-2800
NY Elmsford, Ancar Elctrns. 914-592-7100
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Lynbrook, Peerless Radio Corp. 516-593-2121
NY Melville, Arrow Elctrns. 516-391-1300
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Akron, Aesco Elctrns., Inc. 216-762-8818
OH Columbus, Hughes-Peters, Inc. 614-294-5351
OH Dayton, Stotts Friedman 513-298-5555
OH Warren, Rem Elctrn. Supp. 216-373-1300
OK Tulsa, Radio, Inc. 918-587-9123
PA Philadelphia, PEI/Genesis 215-673-0400
PA Reading, Barbey Elctrns. 215-376-7451
PA Trevose, Almo Elctrns. 215-953-2800
TX Dallas, Norvell Elec., Inc. 214-233-0020
TX Houston, Harrison Equip. Co. 713-879-2600
VA Charlottesville, Virginia Elctrns. 804-296-4184
WA Bellevue, Almac Elctrns. 206-643-9992
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Don Mills, Ont., Saynor Varah 714-895-0060
Can Edmonton, Alb., Cardinal Ind. Elec. 403-483-6266
Can Willowdale, Ont., Electro Sonic 416-494-1666

DIANACHART INC., 101 Round Hill Dr., Rockaway, NJ 07866, Tel: 201-625-2299, FAX: 201-625-2449; Empl.: 10; *Sls. Mgr.:* B. McWilliams

DI/AN CONTROLS, INC., 16 Jonathan Drive, Brockton, MA 02401, Tel: 508-599-8000, FAX: 508-599-8658; FSC No.: 06900; Empl.: 25; *Sls. Mgr.:* Raymond Stafford

DICKINSON USA INC., Dickinson Manufacturing Co. Ltd., 11324 Mukilteo Speedway, Lynnwood, WA 98037, Tel: 206-742-3677, 800-659-9768, In Canada 604-525-6444, FAX: 206-347-8502; Empl.: 30; *Sls. Mgr.:* Robert Farr

DIELECTRIC COMMUNICATIONS, General Signal, Tower Hill Rd., Raymond, ME 04071, Tel: 207-655-4555, 800-341-9678, TELEX: 710-229-6890, FAX: 207-655-4669; FSC No.: 08441; Empl.: 220; *Sls. Mgr.:* Rolf Olsen

DIELECTRIC LABS., Rte. 20 E., Cazenovia, NY 13035, Tel: 315-655-8710, TELEX: 882-691 Dielectric Labs., FAX: 315-655-8179; FSC No.: 55153; Empl.: 100; *Sls. Mgr.:* Gunter Vorlop

DIE-TECH INC., 295 Sipe Rd., RDI, York Haven, PA 17370, Tel: 717-938-6771, FAX: 717-938-6099 ..... **C•1347**

DIETERICH STANDARD, A Dover Industries Company, P.O. Box 9000, Boulder, CO 80301, Tel: 303-530-9600, FAX: 303-530-7064; Empl.: 105; *Sls. Mgr.:* Robert Heiser; *Dist. Mgr.:* Robert Heiser

DIETZ DESIGN, INC., 100 Electronics Pkwy., Belton, MO 64012, Tel: 816-331-4911, FAX: 816-331-4914; FSC No.: 93652; Empl.: 75; *Sls. Mgr.:* Chas. A. McMurray

DIGI-DATA CORP., 8580 Dorsey Run Rd., Jessup, MD 20794, Tel: 301-498-0200, TELEX: 87-580, FAX: 301-498-0771; Empl.: 40; *Sls. Mgr.:* Allen Grams

DIGI-KEY CORP., 701 Brooks Ave. South, Thief River Falls, MN 56701-0677, Tel: 218-681-6674, 1-800-344-4539, FAX: 218-681-3380

DIGITAL DATA SYSTEMS, 1551 N.W. 65 Ave., Ft. Lauderdale, FL 33313, Tel: 305-792-3290, TWX: 910-997-4751 (Digital), ESYLNK: 62756087, FAX: 305-581-13; FSC No.: 65136; Empl.: 20

DIGITAL DYNAMICS, INC., 5274 Scotts Valley Dr., Scotts Valley, CA 95066, Tel: 408-438-4444; FSC No.: (S.I.C. Code – 3823); Empl.: 15

DIGITAL EQUIP., One Iron Way, Marlborough, MA 01752

DIGITAL MOTOR, INC., 1075 N.W. Murray Rd., Ste. No. 255, Portland, OR 97229-5501, Tel: 503-629-9692, FAX: 503-690-9876; Empl.: 6

DIGITAL PRODUCTS, INC., 108 Water Street, Watertown, MA 02172, Tel: 617-924-1680, 800-243-2333, TELEX: 312345, FAX: 617-924-7814; Empl.: 100; *Dist. Mgr.:* Neil Peterson

DIGITAL RADIO CORP., 601 S. Pacific Coast Hwy., Redondo Beach, CA 90277, Tel: 213-316-4114, FAX: 213-543-1256; Empl.: 27; *Sls. Mgr.:* Arvin L. Perry

DIGITEC, 959 Cheney Ave., Marion, OH 43302, Tel: 614-387-3444, TELEX: 3775688; FSC No.: 16152; Empl.: 45; *Sls. Mgr.:* Bruce Poplin; *Dist. Mgr.:* Bruce Poplin

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FAX: 714-391-4558

DIGITRAN DIVISION, Xcel Corporation, 4290 E. Brickell St., Ontario, CA 91761, Tel: 714-391-4321; FSC No.: 07126; Empl.: 300; *Sls. Mgr.:* W. Miller; *Dist. Mgr.:* Kathy Simonds ..... **B•1680, 1805**

Local Distributors

AL Huntsville, Comp. Distrs. 205-883-7501
AL Huntsville, Powell Elec. 205-539-2731
AZ Tempe, Powell Elctrns. 602-967-7538
AR Little Rock, Comp. Distrs. 501-227-6278
CA Cerritos, El-Com 213-404-2961
CA Fullerton, Pyramid 714-773-0781, 213-691-0561
CA San Diego, El-Com 619-578-0900
CA San Jose, Powell Elctrns. 408-943-9020
CA Santa Clara, Pyramid Elec. 408-727-9810
CT Hamden, Impact Elctrns. 203-281-1331
FL Ft. Lauderdale, Comp. Distrs. 305-971-4950
FL Ft. Lauderdale, Powell Electr./Fla. 305-972-4300
GA Norcross, Comp. Distrs. 404-441-3320

IL Mt. Prospect, Magnuson Elctrns. 312-956-0700
IN Indianapolis, Graham Elec. 317-634-8202
MD Columbia, Powell Electr. 301-621-4070
MA Canton, Impact Sls. Co. 617-821-1500
MA West Borough, Powell Electrns. 617-336-6100
MI Livonia, Pioneer/Michigan 313-525-1800
MI St. Clair Shores, Specialties Mfg. 313-771-2700
MN St. Paul, Magnuson Elec. 612-227-8495
NJ Hasbrouck Hgts., Tory Sls. 201-288-5656
NY Rochester, Modutex Corp. 716-647-9700
NC Cary, Powell Elec. 919-467-1212
NC Raleigh, Comp. Distrs. 919-834-9465
PA Philadelphia, Powell Electr. 215-365-1900

DILL INSTRUMENTS INC., 436 W. Willard, Kalamazoo, MI 49005, Tel: 616-388-5708, FAX: 616-388-5704; Empl.: 10; *Sls. Mgr.:* Terry Simpson; *Dist. Mgr.:* Robert Boyle

DILLON, Weigh-Tronix, Inc., 1000 Armstrong Dr., Fairmont, MN 56031, Tel: 507-238-4461, TELEX: 756594, FAX: 507-238-4195; Empl.: 500; *Sls. Mgr.:* Randy Newlin; *Dist. Mgr.:* Tom Gallagher

DILOG, 1555 S. Sinclair St., Anaheim, CA 92806, Tel: 714-937-5700, 1-800-DILOG 32, TELEX: 6836051, FAX: 714-978-2420; FSC No.: 95-3205555; Empl.: 250; *Sls. Mgr.:* Dennis Edwards

DILWOL WIRE & CABLE INC., 435 Enfield Rd., Burlington, Ont., Canada L7T 2X5, Tel: 416-681-2343, FAX: 416-681-8440; *Sls. Mgr.:* J. R. Mattie

DIMCO-GRAY, 8200 S. Suburban Rd., Dayton, OH 45458, Tel: 513-433-7600, FAX: 513-433-0520; Empl.: 120; *Sls. Mgr.:* James L. Harl

DIMENSIONS UNLIMITED, INC., 1636 Gervais Ave., St. Paul, MN 55109, Tel: 612-770-5630, FAX: 612-770-0847; *Sls. Mgr.:* David Flod

DIODES INC., 9957 Canoga Ave., Chatsworth, CA 91311, Tel: 818-882-4920, 800-821-1178, FAX: 818-341-1736; FSC No.: 12060; Empl.: 55; *Sls. Mgr.:* Marvin Zidel; *Dist. Mgr.:* Sue Reinish ..... **A•2093**

Local Sales Offices & Reps

AL Huntsville, Hughes Assocs. 205-533-9108, FAX:205-533-4667
AZ Phoenix, Sanford Sls. 602-957-3570, FAX:602-955-2836
CA Los Angeles, Landa & Assoc. 213-879-0770, FAX:213-478-0190
CA Los Gatos, Norcal 408-356-7771
CA San Diego, Costal Elctrns. Sls. 619-459-4148, FAX:619-454-2611
CA Santa Ana, Landa & Assocs. 714-543-7805, FAX:714-543-1380
CO Denver, AKI Entprs. 303-388-4488
FL Maitland, Hughes Assocs. 407-629-5933
FL Tamaroc, Hughes Assocs. 305-720-1674
GA Norcross, Hughes Assocs. 404-662-1587, FAX:404-662-1561
IL Highland Park, Bransky Sls. 708-433-2375, FAX:708-433-2377
IL McHenry, Mesa 815-344-2820;FAX:815-344-2730
IN Indianapolis, Mktg. Engrs. Inc. 317-872-5665, FAX:317-872-5668
IA Cedar Rapids, KKB & Co. 319-373-1730, FAX:319-373-2019
KY Louisville, Mktg. Engrs. Inc. 502-267-7093, FAX:502-267-6533
MD Randallstown, Beacon North 301-655-2265
MA Needham Heights, The Newscott Co., Inc. 617-444-1923,FAX:617-449-4689
MI Farmington Hills, J.L. Montgomery Assoc. 313-489-0099,FAX:313-489-0189
MN St. Paul, Proud Inds. 612-646-9428, FAX:612-646-6109
MS Comith, Hughes Assocs. 601-287-2915
MO Blue Springs, KKB & Co. 816-229-0001, FAX:816-228-1466
MO St. Louis, KKB & Co. 314-647-2400, FAX:314-647-3773
NJ Berkeley Heights, Cambridge Allen & Assoc. 201-464-0203,FAX:201-464-3030
NY Binghamton, Ontec Elctrn. Mkg., Inc. .. 607-724-5266
NY Forest Hills, Cambridge Allen & Assoc. 718-592-6361
NY Rochester, Ontec Elctrn. Mkg., Inc. 716-464-8636, FAX:716-464-0122
NY Syracuse, Ontec Elctrn. Mkg., Inc. 315-425-9800, FAX:315-478-6108
NY Wappingers Falls, Ontec Elctrn. Mkg., Inc. 914-462-7188,FAX:914-462-8706
NC Gary, Huges Assocs. 919-467-7029, FAX:919-481-9255
OH Dayton, J.C. Hofstetter Co. 513-296-1010, FAX:513-296-1274
OH Medina, J.C. Hofstetter Co. 216-241-4880, FAX:216-725-4471
OK Bethany, Design Mktg. 405-789-5911
OR Beaverton, Westmark Elctrns. Inc. 503-641-8780, FAX:503-641-8783
OR Tigard, Elctrns. Comps. Sls. 503-245-2342
PA Erie, J.C. Hofstetter Co. 412-356-7303
TN Hemitage, Hughes Assocs. 615-871-0908
TN Knoxville, Hughes Assocs. 615-558-0283
TX Austin, Design Mktg. 512-263-9151, FAX:512-263-3447
TX Dallas, Design Mktg. 214-480-8151, FAX:214-480-8214
TX Fort Worth, Design Mktg. 817-232-3155
TX Houston, Design Mktg. 713-550-3318, FAX:713-550-9114
UT Salt Lake City, Wasatch Reps. 801-268-3434, FAX:801-266-9021
VA Lynchburg, Jim Griffin 804-237-0598
VA Sterling, Beacon North 703-478-2480, FAX:703-435-7115
WA Bellevue, Westmark Elctrns. Inc. 206-454-1944, FAX:206-454-2488
WA Mercer Island, Elctrns. Comps. Sls. 206-232-9301
PR Caguas, Caribbean Elctrns. 809-746-9897, FAX:809-746-9441
Can Calgary, Cana Rep. Grp. Inc. 403-255-0294, FAX:403-255-4902
Can Montreal, Cana Rep Grp. Inc. 514-276-4477, FAX:514-276-3646
Can Surrey, Cana Rep Grp. Inc. 604-599-1232, FAX:604-599-3616
Can Willowdale, Cana Rep Grp. Inc. 416-250-6683, FAX:416-250-6684

DIONICS, 65 Rushmore St., Westbury, NY 11590, Tel: 516-997-7474, FAX: 516-997-7479; FSC No.: 50857; Empl.: 45; *Sls. Mgr.:* Ron Colino

DIO-REY, Div. of Info-Lite Corp., 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455, FAX: 201-941-4919; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli ..... **B•1058-1064**

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OR Beaverton, Elctrns. Northwest Inc. 503-629-9241
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Can Montreal, Tekron Comms. Inc. 514-335-0152

DORAN MANUFACTURING CO., 2834 Sidney Ave., Cincinnati, OH 45225, Tel: 513-681-5424, FAX: 513-681-5604; Empl.: 60; *Sls. Mgr.:* Jeff Stegman

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OH	Dayton, Stotts Friedman	513-298-5555
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MA	Norwood, JMG, Inc.	617-762-5333
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NV	Las Vegas, Trembly Assoc.	702-739-9770
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NM	Albuquerque, Trembly Assoc.	505-266-8616
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OH	Cleveland, Geotronix Mktg. Assoc.	216-659-6100
OH	Trotwood, Geotronix, Inc.	513-252-6700
PA	Newtown, Total Control	215-860-5333
TX	Carrollton, High Point Sls.	214-446-0406
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IL	Palatine, Promark Sys.	708-806-0066
LA	New Orleans, Butler & Land	504-734-8888
MA	Middleboro, Glynn Elec.	508-947-4262
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NC	Burlington, AC DC Elctrns.	919-226-0496
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PA	Narberth, Power Modules	215-668-0664
PA	Yeadon, Y-L Prods.	215-583-2800
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TX	Houston, Butler & Land	713-896-0808

DOVA CONTROLS, 4052 148th Ave. N.E., Redmond, WA 98052-5165, Tel: 206-881-7414, FAX: 206-861-8080; Empl.: 6; *Sls. Mgr.:* Phil Johnson

DOVER ELECTRONICS MANUFACTURING, Kirkwood Industrial Park, P.O. Box 5212, Binghamton, NY 13902-5212, Tel: 607-772-7563, 1-800-PWB-ASSY, TWX: 510-252-1990, FAX: 607-772-9274; Empl.: 371; *Sls. Mgr.:* Robert P. Egan ..... **D•2234**

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FL	Longwood, Southern Mktg. Assocs.	407-682-7317
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MO	Maryland Hts., Dytec/South, Inc.	314-739-0665
KS	Lenexa, Dytec/South, inc.	913-888-0215
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MD	Ellicott City, VPI, Inc.	301-461-2525
MA	Chelmsford, Matrix Sls. Inc.	508-459-4000
MA	Lowell, Matrix Sls., Inc.	508-459-4000
MN	Bloomington, Bill Deming & Assocs.	612-888-5000
MO	Maryland Hgts., Dytec/South, Inc.	314-739-0665
NY	Hartsdale, Spectrum Sls. Inc.	914-472-8600
NY	Rochester, Lamb Comps., Inc.	716-272-7720
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OH	Dayton, Delta Sls.	513-435-9735
OH	Miamisburg, Elctrns. Comps.	513-866-3340
PA	Spring City, W. M. Assocs. Inc.	215-948-0505
TX	Garland, Carey, McMahill & Assoc.	214-681-1414
WA	Kirkland, Anzak Corp.	206-822-1510
Can	Nepean, Ont., Dynasty Comps.	613-723-0725

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DOWTY AVIONICS, 300 E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-445-5955, FAX: 818-447-0880; FSC No.: 10412; Empl.: 164; *Sls. Mgr.:* Robert Taylor; *Dist. Mgr.:* Mgr. Business Dev.

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DOWTY INTERCONNECT, Dowty Electronic Components LTD, Knaves Beech Business Centre, Loudwater, High Wycombe, Bucks, ENGLAND HP10 9UT, Tel: 0-628-810810, TELEX: 846874 DEI UKG, FAX: 0-628-810813

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GA	Atlanta, L. & D., Inc.	404-395-7079
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MA Boston, Sager Elctrns. 617-749-6700
MA Boston, Schaal Assocs. Inc. 617-272-2940
MI Ann Arbor, Bell Inds. 313-971-9093
MI Ann Arbor, Capstone Elctrns. 800-388-2277
MN Minneapolis, Aero-Space Computer Supp. 612-884-4725
MO Aero-Space Computer Supp. 800-234-4725
MO Capstone Elctrns. 800-388-2277
NE Aero-Space Computer Supp. 800-234-4725
NE Capstone Elctrns. 800-388-2277
NH Salem, Capstone Elctrns. 800-388-2277
NH Salem, Sager Elctrns. 603-898-1348
NJ East Brunswick, Almo Elctrns. 201-613-0200
NJ Fairfield, Deanco Inc. 201-575-7960
NJ Marlton, Sager Elctrns. 609-964-0830
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Capstone Elctrns. 800-388-2277
NM Minneapolis, Capstone Elctrns. 800-388-2277
NY Farmingdale, Bell Inds. 516-752-9303
NY Farmingdale, Capstone Elctrns. 800-388-2277
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Hauppauge, Schaal Assocs., Inc. 516-434-7100
NY Ithaca, Deanco, Inc. 607-257-4444
NY Ronkonkoma, Conco Elctrns. 516-467-8200
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Capstone Elctrns. 800-388-2277
NC Raleigh, Deanco, Inc. 919-851-2065
NC Raleigh, Sager Elctrns. 919-850-9550
OH Akron, AESCO Elctrns. 216-762-8818
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Capstone Elctrns. 800-388-2277
OK Capstone Elctrns. 800-388-2277
OK Norvell Elctrns. 918-254-8606
OR Beaverton, Acacia/Deanco 503-646-3377
OR Beaverton, Capstone Elctrns. 800-388-2277
OR Beaverton, Component Resources Inc. 503-641-8488
OR Lake Oswego, Bell Inds. 503-635-6500
PA Philadelphia, Almo Elctrns. 215-698-4000
PA Philadelphia, Capstone Elctrns. 800-388-2277
PA Philadelphia, Sage Elctrns. 215-464-4336
PA Pittsburg, Almo Elctrns. 412-931-5990
TX Austin, Norvell Elctrns. 512-837-5555
TX Dallas, Bell Inds. 214-690-0466
TX Dallas, Capstone Elctrns. 800-388-2277
TX Dallas, Force Elctrns. 214-247-9955
TX Dallas, Norvell Elctrns. 214-233-0020
TX Houston, Force Elctrns. 713-561-8644
TX Houston, Norvell Elctrns. 713-777-1666
UT Salt Lake City, Bell Inds. 801-255-9611
UT Salt Lake City, Capstone Elctrns. 800-388-2277
VA Capstone Elctrns. 800-388-2277
VA Deanco, Inc. 800-444-4603
VA Virginaia Elec. 804-296-4184
WA Kent, Components Resources 206-454-8866
WA Seattle, Acacia/Deanco Elctrns. 206-881-5566
WA Seattle, Bell Inds. 206-451-3883
WA Seattle, Capstone Elctrns. 800-388-2277
WI Milwaukee, Aero-Space Computer Supp. 800-231-4725
WI Milwaukee, Belford Inds. 800-323-1231
WI Milwaukee, Bell Inds. 414-547-8897
WI Milwaukee, Capstone Elctrns. 800-388-2277

DUPONT ELECTRO-OPTIC PRODUCTS, Dupont Electronics, P.O. Box 13625, Research Triangle Park, NC 27709, Tel: 1-800-888-LAN1, 919-481-5100, FAX: 919-481-0753; Empl.: 60; *Sls. Mgr.:* Glenn R. Constable

DUPREE, INC., 14395 Ramona Ave., Chino, CA 91710, Tel: 714-597-4889, FAX: 714-597-3043; Empl.: 65

DURACELL®

FAX: 203-791-3273

DURACELL INC.: OEM SALES & MARKETING, Berkshire Industrial Park, Bethel, CT 06801, Tel: 203-791-3274, TELEX: 6972165; Empl.: 8000; *Sls. Mgr.:* R. D'Alessandro ..... **D•1439-1443**

Local Sales Offices & Reps
CA Irvine, Duracell Inc. 714-476-1811
CT Southbury, Duracell Inc. 203-264-3935
IL Oak Brook, Duracell Inc. 708-954-2714

Local Distributors
CA Costa Mesa, Battery Specialties Inc. .. 714-755-0888
CA Mtn. View, Energy Sls. Inc. 415-969-0800
CA San Diego, Tauber Elctrns. Inc. 619-274-7242
CO Englewood, AVT, Inc. 303-798-1958
IL Downers Grove, Telecommunication Dvcs. 312-971-3460
MA Sharon, Adcour 617-784-8123
MN St. Paul, DC Battery Prods. 612-646-7478
NY Bohemia, Battery Assemblers, Inc. 516-567-8855
NY Commack, Bren Tronics Inc. 516-499-5155
NY Mt. Kisco, Multiplier Inds. Corp. 914-241-9510
NC Winston Salem, Progressive Technlgs., Inc. 919-761-1375
TX Stafford, Southwest Elctrns. Inc. 713-240-4000
WA Redmond, Energy Sls. Inc. 206-883-2343

DURAKOOL, INC., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, Tel: 219-264-1116, TELEX: 25-8482, FAX: 219-264-4681; Empl.: 230; *Sls. Mgr.:* Julian Wills ..... **B•1683**

Local Sales Offices & Reps
AZ Mesa, H-D Assocs., Inc. 602-784-2944
CA Canoga Parkk, C & W Comp. Sls. 818-700-2684
CA Sunnyvale, Pass Assocs. 408-735-9040
CO Littleton, Harthun Assocs. 303-795-5545
FL Clearwater, J. J. Galleher Co. 813-461-7706
GA Smyrna, Tech Controls, Inc. 404-333-9883
IN Mishawaka, Power Comps. of Midwest 219-256-6630
IA Davenport, Volco Co. 319-326-5233
KS Overland Park, R. Greene Co. 913-492-6886
MA Hingham, Hingham Bay Corp. 617-740-1900
MI Novi, Advanced Controls & Technlg. .. 313-349-0260
MN Minneapolis, Volco Co. 612-933-6631
MS Corinth, World Dists. 205-533-9108
MO St. Louis, R. Greene Co. 314-994-0222
NE Omaha, Volco Co. 402-346-2203
NY Buffalo, Niagara Elec. Sls. Co. 716-825-3100
NY Wantagh, DONY Tech. Sls. 516-826-5550
NC Pineville, Mel Sls. 704-541-5750
OH Parma, Orr Assocs. 216-871-1800
OR Portland, Branom Instr. Co. 503-283-2555
PA Narberth, Power Modules Inc. 215-668-0664
TX Dallas, Dawson & Assoc. 214-241-3843
UT Salt Lake City, Western Controls 801-292-5900
WA Bothell, Temco N.W. 206-481-6150

Local Distributors
CA Burlingame, Campbell & George 415-697-2965
IN Mishawaka, Power Comps. of Midwest 219-256-6630
PA Narberth, Power Modules 215-839-1331

DUREL CORPORATION, Affiliate of 3M & Rogers Corp., 645 W. 24th St., Tempe, AZ 85282, Tel: 602-731-6200, FAX: 602-731-6210

DURGIN & BROWNE, See Tridyne Process Systems, DBI Inds.

DUTEC, INC., 4801 James McDivitt, P.O. Box 964, Jackson, MI 49204-0964, Tel: 800-248-1632, FAX: 517-750-4740; *Sls. Mgr.:* Bruce Reynolds, Gen. Mgr.

DY-4 SYSTEMS INC., 21 Credit Union Way, Nepean, Ont, Canada K2H 9J4, Tel: 613-596-9911, TELEX: 0534111, FAX: 613-596-0574; Empl.: 280; *Sls. Mgr.:* Mitch Robinson

DYLON GRAPHITE COMPANY, Dylon Industries, Inc., 7700 Clinton Rd., Cleveland, OH 44144, Tel: 216-651-1300, FAX: 216-651-1777; Empl.: 45; *Sls. Mgr.:* L.C. Eucher

DYMEC INC., 8 Lowell Ave., Winchester, MA 01890, Tel: 617-729-7870, TELEX: Hank Diamond; Empl.: 50; *Sls. Mgr.:* Hank Diamond ..... **D•1241**

DYNACAST INC., 1401 Front Street, Yorktown Heights, NY 10598, Tel: 914-962-6300, TELEX: 6716096, FAX: 914-245-7185; Empl.: 150

DYNACIRCUITS INC., 11230 W. Addison, Franklin Park, IL 60131, Tel: 708-451-1700, FAX: 708-451-9266; Empl.: 300; *Sls. Mgr.:* Dennis A. Dworzak

DYNAGE/CONTROLS, INC., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3487, TELEX: 753243 (OAKLEAFINC), FAX: 605-296-3231; Empl.: 12; *Sls. Mgr.:* Sidney C. Oakleaf

DYNAGE Power

FAX: 605-296-3231

DYNAGE/POWER & MAGNETICS, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3462/3487, TELEX: 753243 (OAKLEAFINC); FSC No.: 9Y852; Empl.: 25; *Sls. Mgr.:* Sidney C. Oakleaf ..... **A•2201-2204; D•1708-1710**

DYNALLOY, INC., 18662 MacArthur Blvd., Ste.103, Irvine, CA 92715, Tel: 714-476-1206, FAX: 714-476-3167; Empl.: 25

DYNALOY, INC., 7 Great Meadow La., Hanover, NJ 07936, Tel: 201-887-9270, FAX: 201-887-3678; FSC No.: 27908; Empl.: 19; *Sls. Mgr.:* Jay Parton

Local Sales Offices & Reps

CA	Westminster, Contronic Devices	714-897-2266
CO	Commerce City, WACO	303-289-4743
MA	Newbury Port, William MacDonald	617-465-2768
MA	Waltham, Etchomatic	617-893-2020
MN	Minneapolis, International Sls.	612-831-8423
EXP	South Orange, NJ, K.L. Intl.	201-762-8299

DYNAMIC AIR ENGRG., INC., 620 E. Dyer Rd., Santa Ana, CA 92705-5697, Tel: 714-540-1000, FAX: 714-545-9145; FSC No.: 4140-6105; *Sls. Mgr.:* Carl A. Grisier

DYNAMIC POWER SYSTEMS, Div. Onset International Corp., 12 Sunhill Road, Nesconset, NY 11767-2611, Tel: 516-361-6771, FAX: 516-361-6361; Empl.: 50; *Sls. Mgr.:* Michael Allen

DYNAMICS, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-998-8281, TELEX: 69-6171, FAX: 818-407-1320; Empl.: 100; *Sls. Mgr.:* Tony Mastroianni

DYNAMICS RESEARCH CORP., Encoder Division, 60 Concord St., Wilmington, MA 01887-2193, Tel: 508-658-6100, FAX: 508-658-0522; Empl.: 125; *Sls. Mgr.:* Joe Portada

DYNAPAR, 1675 Delany Rd., Gurnee, IL 60031, Tel: 312-662-2666, TWX: 910-235-1865; Empl.: 150

DYNAPOWER CORPORATION, Box 3180, Farmington Hills, MI 48333, Tel: 313-553-4300, FAX: 313-553-9096,802-864-3782; Empl.: 75 ..... **D•1712-1713**

DYNAPOWER CORPORATION, Box 9210, S. Burlington, VT 05407, Tel: 802-860-7200, FAX: 802-864-3782; Empl.: 100; *Sls. Mgr.:* William E. Feil ..... **D•1712-1713**

DYNAROLL CORPORATION, 551 Fifth St., San Fernando, CA 91340, Tel: 818-837-3456, FAX: 818-837-3466; *Sls. Mgr.:* Roy Wilson; *Dist. Mgr.:* Molly Kosmak

DYNATECH COMPUTER COMPANY, 280 Bernardo Ave., P.O. Box 7400, Mountain View, CA 94039-7400, Tel: 415-964-7400, TWX: 910-379-6988, FAX: 415-969-3350; Empl.: 49; *Sls. Mgr.:* Chris Lynch; *Dist. Mgr.:* Anita Williams

DYNATECH COMPUTER POWER, INC., 5800 Butler Ln., Scotts Valley, CA 95066, Tel: 408-438-5760, TELEX: 887-247, FAX: 408-438-5793; FSC No.: 7045

DYNISCO, 4 Commerical St., Sharon, MA 02067, Tel: 617-784-8400, TELEX: 174-292, FAX: 617-784-2902; FSC No.: 15687; Empl.: 153; *Sls. Mgr.:* Warden B. Hunt

DYTRONICS CO., See Ryan Intl. Corp.

DZUS FASTENER, 425 Union Blvd., W. Islip, NY 11795, Tel: 516-669-6000, FAX: 516-669-0785; FSC No.: 72794; Empl.: 140; *Sls. Mgr.:* Stephen Meshover

EAGLE ELECTRIC MFG. CO. INC., 45-31 Court Square, Long Island City, NY 11101, Tel: 718-937-8000, FAX: 718-482-0160; Empl.: 3000; *Sls. Mgr.:* Joseph Mannarino; *Dist. Mgr.:* Bob Lofgren

EAGLE MAGNETIC COMPANY, INC., P.O. Box 24283, Indianapolis, IN 46224, Tel: 317-297-1030, FAX: 317-299-1323; Empl.: 44; *Sls. Mgr.:* Robert Jackson ..... **C•1689**

Local Sales Offices & Reps

FL	Jupiter, Cherry Assocs.	305-746-4591
FL	Oviedo, Lighthouse Mktg.	407-366-0073
GA	Roswell, Electro Comp. Sls.	404-992-2344
KS	Wichita, Lorenz Sls.	316-721-0500
ME	Bethel, Shain Assoc.	207-836-3200
MD	Hingham, Shain Assoc.	617-740-2334
MD	Kensington, Koebert Assoc.	301-493-8924
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
MO	St. Louis, Lorenz Sls.	314-997-5829
NE	Lincoln, Lorenz Sls.	402-475-4660
NH	Nashua, Shain Assoc.	603-881-4881
NY	Commack, R.C. Engrg.	516-543-3325
PA	Glenside, Koebert Assocs.	215-576-1329
WA	Kirkland, Northwest Comp. Sls.	206-828-2104
WA	Vancouver, Northwest Comps.	206-695-1331
WV	Inwood, Koebert Assoc.	304-229-8401

EAGLE-PICHER, Box 47, Joplin, MO 64801, Tel: 417-623-8000, TWX: 910-774-4508, FAX: 417-623-8000; Empl.: 700 ..... **D•1444-1450**

EAGLE-PICHER, P.O. Box 130, Bethel Road, Seneca, MO 64865, Tel: 417-776-2256, FAX: 417-776-2257; FSC No.: 3L498; Empl.: 400; *Sls. Mgr.:* H. M. York; *Dist. Mgr.:* H. M. York ..... **D•1444-1447**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AR	Hot Springs, Automation Supp. Inc. (ASI)	501-767-5444
CA	San Jose, O'Donnell Assocs.-North	408-263-6500
CA	Torrance, O'Donnell Assoc.	213-539-9664
CO	Broomfield, Connors Co.	303-466-9628
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Longwood, NSL Assocs., Inc.	305-629-5226
GA	Atlanta, L & D Inc.	404-395-7079
IL	Downers Grove, Golten Assocs.	708-512-0093
KS	Overland Park, Spectrum Sls.	913-648-6811
MA	Westboro, Zaslow Sls. Co.	617-393-8150
MI	Livonia, Electro-Mktg. Grp., Inc.	313-421-7590
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Londonderry, Zaslow Sls. Co.	603-432-8907
NY	Massapequa Pk., HC Assocs.	516-541-0262
NY	Morrisville, Naylor Elec. Co.	315-684-9620
NC	Raleigh, L & D Inc.	919-876-5301
OH	Dayton, Electro-Mktg. Grp., Inc.	513-890-8322
OH	Dayton, Lyons Corp.	513-278-0714
OR	Beaverton, Pacific Mktg. Spec.	503-641-9373
PA	Exton, Kiley Elec. Co.	215-363-8550
TX	Dallas, Rem Air Comps.	214-234-1069
VA	Richmond, L & D Inc.	804-359-0125
WA	Redmond, Pacific Mktg. Spec.	206-882-3144

Local Distributors

AK	Anchorage, Frigid North Co.	907-561-4633
AZ	Tempe, Lynntronics	602-433-0288
AR	Hot Springs, Automation Supp. Inc.	501-767-5444
CA	Anaheim, Carefree Unltd.	714-630-3433
CA	Mountain View, The Power Source	415-960-0700
CO	Denver, Hensley	303-455-3643
FL	Dunedin, Battery Powered Lighting & Sys.	813-734-9498
GA	Smyrna, Mark C. Pope Assocs.	404-435-2471
IN	Muncie, Sealed Energy	317-358-4749
KS	Wichita, RSC Elctrns.	316-267-5213
LA	New Orleans, William B. Allen	800-535-9593
MA	Hingham, Sager Elctrns.	617-749-6700
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
OH	Cincinnati, M & B Battery	513-385-5900
PA	Bensalem, Scotts Emergency Lighting	215-639-1777
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-320-0294
TX	Houston, Wofford Elctrns.	713-847-3583
UT	Salt Lake City, Standard Supp. Co.	801-846-3371
WA	Seattle, Radar Electric	206-282-2511
WI	Milwaukee, Battery Shop	414-384-5410
Can	Mississauga, Ont., Battery Tech.	416-670-7373
Can	New Westminster, B.C., Magnacharge Battery	604-525-0391

EAGLE SIGNAL CONTROLS:A MARK IV INDS. CO., 8004 Cameron Rd., Austin, TX 78753, Tel: 512-837-8300, FAX: 512-837-8486; Empl.: 3000; *Sls. Mgr.:* Patrick Short

EAGLE WICHITA

FAX: 316-942-5190

EAGLE WICHITA, P.O. Box 9446, Wichita, KS 67277, Tel: 316-942-5100 ..... **A•1666-1669**

Local Sales Offices & Reps

AZ	Mesa, Sedco	602-461-9069
MA	BrainTree, Lancer Assocs.	617-849-3083

EALING ELECTRO-OPTICS, New Englander Industrial Park, Holliston, MA 01746, Tel: 508-429-8370, 1-800-343-4912, FAX: 508-429-7893; *Sls. Mgr.:* Brian Gaynor

E & L INSTRUMENTS, Interplex Electronics, Inc., 70 Fulton Terrace, New Haven, CT 06512, Tel: 800-368-0880, FAX: 203-468-0060; Empl.: 70; *Sls. Mgr.:* Katina Boulais

EAO SWITCH CORP., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, Tel: 203-877-4577, TELEX: 96-4347, FAX: 203-877-3694; FSC No.: 61706; Empl.: 19; *Sls. Mgr.:* George T. Bracci ..... **B•1684-1685**

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg. Co. of AZ	602-949-9333
CA	Los Gatos, Luscombe Engrg. Co. of S.F.	408-370-2020
CA	Montrose, Luscombe Engrg. Co. of L.A.	818-249-9000
CA	San Diego, Luscombe Engrg. Co. of S.D.	619-292-4323
CO	Longmont, Luscombe Engrg. Co. of CO	303-772-3342
CT	Bethel, Ray Perron & Co.	203-798-0261
CT	Waterbury, Ray Perron & Co., Inc.	203-756-9684
FL	Tampa, Florida Comp. sls.	813-873-3622
GA	Norcross, Mtn. Electro Mktg.	404-448-5594
IL	Arlington Hgts., Brainard-Nielsen Mktg., Inc.	708-437-2700
IN	Ft. Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Greenwood, M/S Sls. & Assocs.	317-881-0110
IA	Cedar Rapids, Delltron Co., Inc.	319-393-0075
MD	Columbia, Delta III Assocs., Inc.	301-730-4700
MA	Needham, Ray Perron & Co., Inc.	800-225-4280, 617-449-6162
MI	Plymouth, Jay Mktg. Assocs., Inc.	313-459-1200
MN	Golden Valley, Highland Elctrn. Sls.	612-546-2123
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Gladstone, Delltron Co., Inc.	816-436-6445
NM	Albuquerque, Luscombe Engrg. Co.	505-888-0333
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NY	Rochester, Apex Assocs., Inc.	716-272-7040
NC	Raleigh, C-Tech Sls., Inc.	919-782-8100
OR	Lake Oswego, Luscombe Engrg. Northwest	503-636-6664
PA	Horsham, Jacobsen Assocs.	215-674-2937
PA	Pittsburgh, R. W. Kneip	412-823-0169
TX	Dallas, Glidden Electro Equip. Co	214-341-0610
TX	Houston, Glidden Electro Equip. Co.	713-681-1415
UT	Midvale, Luscombe Engrg. Co.	801-565-9885
WA	Bellevue, Luscombe Engrg. N.W.	206-223-1541
WI	Mequon, Badgerep	414-241-9200

Local Distributors

AZ	Phoenix, Minarik Elec.	602-233-3000
AZ	Scottsdale, Electronic Supp.	1-800-622-3726
CA	Anaheim, Minarik Elec. Co.	714-994-2251
CA	Fremont, KEA Elctrns.	415-651-2600
CA	Gardena, California Switch & Sig.	213-770-2330
CA	Glendale, Minarik Elec. Co.	818-507-6500
CA	Riverside, Electronic Supp.	714-683-7300
CA	S. San Francisco, Bell Elctrl. Supp.	415-589-7055
CA	Salinas, Bell Elctrl. Supp.	408-758-6110

CA San Diego, Electronic Supp. 619-693-8222
CA San Diego, Minarik Elec. Co. 619-560-6632
CA San Jose, Electronic Supp. 408-453-3770
CA Santa Clara, Bell Elctrl. Supp. 408-727-2355
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CA Sunnyvale, Target Elctrns., Inc. 408-733-0384
CO Commerce City, Minarik Elec. Co. 303-289-5800
CO Denver, CSID, Inc. 303-292-9594
CT Wallingford, Sager Elec. Supp. co. 203-265-4600
FL Lakeland, Wes-Garde/Switch Controls, Inc. 813-644-7564
FL Orlando, Sager Elctrns. 407-240-3114
FL Oviedo, Dixie Sls. 407-365-5211
FL Pompano Beach, Control Design Supp., Inc. 305-782-1331
GA Atlanta, Motion Elctrns. 404-455-8262
IL Crystal Lake, Sub-Sem, Inc. 815-459-4139
IL Elk Grove, Martec Assoc. 708-956-8090
IL Rosemont, Advent Elctrns., Inc. 708-297-6200
IL Schaumburg, Marsh Elctrns. 708-240-9290
IL Schaumburg, Minarik Elec. Co. 708-885-9337
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Mar Elctrns. 317-633-6699
IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
KS Wichita, Radio, Inc. 316-264-2798
KY Louisville, Peerless Elctrns. 502-637-7674
LA Baton Rouge, Menard Elctrns. 504-355-0323
LA New Orleans, Menard Elctrns. 504-734-8445
ME W. Buxton, Nelson & Wright 207-929-8238
MD Columbia, Sager Elctrns. 301-995-6580
MD Gaithersburg, Axis Elctrns. 301-840-9640, 800-492-3190
MD Jessup, Treeko Sls. 301-792-0112
MA Canton, Richey Impact Elctrns. 617-821-1500
MA Hingham, Sager Elec. Supp. Co. 617-749-6700
MA N. Billerica, Minarik Elec. Co. 508-663-0740
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Grand Rapids, R. M. Elctrns. Co. 616-531-9300
MI St. Claire Shores, SPEMCO Switches 313-771-2700
MN Fridley, Voyager Elctrns. 612-571-7766
MN Minneapolis, Electronic Ctr., Inc. 612-378-2442
MO St. Louis, Beckwith, Inc. 314-343-6463
NH Salem, Sager Elec. Supp. Co. 603-898-1348
NJ Cranford, Garden State Indl. Elctrns., Inc. 201-272-6400
NY Bohemia, Key Comps., Inc. 516-567-7500
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY Hauppauge, Sager Elctrl. Supp. 516-348-1300
NY New York, Martin-Audio/Video 212-541-5900
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rochester, Summit Elctrns., Inc. 716-334-8110
NY Woodside, Switches Unlimited 718-478-5000
NC Charlotte, Dixie Elctrns. 704-377-4348
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195
NC Raleigh, Sager Service Plus 919-850-9550
NC Winston-Salem, Kirkman Elctrns., Inc. 919-722-9131,800-334-8688
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Highland Hgts., Electronics Mktg. Corp. 216-442-3441
OK Tulsa, Radio, Inc. 918-587-9123
OR Portland, Minarik Elc. Co. 503-253-3402
PA Harrisburg, Ad-Tech Elctrns. 717-561-9905
PA Mars, Sager Elctrns. 412-772-2233
PA McKean, Advacom 814-476-7744
PA Norristown, Kimberly-James Co. 215-666-7286
PA Philadelphia, Sager Elctrns. 215-464-4336
PA Pittsburgh, Grant Indl. Controls, Inc. 412-787-9770
PA Wayne, Peak Elctrns. Corp. 215-293-9000
SC Columbia, Dixie Elctrns. 803-779-5332
TX Houston, Minarik Elec. Co. 713-748-0808
TX Irving, Harper S.I.D. 214-621-0500
TX Irving, Minarik Elec. Co. 214-402-8188
WA Redmond, Minarik Elec. Co. 206-885-0832
TX San Antonio, Minarik Elec. Co. 512-822-7097
WA Seattle, Platt Elec. 206-624-4083
WI Milwaukee, Marsh Elctrns. Corp. 414-475-6000

E-A-R SPECIALTY COMPOSITES, Cabot Safety Corp., 7911 Zionsville Rd., Indianapolis, IN 46268, Tel: 317-872-1111, TWX: 810-341-3412; *Sls. Mgr.:* Greg R. Handy

EASCO/K D TOOLS, See Hunter Tools, Easco/K D Tools

EASI FILE CORPORATION, 6 Wrigley St., Irvine, CA 92718, Tel: 714-855-4121, FAX: 714-380-0561; Empl.: 10; *Sls. Mgr.:* Jean A. James

EAST CONTROLS, 6851 Church St., Hanover Park, IL 60103, Tel: 708-837-7709, TELEX: 708-837-6235; Empl.: 1

EASTERN AIR DEVICES, INC., 1 Progress Dr., Dover, NH 03820, Tel: 603-742-3330, FAX: 603-742-9080; Empl.: 150 ..... **B•1254**

Local Sales Offices & Reps
CA Glendale, Electric Motor Engr. 818-502-1866
CA San Jose, Motion Sys. 408-246-0641
CO Boulder, R. G. Entprs. 303-447-9211
FL Winter Park, HHP Assocs. 407-740-0320
KS Shawnee Mission, LSC Co. 913-362-2121
MN Edina, Jay Borman Sls. 612-922-5525
NH Dover, Eastern Air Dvs. 603-742-3330
NJ Ridgefield, Rical Assocs. 201-945-5250
NY Rochester, Elcom Sls. 716-385-1400
NY Syracuse, ELCOM Sls. 315-685-8245
NC Charlotte, Jake Rudisill Assocs. 704-377-6901
OH Cincinnati, KCH Co. 513-931-1686
OR Portland, D.A. Sullivan Co. 503-292-2448
PA Paoli, ETC Sales 215-296-3527
TX Dallas, D.J. Sls. Co. 214-783-8876
TX Richardson, D.J. Sls. 214-783-8876
WI Racine, KMG Sls., Inc. 414-639-9005

Local Distributors
CT Hartford, Bearings, Inc. 203-249-1691
CT No. Haven, Bearings, Inc. 203-288-2201
CT Waterbury, Bearings, Inc. 203-755-3151
ME Auburn, Bearings, Inc. 207-784-3769
ME Bangor, Bearings, Inc. 207-947-6583
MA Avon, Bearings, Inc. 508-584-9200
MA W. Springfield, Bearings, Inc. 413-739-4701
MA Wakefield, Bearings, Inc. 617-246-3906
MA Worcester, Bearings, Inc. 617-852-1050
NH Berlin, Bearings, Inc. 603-752-6001
NH Dover, Bearings, Inc. 603-749-2121
NH Manchester, Bearings, Inc. 603-623-8897
NY Plainview, Controls Sls. Inc. 516-756-5652
NC Charlotte, Motionex 704-377-6901
PA Pittsburgh, EXONIC Sys. 412-784-8400
RI Warwick, Bearings, Inc. 401-732-2600
VT Rutland, Bearings, Inc. 802-775-3550

EASTERN ELECTRONICS MFG. CORP., National Patent Dev. Corp., 180 Roberts St., East Hartford, CT 06108, Tel: 203-528-9821, FAX: 203-289-7639; FSC No.: 203-289-7639; Empl.: 200; *Sls. Mgr.:* Wayne M. Baker

EASTERN MARKING MACHINES, 422 S Franklin St., Hempstead, NY 11550, Tel: 516-483-7070, TELEX: 968095, FAX: 516-483-7071; Empl.: 8; *Sls. Mgr.:* L. Sherman; *Dist. Mgr.:* L. Sherman

EASTERN MICROWAVE, 40 Ray Ave., Burlington, MA 01803, Tel: 617-273-4700; FSC No.: 30616; Empl.: 25; *Sls. Mgr.:* S. C. Lowe

EASTMAN KODAK COMPANY, Motion Analysis Systems Division, 11633 Sorrento Valley Road, San Diego, CA 92121-1095, Tel: 619-535-2908, FAX: 619-481-6254; *Sls. Mgr.:* Don Pike

EAST PENN MANUFACTURING, Lyon Station, PA 19536, Tel: 215-682-6361, FAX: 215-682-4781; Empl.: 2000; *Sls. Mgr.:* Peter Grimes

EASY HEAT WIREKRAFT, See Electrical Systems, Div. of Bristol Corp.

EATON CORP, Durant Products, 901 S. 12th St., Watertown, WI 53094, Tel: 414-261-4070, 800-289-3866, TWX: 910-260-3713, FAX: 414-261-9097; Empl.: 350

EATON CORPORATION, Electric Drives Division, 3122-14th Avenue, Kenosha, WI 53141, Tel: 414-656-4011, TELEX: 910-274-2356, FAX: 414-656-4370; Empl.: Approx. 300

EATON CORP., Electronic Instrument Div., 5340 Alla Rd., Los Angeles, CA 90066, Tel: 213-822-3061, TWX: 910-343-6969; Empl.: 200; *Sls. Mgr.:* Lawrence Caney Jr.

EATON (LORLIN) CORP., See Lorlin, Div. of Axiam, Inc.

EATON CORP./CUTLER-HAMMER PRODS, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216, Tel: 414-449-7487, TELEX: 26-716, FAX: 414-449-6760; FSC No.: 81640; *Sls. Mgr.:* Bernard C. Hay

Local Sales Offices & Reps
CA Los Angeles, Eaton Corp./A & CCD 714-548-8553
CA San Francisco, Eaton Corp./A & CCD 415-967-0606
FL Tampa, Eaton Corp./A & CCD 813-628-4717
GA Atlanta, Eaton Corp./A & CCD 404-394-0911
IL Chicago, Eaton Corp./A & CCD 708-530-7980
KS Kansas City, Eaton Corp./A & CCD 913-384-0081
MD Baltimore, Eaton Corp./A & CCD 301-296-9640
MA Boston, Eaton Corp./A & CCD 617-863-5427
MI Detroit, Eaton Corp./A & CCD 313-354-7513
MN Minneapolis, Eaton Corp./A & CCD 612-831-8668
NJ Mt. Laurel, Eaton Corp./A & CCD 609-778-1100
NY Long Island, Eaton Corp./A & CCD 516-864-6065
OH Cleveland, Eaton Corp./A & CCD 216-835-4554
OH Dayton, Eaton Corp./A & CCD 513-294-1877
Can Burnaby, B.C., Solution Elctrns. Ltd. 604-439-9004
TX Dallas, Eaton Corp./A & CCD 214-386-4121
WA Seattle, Eaton Corp./A & CCD 206-946-5157
WI Milwaukee, Eaton Corp./A & CCD 414-449-6709
Can Scarborough, Ont., Eaton Ltd. 416-291-2563

EBERHARD MFG. CO., DIV., Eastern Co., 21944 Drake Rd., Strongsville, OH 44136, Tel: 216-238-9720, FAX: 216-572-2732; FSC No.: 19220; *Sls. Mgr.:* Edward Hongosh

EBG-ELEKTRONISCHE BAUELEMENTE, Gesellschaft m.b.H., 8082 Kirchbach 384, Austria, Tel: (43) 03116 2625, TELEX: 312540, FAX: 43/3116/27540; Empl.: 63; *Sls. Mgr.:* Mag. G. Klauser

EBM INDUSTRIES, INC., 110 Hyde Road, Farmington, CT 06034, Tel: 203-674-1515, TWX: 710-423-8723, FAX: 203-674-8536; FSC No.: 62292; *Sls. Mgr.:* Robert Sobolewski ..... **C•1612-1613**

Local Sales Offices & Reps
AL Huntsville, Cartwright & Bean 205-830-1540
AZ Phoenix, C.T. Carlberg 602-468-0750
CA Los Angeles, Wiley Co. 213-666-1611
CA San Diego, Wiley Co. 619-453-9018
CA Santa Clara, Ross Mktg. Assocs. 408-988-8111
CO Littleton, Simpson Assocs. 303-794-8381
CT Clinton, Selmark Assocs. 203-573-9088
FL Apopka, Cartwright & Bean 407-889-9100
FL Deerfield, Cartwright & Bean 305-429-3400
GA Norcross, Cartwright & Bean 404-368-0160
IL Chicago, Vogel & Assoc. 708-286-6833
IL Itasca, Beta Technlg. Sls. 708-250-9586
IN Greenwood, Liberty Sls. 317-888-8396
IN Noblesville, Powercon 317-773-7745
KS Overland Park, Web Elctrns. 913-381-7986
MD Baltimore, Bramman Co. 301-367-9111
MA Millis, Selmark Assocs. 508-376-2914
MI Warren, Burcaw Co. 313-573-4605
MN St. Paul, Arkco Sls. 612-777-7454
MS Jackson, Cartwright & Bean 601-981-1170
MO Florissant, Web Elctrns. 314-921-5720
NH Hopkinton, Selmark Assocs. 603-746-3299
NJ Marlton, b.g.r. Assocs. 609-983-1020
NM Albuquerque, C.T. Carlberg 505-899-2155
NY Buffalo, NRM Mktg. Grp. 716-634-4300
NY Franklin Sq., Cooper-Simon & Co., Inc. 516-489-4636
NY Skaneateles, NRM Mktg. Grp. 315-685-8991
NC Raleigh, Cartwright & Bean 919-876-4130
OH Kettering, Versatron 513-293-8506
OH Willoughby Hills, Versatron 216-944-0082
OR Hillsboro, Temco Northwest 503-645-2030
TN Knoxville, Cartwright & Bean 615-693-7450
TN Memphis, Cartwright & Bean 901-362-8345
TX Austin, Bonser-Philhower Sls. 512-346-9186
TX Houston, Bonser-Philhower Sls. 713-782-4144
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Midvale, Simpson Assocs. 801-566-3691
VA Birch Bay, Temco Northwest 206-371-0423
VA Chantilly, Colrud 703-904-0240
WA Bothell, Temco Northwest 206-481-6150
WA Spokane, Temco Northwest 509-927-9392
WI Milwaukee, Beta Technolg. Sls., Inc. 414-543-6609
PR Bayamon, Selmark 809-797-9176

Local Distributors
AL Huntsville, Powell Elec. 205-837-5300
AK Anchorage, Alaska Elctrns. 907-563-3774
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Tucson, Southwest Sls. 602-628-1613
CA Anaheim, Deco Elec. 714-630-8252
CA Costa Mesa, Powell 714-754-1717
CA Hollywood, Yale Elctrns. 213-465-3186
CA Irvine, Integrated Elctrns. 714-837-9960
CA Sacramento, Integrated Elctrns. 916-363-6030
CA San Diego, Deco Elctrns. 619-693-1595
CA San Diego, Pyramid 619-271-5404
CA San Jose, Integrated 408-435-1000
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Powell Elec. 408-943-9020
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Sunnyvale, Power Supply Comps. 408-737-1333
CA Torrance, Pyramid 213-320-2700
CO Denver, Integrated Elctrns. 303-292-6121
CO Denver, Integrated Elctrns. 303-292-5537
CO Wheat Ridge, Added Value 303-422-1701
CT Danbury, Pilgrim Elctrns. 203-792-7274
CT E. Haven, J. V. Elctrns. 203-469-2321
CT Southbury, Heilind Elctrns. 203-262-1700
CT Wallingford, Cronin Elec. 203-265-3134
CT Yalesville, Glynn Elctrns. 203-265-2498
FL Ft. Lauderdale, Powell Elec. 305-484-8377
FL Largo, Electronic Precepts 813-544-3636
GA Atlanta, ACK Radio Supp. 404-351-6340

GA	Fayetteville, Frankland	404-461-4026
IL	Chicago, Leeds Elctrns. Comps.	708-625-3800
IL	Hoffman Estates, I.E.C. Intercomp	708-843-2040
IL	Rosemont, Advent Elctrns.	708-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Chelsea/RS Elctrns.	317-253-9065
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Overland Park, Chelsea/RS Elctrns.	913-362-1923
KY	Florence, U.R.I. Elctrns.	606-371-4423
MD	Annapolis Jct., Powell Elctrns.	301-880-3255
MD	Baltimore, Resco/Baltimore	301-931-8200
MD	Beltsville, Resco/D.C.	301-937-9100
MD	Columbia, Peerless Radio	301-997-1717
MA	Canton, Richey Impact	617-821-1500
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Needham, Cronin	617-449-5000
MA	Westborough, Powell	508-366-6100
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, Chelsea/RS Elctrns.	616-241-3483
MI	Grand Rapids, S.F. Elctrns.	616-459-0216
MI	Livonia, Chelsea/RS Elctrns.	313-525-1155
MN	Minneapolis, Control Des. Supp.	612-721-1628
MN	Plymouth, Leeds Elctrn. Comps.	612-557-1277
MO	Kansas City, L Comp	816-221-2400
MO	Maryland Hgts., Chelsea/RS Elctrns.	314-997-7709
MO	Maryland Hgts., L Comp	314-291-6200
MO	St. Louis, Control Design Supply	314-426-3150
NH	Manchester, Cronin	603-624-0105
NH	Manchester, Glynn Elctrns.	603-622-8131
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Englewood, Powell Elec.	201-890-0010
NJ	Rockaway, Tonar	201-586-9000
NJ	W. Berlin, General Comps.	609-768-6767
NM	Albuquerque, Betatron	505-821-1122
NY	Falconer, Falconer Elctrns.	716-665-4176
NY	Hauppauge, Addem Distbg. Grp.	516-273-6777
NY	Hauppauge, Broadline Elec. Distr.	516-231-4100
NY	Hauppauge, Chelsea/RS Elctrns.	516-231-3313
NY	Hicksville, Janesway Elctrns.	516-935-1827
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Mt. Vernon, Janesway Elctrns.	914-699-6710
NY	Rochester, Simcona	716-328-3230
NY	Suffern, Nobel Elctrns.	914-357-4500
NY	Syracuse, Stewart W. Smith	315-437-7836
NC	Boone, I.R.S./Tresco	704-264-8861
NC	Cary, Powell Elec.	919-467-1212
NC	Raleigh, Century	919-782-2116
OH	Akron, Akron Elctrns.	216-762-8818
OH	Broadview Hgts., Related Comps.	216-838-4838
OH	Cincinnati, Chelsea/RS Elctrns.	513-793-2450
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Dayton, Related Comps.	513-253-6116
OH	Maumee, Chelsea/RS Elctrns.	419-893-0721
OH	Stow, Advacom Inc.	216-688-5311
OR	Beaverton, Integrated Elctrns.	503-641-1690
PA	Export, Advacom	412-733-5400
PA	Malvern, Control Design Supp.	215-296-0150
PA	McKean, Advacom/Erie	814-476-7774
PA	Norristown, Century Elctrn. Comp. Co.	215-631-5400
PA	Philadelphia, Powell	215-365-1900
TN	Saddy Daisy, Techni-Tronics	615-332-2119
TX	Austin, Omni Pro Elctrns.	512-794-9200
TX	Dallas, Omni Pro Elctrns.	214-233-0500
TX	Houston, Kent Elctrns.	713-780-7770
TX	Irving, Powell Elctrns.	214-550-0547
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
UT	West Valley, Integrated Elctrns.	801-977-9750
WA	Bellevue, Integrated Elctrns./Jaco	206-455-2727
WA	Redmond, Pyramid Elctrns.	206-883-7200
WA	W. Seattle, Radar Elctrns.	206-282-2511
WI	Mequon, Taylor Elec. Co.	414-241-4321
WI	Milwaukee, Progressive Image	414-321-4722
WI	New Berlin, Control Design Supp.	414-784-1015

EBY COMPANY, 4300 H Street, Philadelphia, PA 19124, Tel: 215-537-4700, FAX: 215-537-4780; FSC No.: 72825; Empl.: 75; *Sls. Mgr.:* Alan S. Olshansky

ECLYPSE INTERNATIONAL CORP., 2042 S. Grove Ave., Ontario, CA 91761-9925, Tel: 714-947-8839, FAX: 714-947-9395; Empl.: 9; *Sls. Mgr.:* Christopher J. Gilbert; *Dist. Mgr.:* Christopher J. Gilbert

ECOSOFT, INC., 8295 Indy Court, Indianapolis, IN 46214, Tel: 317-271-5551, FAX: 317-271-5561; Empl.: 2; *Sls. Mgr.:* Emma Alkire

ECS COMPOSITES

FAX: 503-474-2479

ECS COMPOSITES, 3560 Rogue River Hwy., Box 188, Grants Pass, OR 97526, Tel: 503-476-8871, TWX: 510-755-0777; FSC No.: 24995; Empl.: 165; *Sls. Mgr.:* Jill K. Gleysteen ..... **C•1027**

Local Sales Offices & Reps

AL	Huntsville, EMA	205-830-4030
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
CA	Mtn. View, Kim Buurma	415-962-9027
CO	Englewood, Electronic Comp. Sys.	303-762-9576
FL	Largo, Burke Assocs. Inc.	818-536-4335
IL	Wilmette, Joel Wasserman Assocs.	708-256-3566
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Westwood, Apex Assocs.	617-326-5042
MN	Minneapolis, MS J Mktg., Inc.	612-755-1685
NY	New York City, Smith Engrg. Sls.	516-689-6514
OH	Cleveland, Ashby Assocs., Inc.	216-461-0826
OR	Grants Pass, ECS Inc.	503-476-8871
TX	Dallas, Advance Tech. Sls.	214-340-1300
WA	Bellevue, Comtec	206-453-1188
Can	Stittsville, Ont., Production Case Co.	613-836-2248

Ectron CORPORATION

FAX: 619-278-0372

ECTRON CORP., 8159 Engineer Rd., San Diego, CA 92111-1980, Tel: 619-278-0600, TWX: 910-335-1259; FSC No.: 24856; Empl.: 50; *Sls. Mgr.:* W. W. Hanford ..... **D•1010**

Local Sales Offices & Reps

AZ	Tempe, Aztec Entprs.	602-431-8401
CA	Canoga Pk., FLW Inc.	818-719-0037,
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Fremont, FLW Inc.	415-651-6511
CO	Denver, Aztec Entprs.	303-779-5285
FL	Melbourne, Saber Assocs.	407-724-0920
GA	Norcross, Saber Assoc. Inc.	800-327-0853
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
KS	Overland Pk., Ramsey Assocs.	913-541-1007
MD	Laurel, Elctrn. Mktg. Assoc.	301-792-9300
MA	Needham, Addelco Corp.	617-444-4754
MI	Troy, Satullo Assocs.	313-585-4811,
MN	Minneapolis, Sector Eng. Sls. Inc.	612-378-2123
MO	St. Louis, Ramsey Assocs.	314-532-9386
NM	Albuquerque, Westfhal & Assocs.	505-268-1433
NY	Plainview, Eastern-Metro Assoc.	516-931-1414
NY	Victor, Sanwal Technlgs.	716-924-1950
NC	Clayton, Saber Assocs.	800-327-0853
OH	Cleveland, Instrmn. Sys.	216-845-8800
OH	Dayton, Instrmn. Sys.	513-294-2838
PA	Pittsburgh, Instrmn. Sys.	412-823-7005
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Seattle, Datacom Assoc. Inc.	206-285-2525
WI	Milwaukee, Sector Eng. Sls. Inc.	414-352-8280

EDA INC., Div. of Connector, 637 S. Palm St. Ste. F, La Habra, CA 90631, Tel: 213-697-7151, FAX: 213-691-1509; Empl.: 160; *Sls. Mgr.:* Roy Wang

EDAC INC., 40 Tiffield Rd., Scarborough, Ont., CAN M1V 5B6, Tel: 416-754-3322, FAX: 416-754-3299; FSC No.: 31781; Empl.: 110; *Sls. Mgr.:* Terry Thornton; *Dist. Mgr.:* W. Mango

EDAK INC., EDAK Ltd., 285 North Drive,Ste.H, Melbourne, FL 32934, Tel: 407-242-2953, 800-462-8478, FAX: 407-242-3430; FSC No.: 8145; Empl.: 210; *Sls. Mgr.:* Max Reichlin; *Dist. Mgr.:* Jack Lenett

Local Sales Offices & Reps

CA	Palos Verdes, Zimmerman Assocs.	213-378-3088
MA	Wakefield, Instr. Dynamics	617-245-5100
TX	Dallas, Space Elctrns.	214-251-3636
VA	Springfield, PANTECH	703-451-5700

EDA INSTRUMENTS, INC., 4 Thorncliffe Park Dr., Toronto, ON, Canada M4H1H1, Tel: 416-425-7800, TELEX: 06 23222 FEDA TOR, FAX: 416-425-8135; Empl.: 100; *Sls. Mgr.:* Bill Laham

EDCLIFFE DIV., BEI Electronics Co., 13100 Telfair Avenue, Sylmar, CA 91342, Tel: 818-362-7151, FAX: 818-362-2487; FSC No.: 00153; Empl.: 110; *Sls. Mgr.:* Cosmo L. Avellis; *Dist. Mgr.:* R. P. Bastone

EDI, 780 Creel, Wood Dale, IL 60191, Tel: 708-860-5838, FAX: 708-860-0502; Empl.: 13; *Sls. Mgr.:* J. Holmberg ..... **B•1065**

EDITRON SYSTEMS INC., 1560 Teaneck Rd., Teaneck, NJ 07666, Tel: 201-837-0051, FAX: 201-837-0504; *Sls. Mgr.:* L. G. Mansoor

EDL, INC., Rt. 5, Box 1398, Danville, VA 24540, Tel: 804-799-0807, 1-800-DIAL EDL, FAX: 804-799-0847; Empl.: 35; *Sls. Mgr.:* Jean Moore

EDO CORP., ELECTRO-ACOUSTIC DIV., 2645 South 300 West, Salt Lake City, UT 84115, Tel: 801-486-7481, TELEX: 388-315, FAX: 801-484-3301; Empl.: 360; *Sls. Mgr.:* Fran Gareffa ..... **A•1357**

EDO CORPORATION, Electro-Ceramic Division, 2645 South 300 West, Salt Lake City, UT 84115, Tel: 801-486-2115, TELEX: 388-315, FAX: 801-484-3301; Empl.: 300; *Sls. Mgr.:* Yvonne Bartholomew ..... **A•1357**

EDO CORP./ELINCO DIV., See Electrical Indicator Co., Inc.

EDSYN, INC., 15958 Arminta Ave., Van Nuys, CA 91406, Tel: 818-989-2324, 213-873-5115, TELEX: 65-1469; *Sls. Mgr.:* Wayne Murry

EDWARDS CO., Signaling Prods. Div., P.O. Box 1188, Farmington, CT 06034, Tel: 203-678-0410; Empl.: 1000; *Sls. Mgr.:* Al Canevari; *Dist. Mgr.:* Al Canevari

EDWARDS HIGH VACUUM INTERNATIONAL, Div. of the BOC Group, 301 Ballardvale St., Wilmington, MA 01887, Tel: 508-658-5410, FAX: 508-658-7969; Empl.: 2000; *Sls. Mgr.:* Frank Carpino

EECO INCORPORATED, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, Tel: 714-835-6000, FAX: 714-953-3747; FSC No.: 97525; Empl.: 95; *Sls. Mgr.:* Scott Thorpe; *Dist. Mgr.:* Steve Hyter

EEMCO, Datron, Inc., 4585 Electronics Pl., Los Angeles, CA 90039, Tel: 818-247-7060, TWX: 910-497-2269, FAX: 818-244-6621; FSC No.: 72121; Empl.: 300; *Sls. Mgr.:* Russell Johnson

EEV INC., 4 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-6050, TELEX: 6818096, FAX: 914-682-8922; Empl.: 42; *Sls. Mgr.:* Stuart Hesselson

EFECTOR, INC., 805 Springdale Dr., Exton, PA 19341, Tel: 215-524-2000, 800-441-8246, FAX: 215-524-2010; Empl.: 35; *Sls. Mgr.:* J. Kelly

EFI ELCTRNS., 2415 South 2300 West, Salt Lake City, UT 84119, Tel: 801-977-9009:800-221-1174, FAX: 801-977-0200; Empl.: 90; *Sls. Mgr.:* Mark A. Norrie

EFOS INC., 5716 Coopers Ave., Unit 1-5, Mississauga, Ont., Can L4Z 2E8, Tel: 416-568-4268, FAX: 416-568-4280; Empl.: 25-50; *Sls. Mgr.:* Beverley Barber

EFRATOM, See Ball Corp., Efratom Div.

EG&G, INC., Electro-Optics Div., 35 Congress St., Salem, MA 01970, Tel: 508-745-3200, TELEX: 681-7405 EGGSA; FSC No.: 25506; Empl.: 184; *Sls. Mgr.:* J. Murachver

EG&G, INC., Electronics Components Div., 35 Congress St., Salem, MA 01970, Tel: 508-745-3200, TELEX: 681-7405 EGGSA; FSC No.: 25506; Empl.: 329; *Sls. Mgr.:* J. Murachver

EG & G BIRTCHER, EG & G, Inc., 4505 N. Arden Dr./P. O. Box 5268, El Monte, CA 91734-1268, Tel: 818-442-2572, FAX: 818-442-8127; FSC No.: 18915; Empl.: 135; *Sls. Mgr.:* Bill Hayes; *Dist. Mgr.:* Bill Hayes ..... **C•1028-1029**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
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NY Syracuse, IA Hotze Assocs. 315-455-8807
OH Dayton, Electro Mktg. Grp 513-890-8322
OH N. Royalton, Electro Mktg. Grp. 216-582-0075
OR Tigard, RTS 503-684-1803
PA Doylestown, Monteiro Assocs., Inc. 215-345-5855
PA Pittsburgh, Electro Mktg. Grp. 412-823-5400
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WA Vashon, RTS 206-285-1363
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MA Winchester, Rush Inds., Inc. 617-729-5800
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NY Rochester, Summit Distrs. 716-334-8110
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WA Redmond, Murphy Elctrns. 206-881-1234
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EG & G FLOW TECHNOLOGY, INC., Box 52103, Phoenix, AZ 85072, Tel: 602-437-1315, TELEX: 187-163, FAX: 602-437-4459; Empl.: 100; *Sls. Mgr.:* Ron Madison

EG & G FREQUENCY PRODUCTS INC., EG & G Inc., 4914 Gray Rd., Cincinnati, OH 45232, Tel: 513-542-5555, FAX: 513-542-5146; FSC No.: 58997; Empl.: 163; *Sls. Mgr.:* C. Fithen, Sls. Engr.

EG&G GAMMA SCIENTIFIC, Div. of EG&G Inc., 8581 Aero Drive, San Diego, CA 92123, Tel: 619-279-8034, TELEX: 697938, FAX: 619-576-9286; Empl.: 50; *Sls. Mgr.:* Robert Ruff

EG&G GEOMETRICS, Div. of EG&G Inc., 395 Java Dr., Sunnyvale, CA 94089, Tel: 408-734-4616, TELEX: 357-435, FAX: 408-745-6131; FSC No.: 34314; *Dist. Mgr.:* Doug Crice

EG & G JUDSON, 221 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-368-6900, TELEX: 846120, ESYLNK: 62820476, FAX: 215-362-6107; Empl.: 65; *Sls. Mgr.:* Andrew Allen

EG&G OPTOELECTRONICS, EG&G Canada Ltd., 22001 Dumberry Road, Vaudreuil, Quebec, Canada J7V 8P7, Tel: 514-424-3300, TELEX: 05-823646, FAX: 514-424-3411

EG & G POWER SYSTEMS, INC., 1330 E. Cypress St., Covina, CA 91724, Tel: 818-967-9521, TWX: 910-584-1320, FAX: 818-967-3151; Empl.: 490; *Sls. Mgr.:* Dave Adams ..... **D•1714-1715**

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AZ Scottsdale, Faser-Tech Sls. 602-948-4404
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FL Orlando, Truex Assocs. 305-859-2160
MD Columbia, Avtek 301-740-5100
MA Dover, George Urban Assoc. 617-329-4068
NY Endwell, Tri-Tech Elctrns., Inc. 607-754-1094
PA Broomall, Robert J. Sapanosa 215-353-7267
TN Nashville, MIL-SPEC Sls. 615-367-2427

EG&G RETICON, Div. of EG&G, 345 Potrero Ave., Sunnyvale, CA 94086-4197, Tel: 408-738-4266, FAX: 408-738-6979; *Sls. Mgr.:* John Skurla

EG & G ROTRON, Custom Div., Hasbrouck La., Woodstock, NY 12498, Tel: 914-679-5201, FAX: 914-679-7080; FSC No.: 82877; *Sls. Mgr.:* Mike Lyon; *Dist. Mgr.:* Mary Fellows

EG&G ROTRON, Industrial Division, North Street, Saugerties, NY 12477, Tel: 914-246-3401, TELEX: 981511, FAX: 914-246-3802; FSC No.: 551496; Empl.: 55; *Sls. Mgr.:* Jay Jarboe; *Dist. Mgr.:* Jay Jarboe

EG & G VACTEC, 10900 Page Blvd., St. Louis, MO 63132, Tel: 314-423-4900, TWX: 910-764-0811, FAX: 314-423-3956; Empl.: 250; *Sls. Mgr.:* D. Hartley; *Dist. Mgr.:* D. Hartley ..... **B•1319**

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MN Eden Prairie, Rockmore Sls. 612-941-1390
MO St. Louis, Acron Elctrns. 314-421-1751
PA Newtown Sq., W. Reeves Assoc. 215-356-7500
NY Pittsford, C. W. Beach Co. 716-586-3200
NY Syracuse, C. W. Beach Co. 315-446-9587
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Dayton, Scott Elctrns. 513-294-0539
OH Westerville, Scott Elctrns. 614-882-6100
TX Richardson, Interactive Comps. 214-669-2277
VA Shipman, R. W. Mitscher Co. 804-263-5154

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CA Palo Alto, Zack Elctrns. 415-326-5432
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FL Orlando, Nico 305-898-7444
IL Chicago, Newark Elctrns. 312-638-4411
IL Elgin, Allied Elctrns. 312-697-8200
CA Mission Viejo, Opto Plus Inc. 714-380-8654
TX Richardson, Altair 214-231-5166
TX Fort Worth, Allied Elctrns. 817-336-5401

EG & G WAKEFIELD ENGINEERING, 60 Audubon Rd., Wakefield, MA 01880, Tel: 617-245-5900, FAX: 617-246-0874; Empl.: 250; *Sls. Mgr.:* Frank Casdia; *Dist. Mgr.:* Harry Dorian ..... **C•1614**

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AL Huntsville, Over & Over, Inc. 205-837-7105
AZ Phoenix, Sanford Sls. 602-957-3570
CA Los Altos, Recht Assocs. 415-964-6321
CA San Diego, Mesa Elctrns. 619-278-8021
CO Denver, Donohue Sls. 303-455-1719
FL Tampa, Over & Over Inc. 813-626-9100
GA Norcross, Over & Over, Inc. 404-449-6205
IL Rolling Meadows, Sumer, Inc. 708-991-8500
IA Cedar Rapids, C. H. Horn Assocs. 319-393-8703
MI Farmington Hills, Luebbe Sls. 313-489-8828
MN Mendota Heights, G-II Sls. 612-454-3086
MO Chesterfield, Weisler & Assocs., Inc. ... 314-537-0010
NY Commack, ERA, Inc. 516-543-0510
NY E. Rochester, Tri Tech Elctrns. 716-385-6500
NY Fayetteville, Tri Tech Elctrns. 315-446-2881
NC Charlotte, Over & Over, Inc. 704-542-9111
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Dayton, Luebbe Sls. Co. 513-294-0426
OH Westlake, Luebbe Sls. Co. 216-899-0071
OR Tigard, RTS Inc. 503-244-4123
PA Narbeth, Bresson Assocs. 215-664-6460
TX Austin, Milco Mktg. 512-835-5359
TX Houston, Milco Mktg. 713-469-5156
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WI Brookfield, Sumer, Inc. 414-784-6641

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MI Livonia, RS Elec. 313-525-1155
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NJ Pennsauken, Newark 609-663-9490
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NC Raleigh, Southeastern Elctrns. 919-828-2311
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VA Charlottesville, Virginia Elec. 804-296-4184
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WI Waukesha, Bell 414-547-8879

EGIS CORPORATION, 655 Plum Tree Rd., Barrington Hills, IL 60010, Tel: 708-639-1555, FAX: 708-639-8710; Empl.: 6

EH ELECTRONICS, INC., See Wavetek San Diego, Inc., Tel. 619-279-2200

EHRHORN TECHNOLOGICAL OPERS., INC., 4975. North 30th St., Colorado Springs, Colorado 80919, Tel: 719-260-1191, FAX: 719-260-0395; FSC No.: 1106; Empl.: 75; *Sls. Mgr.:* Tim Coutts; *Dist. Mgr.:* Tim Coutts

El & S, Prime Technology Inc., Twin Lakes Rd., P.O. Box 185, North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 14908; Empl.: 60; *Sls. Mgr.:* R. A. Boisseau ..... **B•1462-1463**

Local Sales Offices & Reps

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FL Lakeland, Munday Sls. .. 813-858-5606,818-858-7257
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NY Albany, Lynn Assocs. ... 518-459-1239,518-459-4810
NY Hauppauge, Masin-Esco, Inc. 516-273-3500, 516-273-3516
OH Westlake, Advanced Technlg. Assocs. 216-835-5050,216-835-3599
TX The Colony, Juliana Co. 214-625-1075
PA Malvern, Stitzer Assocs. 215-664-5500, 215-664-5503
PA Gibsonia, Lynn Assocs. 412-443-3670, 412-443-3166
WA Seattle, Datacom Assoc. 206-285-2525
Can St. Laurent,PQ, Electronique Versatech 514-335-3833

Local Distributors

AZ Phoenix, Keystone Electro Sls. 602-995-3005
CA San Jose, Spectra Elctrns. 408-452-1590
CA Canoga Pk., Acort Inds. 818-700-2991
MD Columbia, DK Elctrns. 301-995-1950
MA Billerica, A. W. Mayer Co. 508-229-2255
MA Newton, The Greene-Shaw Co. 617-969-8900
NJ Oakland, Relay Specialties 201-337-1000

FAX: 401-738-7154

EICHHOFF ELECTRONICS, 205 Hallene Rd., Warwick, RI 02886, Tel: 401-738-1440, 800-678-1040; Empl.: 2,000; *Sls. Mgr.:* Randall Jones .... **A•1614-1617, 2206-2207; B•1464-1465**

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CA	Mission Hills, The Pentagon Co.	818-894-0299
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CT	W. Simsbury, Electrotechnika, Inc.	203-658-6762
FL	Tampa, Std. Mktg. Inc.	813-933-5833
FL	W. Melbourne, Std. Mktg. Inc.	305-725-7073
IL	Wheaton, CS Tech. Sls.	312-653-8126
MA	Needham, Kanan Assoc.	617-449-7400
MA	Waltham, Newport Tech. Sls.	617-890-7255
MD	Norwell, M.J. Sls. & Engrg. Inc.	617-982-8776
MI	Livonia, Wenner & Assocs.	313-591-7955
MN	Minneapolis, Electro-Serv Co.	612-338-3475
NC	New Hill, Tom Santel	919-362-4091
NJ	Kenvil, Comps. for Elctrns.	201-927-6662
NJ	Red Bank, Varrelman Corman	201-219-0088
OH	Mansfield, Rich Tech. Sls.	419-756-1953
SC	Mauldin, Carl Hart Assoc.	803-288-2023
TN	Chattanooga, Stetco, Inc.	615-899-6831
TX	Missouri City, Intercon Sls.	713-499-4163
VA	Front Royal, Eltron Sls. Ltd.	703-635-7201

EIKONIX, 15 Wiggins Avenue, Bedford, MA 01730, Tel: 617-276-7161, TELEX: 951231, FAX: 617-276-5063; Empl.: 175; *Sls. Mgr.:* Jim LLoyd

E.I.L. INSTRUMENTS, INC., 10 Loveton Circle, Sparks, MD 21152, Tel: 301-771-4800, TELEX: 87797, FAX: 301-771-4629; Empl.: 500; *Sls. Mgr.:* Keith D. Hadley

EI MICROCIRCUITS, INC., 1651 Pohl Road, Mankato, MN 56001, Tel: 507-345-5786, FAX: 507-345-7559; Empl.: 55; *Sls. Mgr.:* Perry Eimers

EI NORTH AMERICA, 435 E. 79th St., New York, NY 10021, Tel: 212-517-5622, FAX: 212-517-5516; *Sls. Mgr.:* Judy Simons; *Dist. Mgr.:* Adam Goodman

EIP MICROWAVE, INC., 1589 Centre Pointe Dr., Milpitas, CA 95035, Tel: 408-945-1477, FAX: 408-945-0977; FSC No.: 34257; Empl.: 100; *Sls. Mgr.:* Rick Bush

EITEL MFG., 33208 Paseo Cerveza, Ste. G, San Juan Capistrano, CA 92675, Tel: 714-240-3933; Empl.: 6; *Sls. Mgr.:* H. Mengel

ELAN DIGITAL SYSTEMS, Div. of Elan Digital Sys. Ltd., 538 Valley Way, Milpitas, CA 95035, Tel: 800-541-ELAN, 408-946-8495, FAX: 408-946-0351; Empl.: 3 ..... **A•1724**

Local Sales Offices & Reps

CA	Milpitas, Elan	408-946-8495

ELAN TECHNICAL CORP., 35 Kings Highway East, Fairfield, CT 06430, Tel: 203-335-2115, FAX: 203-335-2723

ELANTEC, INC., 1996 Tarob Ct., Milpitas, CA 95035, Tel: 408-945-1323, 800-821-7429, FAX: 408-945-9305; FSC No.: 64762; Empl.: 106; *Sls. Mgr.:* Ralph Granchelli; *Dist. Mgr.:* John Charette

ELASTOMERIC TECHNOLOGIES, INC.

FAX: 215-672-4633

ELASTOMERIC TECHNOLOGIES, INC., 2940 Turnpike Dr., Hatboro, PA 19040, Tel: 215-672-0787, 215-672-4741, TWX: 387-236; FSC No.: 64914; *Sls. Mgr.:* George Glatts ..... **C•1357**

Local Sales Offices & Reps

AL	Huntsville, Remco/Huntsville	205-533-3763
AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Orange, Libratronix	714-871-1513
CA	San Jose, W I N	408-559-8118
CO	Monument, Sunbird Inds.	719-481-2900
FL	Ft. Lauderdale, Synergistic Tech. Inc.	305-791-8255
FL	Melbourne, Synergistic Tech. Inc.	407-242-9661
FL	Odessa, Synergistic Tech.	813-920-5814
GA	Lilburn, Remco/Atlanta	404-447-6937
IL	Des Plaines, Lincoln, Hodges	708-297-3810
IN	Ft. Wayne, Outman Sls.	219-489-7699
KS	Wichita, Baka Corp.	316-682-8411
MD	Gaithersburg, Carwithen	301-921-9545
MA	Needham, Comp. Technlg., Inc.	617-449-8490
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Bloomington, Northmark Assocs.	612-854-9299
MO	St. John, Baka Corp.	314-878-4224
NJ	Hasbrouck Hgts., Comp-Tech	201-288-7400
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Raleigh, C-Tech Sls. Co.	919-782-8100
OH	Cleveland, Arthur Baier Co.	216-461-6161
OR	Tigard, L. D. Elctrns.	503-684-8221
PA	Hatboro, A.Q.S. Electro	215-674-3562
PA	Pittsburg, Arthur Baier Co.	412-367-7799
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-REP	713-271-5635
UT	Ogden, Sunbird Inds., Inc.	801-479-7151
WA	Snohomish, L. D. Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Janesville, Lincoln,Hodges	608-754-4214

ELCO CORP., Electronic Connector Div., Huntingdon Ind'l. Park, Huntingdon, PA 16652, Tel: 814-643-0700, FAX: 814-643-0426; Empl.: 500; *Sls. Mgr.:* W. J. Graef; *Dist. Mgr.:* W.J. Graef

U.S. ELCO INC., 2930 Scott Blvd., Santa Clara, CA 95054, Tel: 1-800-888-ELCO, FAX: 408-980-9754; *Sls. Mgr.:* Douglas Hemingway

EL-COM CABLETEK, 22612 Albares, Mission Viejo, CA 92691, Tel: 714-432-6630

ELCOM INDUSTRIES, INC., 10268 Bach Blvd., St. Louis, MO 63132, Tel: 314-429-3100, FAX: 314-429-9706; Empl.: 25; *Sls. Mgr.:* Thomas C. Noel

ELCOM SYSTEMS, INC., 932 Clint Moore Rd., Boca Raton, FL 33487, Tel: 407-994-1774, FAX: 407-994-1770; FSC No.: 32424; Empl.: 8; *Sls. Mgr.:* D. Pollachek ..... **A•1747**

ELCON INSTRUMENTS, INC., 135-137-139 Gibralter Street, Annapolis, MD 21401, Tel: 301-280-6686, FAX: 301-263-5790; Empl.: 5; *Sls. Mgr.:* Paolo Landrini

ELCON PRODUCTS INTERNATIONAL COMPANY, 42700 Lawrence Place, Fremont, CA 94538, Tel: 415-490-4200, FAX: 415-490-3740; FSC No.: 85901; Empl.: 33; *Sls. Mgr.:* Shirlee Gendreau (inside Sls. Mgr.)

ELDRE CORPORATION, 1500 Jefferson Rd., Rochester, NY 14623, Tel: 716-427-7280, FAX: 716-272-0018; FSC No.: 19648; Empl.: 220; *Sls. Mgr.:* James N. Fitzpatrick

Local Sales Offices & Reps

AL	Huntsville, Elctrns. Mktg. Assocs.	205-880-8050
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Carlsbad, Prime Source Comps.	619-434-1297
CA	Los Gatos, Norwest Elctrns.	408-395-1190
CO	Wheat Ridge, Waugaman Assocs.	303-423-1020
FL	Tampa, APM Assocs.	813-886-2457
GA	Atlanta, Electronic Mktg. Assocs.	404-448-1215
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
MD	Towson, Arbotek Assocs.	301-825-0775
MA	Brookline, Harman Assocs.	617-232-6687
MO	St. Louis, Cadon Techn. Sls.	314-645-8670
NJ	Haddonfield, Tritek Sls.	609-429-1551
NY	Rochester, ELDRE Corp.	716-427-7280
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Raleigh, Electronic Mktg. Assocs.	919-847-8800
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
OH	Centerville, Omega Sls.	513-434-5507
UT	Salt Lake City, Waugaman Assocs./Utah	801-261-0802
SC	Greenville, Elctrns. Mktg. Assocs.	803-233-4637
Can	St. Laurent, Que., Componetics, Ltd.	514-331-9930
WA	Redmond, Electronic Mktg. Grp.	206-882-0962

ELECSYS,INC., Div. of C & C Jetronic, 320 Wall St., Princeton, NJ 08540, Tel: 609-921-2726, TELEX: 4971717, FAX: 609-921-7971; Empl.: 1; *Sls. Mgr.:* C. Jerry Chiang

ELECTRA-SSEMBLY, Lancer Chemical, 80 Cutter St. - Box 30, Warren, RI 02885, Tel: 401-245-5493

ELECTRA-TEC, Impert Industries, Inc., 557 W. M-89, Otsego, MI 49078, Tel: 800-225-3532, 616-694-2058, FAX: 616-694-5880; FSC No.: 4J966; Empl.: 20; *Sls. Mgr.:* William Robinson ..... **C•1033**

ELECTRICAL INDUSTRIES CORP., 691 Central Ave., Murray Hill, NJ 07974, Tel: 908-464-3200, FAX: 908-464-7619; FSC No.: 20093; Empl.: 300; *Sls. Mgr.:* D.V. Wilson

ELECTRICAL INSTRUMENT SERVICE, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1322-1323**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-494-0790
CO	Commerce City, Williams Assocs.	303-289-5647
IL	Lincolnwood, Saffro & Assocs.	708-677-9722
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-550-0506
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Columbus, Comtel Instrs. Co.	614-876-8305
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OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-954-5020
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WI	Lake Mills, Saffro & Assocs.	1-800-327-0312
Can	Beaconsfield, Que., Mesurina Ltee/Ltd.	514-630-5990

ELECTRICAL INSULATION SUPPLIERS, INC., 300 N. Mannheim Road, Hillside, IL 60162, Tel: 708-574-5400, FAX: 708-547-7538; Empl.: 450; *Sls. Mgr.:* Robert Gannon

ELECTRICAL STANDARDS DIV., E.S.R.S., Inc., 7337 Greenbush, N. Hollywood, CA 91605, Tel: 818-765-4224; Empl.: 6

ELECTRIC DEVICE, PO Box 337, Canfield, OH 44406, Tel: 216-533-1111, FAX: 216-533-2639

ELECTRIC INDICATOR COMPANY INC., 272 Main Ave., Norwalk, CT 06851, Tel: 203-847-5861, FAX: 203-846-3933; FSC No.: 73693; Empl.: 60

ELECTRIC MOTOR ENGINEERING, 23362 Madero, Suite C, Mission Viejo, CA 92691, Tel: 714-583-9802, FAX: 714-583-9785; Empl.: 5; *Sls. Mgr.:* Jerry Kibler; *Dist. Mgr.:* Frank Buday

Distributor

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ELECTRIC TACHOMETER, 68th & Upland Sts., Philadelphia, PA 19142, Tel: 215-726-7723, FAX: 215-724-3582; FSC No.: 20049; Empl.: 50; *Sls. Mgr.:* F. M. Porter

ELECTRIC TIME COMPANY, INC., P.O. Box 466, Medfield, MA 02052, Tel: 508-359-4396, FAX: 508-359-4482; FSC No.: 6645; Empl.: 10

ELECTRO ASSEMBLIES CORP., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062-2319, Tel: 708-498-6520, FAX: 708-272-2915; FSC No.: 09250; Empl.: 60; *Sls. Mgr.:* Greg Andrews

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MA	Sutton, Engrd. Assemblies Corp.	508-865-0722
FL	Lutz, Engrd. Assemblies Corp.	813-971-9471
GA	Marietta, Engrd. Assemblies & Comps. Corp.	404-951-8935
IL	Morton Grove, Power Pak	708-966-6000
MA	Sharon, Adcour, Inc.	617-784-8123
MI	Ann Arbor, Wedemeyer Elctrns. Supp. Co.	313-665-8611
NJ	Teterboro, Engrd. Assemblies Corp.	201-288-4477
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
NC	Raleigh, Engrd. Assemblies Corp.	919-790-9700
OR	Beaverton, Micro Power	503-626-7086
PA	McKean, Advacom, Inc.	814-476-7774
TX	Houston, K Power Elctrns.	713-783-2288
TX	Stafford, Southwest Elctrns. Inc.	713-240-4000
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Brampton, Innovative Power Pak	416-791-2132
Can	Calgary, Alberta, Electro-Sonic, Inc.	403-255-9550
Can	Don Mills, Ont., Saynor Varah Inc.	416-445-2340
Can	Quebec, Saynor-Varah	514-630-7470
Can	Richmond, BC, Electro Sonic, Inc.	604-273-2911
Can	Victoria, BC, Pacific Coast Elctrns. Ltd.	604-385-5111

ELECTROCOM INDUSTRIES, 1105 N. Ironwood Dr., S. Bend, IN 46615, Tel: 219-232-2743; FSC No.: 27114; *Sls. Mgr.:* B. Jaffe

ELECTRODATA, INC., 23020 Miles Rd., Bedford Heights, OH 44128, Tel: 216-663-3333, TWX: 810-427-2280, FAX: 216-663-0507; FSC No.: 34-1173465; Empl.: 15; *Sls. Mgr.:* Anthony Cardone; *Dist. Mgr.:* Anthony Cardone

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ELECTRODYNAMICS, INC., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, Tel: 708-259-0740; FSC No.: 10236; Empl.: 200; *Sls. Mgr.:* Frank Rafferty ..... **D•1134**

Local Sales Offices & Reps

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CO	Denver, West High-Tech, JV	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Altamonte Spgs., Quantum Sls.	407-788-0550
IL	Collinsville, Magna Engrg. Sls.	618-345-5583
IA	Cedar Rapids, J.R. Sales Engrg.	319-393-2232
KS	Wichita, Magna Engrg. Sls.	316-744-0851
MD	Severna Park, Delmarva Engrg. Assocs., Ltd.	301-647-8007
MA	Burlington, FJS Assocs.	617-273-5959
NJ	Basking Ridge, Churchill Assocs.	201-204-0744
NY	E. Rochester, Noeth Honsinger Assocs.	716-381-4430
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
OR	Tigard, ElTech, Inc.	503-684-3458
PA	Norristown, Rivco January Inc.	215-631-1414
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ELECTRO-DYN ELECTRONICS, 1201-19th St., Niagara Falls, NY 14301, Tel: 716-284-8747, FAX: 716-284-9112; *Sls. Mgr.:* H. Emes

THE ELECTRODYNE COMPANY, INC., 4188 Taylor Rd., Batavia, OH 45013, Tel: 513-732-2822, TELEX: 241 463, FAX: 513-732-6953

ELECTROFILM, 27727 Avenue Scott, P.O. Box 55669, Valencia, CA 91355, Tel: 805-257-2240, TELEX: 65-1438; FSC No.: 85932; Empl.: 95; *Sls. Mgr.:* Richard W. Pearson

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FAX: 401-738-4389

ELECTRO-FILMS, INC., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, Tel: 401-738-9150, TWX: 710-382-0405; FSC No.: 57252; Empl.: 275; *Sls. Mgr.:* Jean Madden .. **A•1748, 1910-1912; C•1680-1681**

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
CA	San Jose, NES Assocs.	408-437-9300
CA	Santa Ana, Weatherman Assocs.	714-544-1304
CA	Sunnyvale, NES Assocs.	408-738-3259
CO	Ft. Collins, Rep Sls.	303-226-1504
FL	Apopka, Micro Mktg., Inc.	407-889-2022
GA	Chamblee, BCI, Inc.	404-455-0405
IL	Palatine, M & S Sls.	708-934-1200
IN	Ft. Wayne, Corrao Marsh	219-482-2725
IN	Greenfield, Corrao Marsh, Inc.	317-462-4446
MA	Bedford, Vector Assocs.	617-271-0000
MN	Minneapolis, Ferrian Sls.	612-721-8915
NM	Albuquerque, Western High Tech. Mktg.	505-884-2256
NY	Clifton Park, Empire Technlg., Inc.	518-371-2480
NY	Plainview, Robert Smith Assocs.	516-681-3155
NC	Lewisville, Component Circuits, Inc.	919-945-5678
OH	Cincinnati, Arthur Baier Co.	513-779-9011
OH	Cleveland, Arthur Baier Co.	216-461-6161
OH	Columbus, Arthur Baier Co.	614-764-1157
OH	Dayton, Arthur Baier Co.	513-276-5486
OK	Broken Arrow, Merlin Elctrns.	918-251-2084
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OR	Portland, Demarest Assocs., Inc.	503-297-7327
PA	Pittsburg, Arthur Baier Co.	412-367-7799
TX	Ft. Worth, Merlin Elctrns.,	817-429-4420
TX	Missouri City, Jackson Arnold Assocs.	713-261-0798
VA	Ashland, Glasscock Assocs.	804-798-2125
WA	Seattle, Demarest Assocs.	206-523-3210
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ELECTRO INDUSTRIES, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590, Tel: 516-334-0870, TELEX: 4948652 ELECTRO, FAX: 516-338-4741; Empl.: 40; *Sls. Mgr.:* S. Kagan

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ELECTRO INSULATION CORP./REMTEK CORP., 3921 Ventura Drive, Arlington Hgts., IL 60004, Tel: 708-632-1020, FAX: 708-632-1089; Empl.: 25; *Sls. Mgr.:* Mike Kamperschroer; *Dist. Mgr.:* Mike Kamperschroer

ELECTROL CO., 321 Dewey St., P.O. Box 29, York, PA 17405, Tel: 717-848-1722, FAX: 717-848-4514; Empl.: 30; *Sls. Mgr.:* Debra Dudley; *Dist. Mgr.:* Debra Dudley

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ELECTROMATIC CONTROLS CORP., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010, Tel: 708-882-5757, TWX: 910-222-3452; FSC No.: 75203; Empl.: 400; *Sls. Mgr.:* Mike Meurer; *Dist. Mgr.:* Mike Meurer

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FAX: 201-997-9208

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NJ	Kearny, Electromech, Inc.	201-997-0950

ELECTRO MECHANICAL SYSTEMS, INC., 801 W. Bradley Ave., Champaign, IL 61820, Tel: 217-359-7125, FAX: 217-359-2075; Empl.: 26; *Sls. Mgr.:* Julie L. Redman

ELECTRO-MECHANISMS, INC., 2745 E. Huntington Dr., Duarte, CA 91010, Tel: 818-359-2535, FAX: 818-303-2189; FSC No.: 52592; Empl.: 27 ..... **B•1624-1625**

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CA	San Carlos, Hickey Indl. Sls.	415-594-9978
OH	Dayton, Harvey Teplitz	513-898-5282

ELECTRO-MECH CO., 707 Hathaway Dr., Colorado Springs, CO 80915, Tel: 719-597-1620, FAX: 719-597-1628

ELECTRO-MECH COMPONENTS, INC., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, Tel: 818-442-7180, FAX: 818-350-8070; FSC No.: 07150; Empl.: 25; *Sls. Mgr.:* Terry Trumbull; *Dist. Mgr.:* Terry Trumbull ..... **B•1686-1687**

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CA	San Diego, Qualtronics	619-695-0118
CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Denver, Franklin Sls.	303-722-8824
FL	Orlando, Publicover	407-898-9361
IL	Chicago, IRI	312-967-8430
MD	Baltimore, Callas Elctrns., Inc.	301-744-7711
MA	Needham Hgts., Todino Engrg.	617-444-7925
MI	Livonia, Leading Edge Sls.	313-478-6700
MN	Minneapolis, D. A. Case Assocs.	612-831-6777
NJ	Medford, Comp. Consltns.	609-654-5300
NY	Mamaroneck, Bassin Tech.	914-698-9332
NY	Orchard Pk., SHR	716-662-0589
OH	Cincinnati, KCH Co.	513-931-1686
OR	Hillsboro, Doran Sls.	503-640-4500
TX	Richardson, McCoy Assocs.	214-864-1838
WA	Redmond, Doran Sls.	206-885-1885

Local Distributors

CA	Los Angeles, Elec. Switches	213-660-1310
CA	Los Angeles, Master Distrs.	213-452-1229
NY	Buffalo, Genesee Ind. Elec.	716-873-9661
NY	Mamaroneck, Logicomp Elctrns.	800-431-2625

ELECTRO-METRICS, INCORPORATED, A Penril Corp., 100 Church St., Amsterdam, NY 12010, Tel: 518-843-2600, TWX: 710-446-4798, FAX: 518-843-2812; FSC No.: 18581; Empl.: 80; *Sls. Mgr.:* Vito L. Greco

ELECTRO NATIONAL CORP., P.O. Box 402 Matthews Ave., Canton, MS 39046, Tel: 601-859-5511, TWX: 810-990-0938, FAX: 601-859-5518; FSC No.: M-54208; Empl.: 40; *Sls. Mgr.:* Patsy Hicks

ELECTRONETICS, INC., Paine Field Bldg 335, Everett, WA 98204, Tel: 206-355-1855; Empl.: 10

ELECTRONIC APPLICATIONS CO., 4918 Santa Anita Ave., PO Box 4308, El Monte, CA 91734, Tel: 818-442-3212, FAX: 818-442-6873; Empl.: 70; *Sls. Mgr.:* Harvey Smith

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ELECTRONIC COIL CORP., 125 Old Iron Ore Rd., Bloomfield, CT 06002, Tel: 203-243-5233, FAX: 203-243-5233; Empl.: 8; *Sls. Mgr.:* Raymond Gorski, Jr.

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ELECTRONIC COMPONENTS GROUPE, INC.

FAX: 612-375-1905

ELECTRONIC COMPONENTS GROUPE, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, Tel: 612-375-9639, 800-677-8719; *Sls. Mgr.:* Rick Hampton; *Dist. Mgr.:* Rick Hampton ..... **B•1689-1693**

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CA	Irvine, Groh Assocs.	714-837-9871
CA	San Diego, Groh Assocs.	619-673-4321
CA	Santa Clara, Cindel/Penmark	408-988-8331
FL	Melbourne, Phoenix Comps.	407-723-4414
GA	Norcross, Cartwright & Bean, Inc./GA Div.	404-368-0160
IL	Palatine, Golbeck Milota Assoc.	708-639-3424
IN	Indianapolis, STB & Assocs., Inc.	317-844-9227
KS	Overland Pk., Electri-Rep	913-649-2168
LA	Covington, Cartwright & Bean, Inc.	504-892-1780
MA	Amherst, Bennetron	603-880-7008
MI	Ypsilanti, Tech Rep	313-572-1950
MD	Glen Burnie, Macrotech Assoc.	301-766-1111
MN	Oakdale, Complete Sls.	612-731-2923
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170
MO	St. Louis, Electri-Rep	314-993-4421
NH	Amherst, Bennetron	603-880-7008
NY	Islip, Cogent Technlg. Assoc., Inc.	516-277-7101
NY	Syracuse, Pi'Tronics	315-455-7346
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
OH	Centerville, Components Inc.	513-436-0255
OH	Cleveland, Components, Inc.	216-243-9200
OR	Hillsboro, Turn-Around Sls.	503-640-4641
TN	Knoxville, Cartwright & Bean	605-693-7450
TN	Memphis, Cartwright & Bean, Inc.	901-362-8345
TX	Dallas, Rem Air Comps. Corp.	214-234-1069
WA	Kirkland, Turn-Around Sls.	206-822-4634
WI	Madison, Golbeck Milota Assocs.	608-222-7037

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AL	Huntsville, C.D.I.	205-883-7501
AZ	Phoenix, Beswitched	602-275-4805
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CA	Hollywood, Yale Elec.	213-465-3186
CA	Manhattan Beach, Prime Electro	213-379-3642
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CA	San Diego, Sigma Elctrns.	619-565-7000
CA	Santa Ana, El-Com, Inc.	714-432-6630
CA	Santa Ana, Sigma Elctrn.	714-558-8600
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CA	Yorba Linda, Target Elctrns.	714-692-1630
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CO	Littleton, Indelco	303-795-3431
CT	Norwalk, Cobra Comps.	203-847-6442
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Melbourne, C.D.I.	305-724-9910
GA	Norcross, C.D.I.	404-441-3320
IL	Bensenville, Voyager Elctrns.	708-860-1300
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Wichita, Radio Inc.	316-264-2798
MD	Beltsville, PSI	301-937-4960
MD	Columbia, D. K. Elctrns.	301-995-1950
MD	Elk Ridge, Interconnect Elect.	301-621-5424
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MA	Nashua, Brevan Elctrns.	603-889-7230
MA	Salem, Diamond Elctrns.	603-894-4420
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	Florrissant, Deltron Co., Inc.	314-839-0033
NJ	W. Berlin, G.C.I.	609-768-6767
NY	Rochester, CAM-RPC	716-427-9999
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Woodside, Switches Unlimited	800-221-0487
NC	Raleigh, C.D.I.	919-834-9465
OH	Cleveland, CAM-RPC	216-461-4700
OH	Columbus, CAM-RPC	614-888-7777
OH	Dayton, CAM-RPC	513-898-1111
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OR	Beaverton, Comp. Resources	503-641-8488
OR	Portland, Radar Elec.	503-232-3404
PA	Pittsburgh, CAM-RPC	412-963-6202
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, C.D.I.	214-644-0373
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Dallas, Wofford Elctrns.	214-320-0294
TX	Houston, Wofford Elctrns.	713-847-3593
TX	Richardson, Off-the-Shelf Comps.	214-238-0808
WA	Kent, Comp. Resources	206-454-8666
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Progressive Image	414-321-4722



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Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	La Mirada, Select Elctrns.	714-739-8891
CO	Englewood, TMC	303-770-8995
IL	Wheaton, Elctrn. Concepts, Inc.	312-668-8747
MN	Minneapolis, Components Grp.	612-374-1250
MO	Grandview, Harris-Hanson Co.	816-763-6200
NJ	Eatontown, Elctrn. Concepts, Inc.	908-542-7880
NM	Albuquerque, Piper Sls. Co.	505-883-9090
MO	St. Louis, Harris-Hanson Co.	314-432-3611

Local Distributors

NJ	Clifton, Elcon Sls.	201-546-5022



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1301 Olympic Blvd., Santa Monica, CA 90404

1026 6th Avenue, Oakland, CA 94606

ELECTRONIC COUNTERS & CONTROLS, INC., LFE Corp., 1117 S. Milwaukee Ave., Ste. B-9, Libertyville, IL 60048, Tel: 708-362-8910, 800-422-3224, FAX: 708-362-8953; Empl.: 150; *Sls. Mgr.:* G. Nielsen; *Dist. Mgr.:* G. Nielsen

ELECTRONIC DESIGN ENGINEERING, 1820 Temescal Av., Norco, CA 91760, Tel: 714-735-1761; Empl.: 3

ELECTRONIC DEVELOPMENT ASSOCIATES, INC., 1 Westcliff Drive, Dix Hills, New York 11746, Tel: 516-673-3881, FAX: 516-673-5979; FSC No.: 9V841

FAX: 617-268-6754

ELECTRONIC DEVELOPMENT CORP., EDC, 11 Hamlin St., Boston, MA 02127-4198, Tel: 617-268-9696, TELEX: 951596; FSC No.: 12619; Empl.: 25; *Sls. Mgr.:* R. B. Ross ..... **D•1242-1243**

Local Sales Offices & Reps

AL	Huntsville, Jim Springer	205-883-4163
AZ	Tempe, Mesa Tech.	602-279-5243
CA	All of CA, F.L.W.	800-339-6030
CO	Englewood, R. A. Mayes Co.	303-761-9447
FL	Orlando, Gentry Assocs.	407-859-7450
FL	Tampa, Gentry Elec. & Instr.	813-886-0720
IL	Arlington Heights, Berndt Assoc.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-541-1007
MA	Boston, Elctrn. Dev. Corp.	617-268-9696
MA	Needham, Addelco Corp.	617-444-4754
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Minneapolis, The Mark Co.	612-933-3026
MO	Chesterfield, Ramsey Assocs.	314-532-9386
NJ	Union, Friedman Assocs.	201-964-6200
NM	Albuquerque, Mesa Technlg.	505-883-8833
NY	Victor, SAN WAL Technlg.	716-924-1950
NC	Raleigh, Lee Assocs.	919-848-8818
OH	Cleveland, Tiby Co.	216-371-5335
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Hatboro, Rhodes Technlg.	215-672-3336
TX	Richardson, Scientific Sls.	214-231-6541
VA	Richmond, Advance Control Equip.	804-282-9499
WI	Milwaukee, Berndt Assoc.	414-545-8400
Can	Mississauga, Ont., Omnitronix Ltd.	416-828-6221

ELECTRONIC DEVELOPMENT LABS., See EDL Inc.

ELECTRONIC DEVICES, INC., 21 Gray Oaks Ave., Yonkers, NY 10710, Tel: 914-965-4400, TELEX: 681-8047, FAX: 914-965-5531; Empl.: 200; *Sls. Mgr.:* Paul Dengler; *Dist. Mgr.:* Paul Dengler ..... **A•2094**

Local Sales Offices & Reps

AZ	Tempe, Cantec Sls.	602-345-1276
CA	Northridge, Myco Sls.	818-886-7101
CA	San Jose, Nelson Elctrn. Sls., Inc.	408-437-9300
CO	Golden, Dossett Elctrn. Mktg. Inc.	303-278-4620
FL	Melbourne, Kennedy Assocs.	407-676-6875
IN	Carmel, Berndt Assocs.	317-844-0114
MA	Sharon, Cummings Assocs.	617-784-5600
MI	Livonia, Amtech	313-474-8300
MN	Brooklyn Ctr., Lydon Assoc.	612-535-6526
MO	St. Louis, Rep-tronics Inc.	314-997-4707
NY	Patchogue, Optimum Sls. Co.	516-758-0644
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, B.T. Funderburk Inc.	919-846-2373
OH	Cleveland, Versatron	216-581-0090
OR	Portland, Index, Inc.	503-297-3364
PA	Pipersville, Yax Assocs.	215-776-2100
TX	Dallas, Kruvand Assocs. Inc.	214-437-3355
WI	Mequon, Stumm Sls.	414-241-8414
Can	Montreal, Que., Elcom GMB Inc.	514-668-3361

Local Distributors

AL	Huntsville, Comp. Dists.	205-883-7501
CA	San Jose, Compass	408-432-7575
CA	Costa Mesa, Orange Cty. Comps.	714-979-3597
CO	Englewood, Comp. Distrs.	303-799-4916
CT	Greenwich, Wise Comps.	203-531-4880
FL	Melbourne, Comp. Dists.	305-724-9910
GA	Norcross, Comp. Dists.	404-449-9508
IL	Chicago, E M D	312-577-0067
IN	Indianapolis, Gateway Megatech	317-844-3906
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
MA	Billerica, Mayer Elctrns. Inc.	617-229-2255
MI	Grand Rapids, SF Elctrns.	616-459-0216
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	St. Louis, Ric-Tronics	314-576-9816
NJ	Fairfield, Verdura Sls. Co.	201-227-0414
NY	Albany, Edwin Taylor Co.	518-438-7811
NM	Albuquerque, Walker Radio	505-247-2288
NY	Buffalo, Summit Dists.	716-334-8110
NY	Elmsford, Multmetrics	914-347-3666
NC	Raleigh, Comp. Distrs.	919-787-2116
OH	Willoughby, Gateway Megatech	216-953-0333
OK	Tulsa, Quality Comps.	918-664-8812
OR	Portland, Radar Elec. Co.	503-232-3404
TX	Houston, Jaco/QC	713-240-2255
PA	Pittsburgh, Advacom	814-476-7774
VA	Roanoke, Peoples Elctrns.	703-342-8933
WA	Seattle, Radar Elec.	206-282-2511
WI	Racine, Badger Elctrns.	414-637-1256
Can	Ontario, Westburne	613-737-5570

ELECTRONIC DISPLAYS, INC., 780 Creel Dr., Wood Dale, IL 60191, Tel: 708-860-5838, FAX: 708-860-0502

ELECTRONIC ENCLOSURES, Div. Wyle Laboratories, 225 South Aviation Blvd., El Segundo, CA 90245, Tel: 213-643-8181, FAX: 213-643-8565; FSC No.: 09097; Empl.: 230; *Sls. Mgr.:* Robert Sproul ..... **C•1030-1032**

Local Sales Offices & Reps

AL	Huntsville, FLW Southeast	205-990-8989
AZ	Phoenix, Mercury Engrg. Sls.	602-265-0344
CA	Campbell, Carlson & Assocs.	408-370-1284
CA	El Segundo, Wyle Labs.;Elctrn. Encl.	213-643-8181
CA	San Diego, McKinley Elctrn. Sls.	619-271-7221
FL	Casselberry, T-Squared Mktg.	407-699-9992
FL	Ft. Lauderdale, T-Squared Mktg.	305-735-3246
GA	Marietta, FLW Southeast	404-424-1731
IL	Arlington Heigts, Coombs Assoc.	708-439-9810
MD	Upperco, Imigtron Sls. Co.	301-374-5600
MA	Needham Heights, Todino Engrg. Sls. Inc.	617-444-7925
MI	Jackson, Norwood Scroggs Co.	517-750-1170
NJ	Pennsauken, Wyle Labs.;Elctrn. Encl.	609-665-6810
NY	Sanquoit, JBR Engrg. Inc.	315-737-9432
OH	Galion, J. R. Bright Agy.	419-468-3787
TX	Ft. Worth, Zonk Engrg. Co.	214-238-7651
TX	Houston, Zonk Engrg. Co.	713-579-7777
TX	Richardson, Zonk Engrg. Co.	214-238-7651
WI	Milwaulkee, Coombs Assoc.	414-351-6123

ELECTRONIC ENGRG. CO. OF CAL., See EECO

EEM/ELECTRONIC ENGINEERS MASTER, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

ELECTRONIC ESSENTIALS, 60-20 34th Avenue, Woodside, NY 11377, Tel: 718-898-8300, TELEX: 384-873, ESYLNK: 6275-6172, FAX: 718-899-7995; Empl.: 49

ELECTRONIC FILM CAPACITORS, INC., 41 Interstate Lane, Waterbury, CT 06705, Tel: 203-755-5629, FAX: 203-755-0659; Empl.: 65; *Sls. Mgr.:* A. Jewel Quinn; *Dist. Mgr.:* A. Jewel Quinn

ELECTRONIC HARDWARE, 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-752-1950, FAX: 516-752-1971; Empl.: 110; *Sls. Mgr.:* June Franke

ELECTRONIC INDUSTRIES ASSOC., 2001 Pennsylvania Ave. NW, Washington, DC 20006, Tel: 202-457-4900, FAX: 202-457-4985

ELECTRONIC INNOVATIONS CORP., 3107 W. Hampden Ave., Englewood, CO 80110, Tel: 303-789-0424, FAX: 303-789-0809; Empl.: 4

ELECTRONIC MEASUREMENTS INC.

FAX: 908-922-9334

ELECTRONIC MEASUREMENTS, 405 Essex Rd., Neptune, NJ 07753, Tel: 908-922-9300, TELEX: 132-424; FSC No.: 89022; Empl.: 250; *Sls. Mgr.:* Charles Lehmann ..... **D•1718-1727**

Local Sales Offices & Reps

AZ	Phoenix, Sci. Devices	602-957-0401
CA	Huntington Beach, Sci. Devices	714-840-3501
CA	San Diego, Sci. Devices	619-573-0157
CA	San Jose, Sci. Devices	408-554-0455
CO	Broomfield, Sci. Devices	303-469-5145
GA	Marietta, Elctrn. Measurements	404-427-8660
IL	Chicago, Comtel	312-539-4838
IN	Indianapolis, Comtel	317-253-1681
IA	Cedar Rapids, Comtel	319-377-9434
MA	Winchester, FJS Assoc.	617-729-3135
MI	Southfield, Comtel	313-358-2510
MN	Wayzata, Comtel	612-476-1551
NM	Albuquerque, Sci. Devices	505-883-3668
NY	Syracuse, T-Squared	315-463-0355
OH	Dayton, WKM Assoc.	513-434-7500
PA	Pittsburgh, WKM Assoc.	412-892-2953
PA	Plymouth Meeting, Electronic Mktg. Assocs.	215-828-7400
TX	Houston, AccuData	713-580-2451
WA	Redmond, Sci. Dvcs.	206-885-0004
WI	New Berlin, Comtel	414-544-6042

ELECTRONIC MODULES, INC., 10410 Vista Park Rd., Dallas, TX 75238-1687, Tel: 214-340-6789; Empl.: 40-50; *Sls. Mgr.:* Leo Rios; *Dist. Mgr.:* Paul Stolar

ELECTRONIC NAVIGATION INDUSTRIES, See ENI, Inc.

ELECTRONIC PRECISION COMPONENTS CORPORATION, 519 South 5th Ave., Mt. Vernon, NY 10550-4430, Tel: 914-664-2333, FAX: 914-664-4729; FSC No.: 59131; Empl.: 8; *Sls. Mgr.:* Don Edwards ... **A•1670**

ept

FAX: 617-661-2989

ELECTRONIC PRECISION TECHNOLOGY INC., 126 Jackson St., Cambridge, MA 02140, Tel: 617-661-2454; Empl.: 4; *Sls. Mgr.:* Werner Christ ... **C•1359-1361**

Local Sales Offices & Reps

AL	Huntsville, McKay Smith Assocs.	205-539-8000, FAX:205-539-2472
AZ	Mesa, McDonald Kerr Technlg. Assocs.	602-833-7734,FAX:602-834-8339
CA	Campbell, PCA Mktg. & Sls. Engrg.	408-559-2866, FAX:408-559-8277
CA	Dana Point, P C A	714-493-9822, FAX:714-240-1894
FL	Orlando, McKay Smith Assocs.	407-423-4353, FAX:407-841-8554
FL	Pinellas Pk., P & M Mktg. Assocs.	813-546-4175, FAX:813-544-3826
GA	Tucker, McKay Smith Assocs.	404-496-9913, FAX:404-496-5743
IN	Fishers, Carter, McCormic & Peirce Inc.	317-842-9277,FAX:317-577-2741
MD	Randallstown, Chesepeak Indl. Mktg.	301-653-0476,FAX:301-653-4675
MA	Concord, Noyes Assoc.	508-369-0425, FAX:508-371-2931
MI	Farmington Hills, Carter, McCormic & Pierce Inc.	313-477-7700,FAX:313-477-4149
NC	Raleigh, McKay Smith Assocs.	919-847-2277, FAX:919-847-0956
OH	Englewood, Carter, McCormic & Peirce Inc.	513-836-0951,FAX:513-836-2358
OH	Parma, Carter,McCormic & Peirce Inc.	216-398-0400,FAX:216-398-0766
PA	Pittsburgh, Carter, McCormic & Peirce Inc.	412-826-3800,FAX:412-826-3800
TX	Plano, Connector Specs.	214-517-3660, FAX:214-517-1207

Local Distributors

CA	Costa Mesa, Eric Elctrns.	714-751-1185, FAX:619-236-9910
CA	San Jose, Eric Elctrns.	408-432-1111, FAX:408-433-0570
CA	Santa Anna, Elcom Cabletek	714-432-6630, FAX:714-556-0468
CA	Sunnyvale, PSC ... 800-654-1518,FAX:408-737-0502	
MD	Beltsville, PSC/Petricko Sls.	800-333-5292, FAX:301-937-5299
MD	Gaithersburg, Axis Elctrns.	800-368-2815, FAX:301-840-9299
MA	Ashland, Quality Components	508-881-6504, FAX:508-881-1704
TX	Arlington, Bell Comp. Sls. Inc.	817-461-5303
Can	Mississagua, Ont., R. Theta	416-890-0221, FAX:416-890-1628

ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1444

ELECTRONIC RESEARCH CO., 7618 Wedd St, Overland Park, KS 66204, Tel: 913-631-6700, TWX: 910-749-6477; FSC No.: 13571; Empl.: 60; *Sls. Mgr.:* Charles Ditzler

ELECTRONIC RESOURCES INC., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089, Tel: 408-745-1420, FAX: 408-745-0533; Empl.: 6; *Dist. Mgr.:* Cari Ikya

THE ELECTRONICS GROUP, INC., 2828 Interstate St., Charlotte, NC 28208, Tel: 704-391-9500, FAX: 704-597-9500 Ext. 20; Empl.: 30; *Sls. Mgr.:* Doug Mckenzie

ELECTRONIC SOLUTIONS, A Unit of Zero Corp., 6790 Flanders Dr., San Diego, CA 92121, Tel: 619-452-9333, TELEX: 910-335-1169, FAX: 619-452-9464; Empl.: 150

ELECTRONIC SPACE SYSTEMS CORP., Old Powder Mill Rd., Concord, MA 01742, Tel: 508-369-7200, TELEX: 923480 ESSCO WCRD, FAX: 508-369-7641; FSC No.: 15175; Empl.: 150; *Sls. Mgr.:* Susan M. Cuevas

ELECTRONIC SPECIALISTS, 171 South Main St., Natick, MA 01760, Tel: 508-655-1532, 800-225-4876, TELEX: 955-329 ATTN: ESP; Empl.: 42; *Sls. Mgr.:* Frank Brown



FAX: 206-573-4635

ELECTRONIC SPECIALTY CORP., 14511 N.E. 13th Ave., Vancouver, WA 98665, Tel: 206-574-5000; FSC No.: 98927; Empl.: 100; *Sls. Mgr.:* Leon Fuller ..... **B•1467, 1626**

Local Sales Offices & Reps

CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	San Jose, Westron Assocs.	408-997-7332
CO	Longmont, Tri Tec Sls.	303-440-7862
GA	Atlanta, &	404-395-7079
IA	Des Moines, SPS Assocs. Ltd.	515-225-0607
KS	Olathe, SPS Assocs. Ltd.	913-764-4460
MD	Baltimore, Eastern Comps.	301-788-7050
MD	Gaithersburg, Eastern Comp.	215-825-8610
MA	Lexington, Hathaway Elctrns.	617-861-7010
MN	Hopkins, The Kits Co.	612-933-1888
MN	Stillwater, The Kits Co.	612-439-8088
MO	Earth City, SPS Assocs. Ltd.	314-291-0520
NE	Panama, SPS Assocs. Ltd.	913-764-4460
NJ	Ft. Lee, Neptune Elctrns. Co.	201-461-2789
NM	Albuquerque, Tri Tec Sls.	505-293-3730
NY	Glen Head, Neptune Elctrns. Co.	516-349-1600
NC	Raleigh, Eastern Comp.	919-787-3416
NC	Raleigh, L & D Inc.	919-876-5301
OH	Cleveland, Components Inc.	216-243-9200
OR	Beaverton, Earl & Brown Co., Inc.	503-643-5500
PA	West Conshohocken, Eastern Comp.	215-825-8610
TX	Dallas, Barry Sls.	214-234-0255
TX	Houston, Barry Sls. Inc.	713-784-5860
TX	Richardson, Barry Sls. Inc.	612-439-8088
VA	Annandale, Eastern Comp.	703-354-0723
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064

EP/ELECTRONICS PRODUCTS, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, TELEX: 516-227-1901

ELECTRONICS REPRESENTATIVE ASSOC., 20 E. Huron St., Chicago, IL 60611, Tel: 312-649-1333, FAX: 312-649-9509

ELECTRONICS RESEARCH ASSOCIATES INC., West Hill Rd., Winsted, CT 06098, Tel: 203-379-2731, TWX: 710-449-6464, FAX: 203-379-8861; FSC No.: 28564; Empl.: 200; *Sls. Mgr.:* Phillip J. Brown

ELECTRONIC SYS. & PROGRAMMING, See Augat/ES)sP, Inc.

ELECTRONIC SYSTEMS DIVISION, Boeing Defense & Space Grp., P.O. Box 3999, M/S 9/F-UA, Seattle, WA 98124-2499, Tel: 206-657-7474, TELEX: 329430, FAX: 206-657-9874; FSC No.: 81205; Empl.: 4,000; *Sls. Mgr.:* R.F. Priebe

ELECTRONICS SYSTEMS, INC., P.O. Box 5013, Sioux Falls, SD 57117, Tel: 605-338-6868, FAX: 605-338-5061; Empl.: 98; *Sls. Mgr.:* Leo Reynolds

ELECTRONICS TEST CENTRE, Alberta Research Council, 250 Karl Clark Road, Edmonton, AB, Canada T6N 1E4, Tel: 403-450-5370, TELEX: 0372147, FAX: 403-462-7285; Empl.: 16; *Sls. Mgr.:* Chris Talliss

ELECTRONIC TELE-COMMUNICATIONS, INC., 3620 Clearview Parkway, Atlanta, GA 30340-2178, Tel: 404-455-4890, FAX: 404-455-7972; Empl.: 145; *Sls. Mgr.:* Doug Altman; *Dist. Mgr.:* Doug Altman

ELECTRONIC TESTING & CONSULTING, Rt 4 Box 933, Decatur, TX 76234, Tel: 817-627-2929; Empl.: 2

ELECTRONIC TRANSFORMER CORP., P.O. Box 188, Totowa, NJ 07511, Tel: 201-942-2222, FAX: 201-942-9014; FSC No.: 72149; Empl.: 130; *Sls. Mgr.:* Dan Rovine

ELEC-TRON, INC., 2050 Northern St., Wichita, KS 67216, Tel: 316-522-3401, FAX: 316-524-6767; Empl.: 65; *Sls. Mgr.:* Gary Beddow

ELECTRON PRODUCTS, 5367 Third St., Irwindale, CA 91706, Tel: 818-960-2299, ESYLNK: 910-333-9810, FAX: 818-814-4434; FSC No.: 99515; Empl.: 65; *Sls. Mgr.:* Cliff Sailor; *Dist. Mgr.:* Ann Meunier



FAX: 714-250-0958

ELECTRO-NUMERICS, INC., 1811 Reynolds, Irvine, CA 92714, Tel: 714-250-1501; FSC No.: 51666; Empl.: 16; *Sls. Mgr.:* Ro Shultz ..... **D•1344**

Local Distributors

IL	Chicago, Dalec Distrs.	312-283-0300
CA	Costa Mesa, FLW, Inc.	714-751-7512
GA	Atlanta, FLW S.E., Inc.	404-424-1731
MI	Detroit, RAM Meter, Inc.	313-398-6767
NY	Syracuse, W.E.I., Inc.	315-437-4281

ELECTRO OPTICAL INDUSTRIES INC., 859 Ward Drive, Santa Barbara, CA 93111, Tel: 805-964-6701 (ext. 280), TELEX: 65-8427 EOIND SNC, FAX: 805-967-8590; Empl.: 130

ELECTRO-PACIFIC, 5770 Thornwood Dr., Goleta, CA 93117, Tel: 805-964-0751; FSC No.: 29853; Empl.: 60; *Sls. Mgr.:* T. Calhoun

ELECTRO PHYSICS CO., INC., 3009 Central Ave., Waukegan, IL 60085, Tel: 708-249-5801; Empl.: 6; *Sls. Mgr.:* Abe Siegelman

ELECTROPHYSICS CORP., 48 Spruce St., Nutley, NJ 07110, Tel: 201-667-0170; Empl.: 25; *Sls. Mgr.:* Frank J. Vallese

ELECTRO PREP INC. & N-E-D CABLE, 14 Kendrick Rd, Unit 3, Wareham Ind. Park, Wareham, MA, MA 02571, Tel: 508-291-2880, FAX: 568-291-2882; Empl.: 10; *Sls. Mgr.:* R. M. Sullivan

ELECTRORACK PRODUCTS CO., 1443 S. Sunkist St., Anaheim, CA 92806, Tel: 714-776-5420, FAX: 714-776-9683; FSC No.: 26073; Empl.: 50; *Sls. Mgr.:* Chris Allen

ELECTRO RENT CORP., 6060 Sepulveda Blvd., Van Nuys, CA 91411, Tel: 818-787-2100, FAX: 818-786-4224; Empl.: 480; *Sls. Mgr.:* Gary Phillips

ELECTRO-SCIENCE LABS., INC., 416 E. Church Rd., Po Box 1533, King of Prussia, PA 19406-1533, Tel: 215-272-8000, TELEX: 83-4788, FAX: 215-272-6759; Empl.: 120

ELECTRO SCIENTIFIC INDUSTRIES, INC. (ESI), 13900 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-4141, TELEX: 474-2064; FSC No.: 11837; Empl.: 600; *Sls. Mgr.:* Dick Donaca, Sys.



FAX: 215-682-2133

ELECTRO SPACE FABRICATORS, 300 W. High St., P.O. BOX 67, Topton, PA 19562-0067, Tel: 215-682-7181; Empl.: 205; *Sls. Mgr.:* T. Roth ..... **C•1034-1037**

Local Sales Offices & Reps

CA	Campbell, Shursales	408-374-5577
CA	Irvine, Vale Assocs.	714-551-4004, 4821
FL	Melbourne, Winter Assocs.	305-254-6556
FL	Vero Beach, S.E. Pro. Sls.	407-778-0454
GA	Norcross, Benchmark Tech. Sls.	404-448-2854
IL	Northbrook, Howard Benjamin Assocs.	312-272-2900
MD	Monkton, Imagitron Sls. Co.	800-638-3592
MD	Upperco, Imagitron Sls. Co.	800-638-3592
MA	Needham Heights, TESCO	617-444-7925
NJ	Boonton, Winter Assocs.	201-334-3434
NY	Buffalo, Promark Elctrns., Inc.	716-877-6300
NY	Morrisville, Promark Elctrns., Inc.	315-662-3310
OH	Galion, James R. Bright	419-468-3787
PA	Huntingdon Valley, OMEGA Elctrn. Sls., Inc.	215-947-4135
TX	Dallas, Dynamark	214-437-3333

Local Distributors

CA	Irvine, McGillis Inds.	714-551-4004
CA	Redwood City, HdB Elctrns.	415-368-1388
MD	Columbia, DK Elctrns.	301-995-1950
NY	Baldwin, Accessories for Elctrns.	516-546-1751

ELECTROSPACE SYSTEMS, INC., P. O. Box 831359, Richardson, TX 75083-1359, Tel: 214-470-2137, TELEX: 163590 ESIUT, TWX: 910-867-4768, FAX: 214-470-2466; FSC No.: 33875; Empl.: 1283; *Sls. Mgr.:* John E. Cochran, Dir. Bus Dev.

ELECTRO STANDARDS LAB., INC., Data Communications Products Div., 36 Western Industrial Dr., Cranston, RI 02921, Tel: 401-943-1164, FAX: 401-946-5790; Empl.: 25; *Sls. Mgr.:* R. B. Sepe; *Dist. Mgr.:* R. B. Sepe

ELECTROSTATIC CONSULTING ASSOCS., 556 Lowell Rd., P.O. Box 552, Groton, MA 01450, Tel: 508-448-5583, FAX: 508-448-5583; Empl.: 5; *Sls. Mgr.:* Paul Malinaric

ELECTROSTATICS, 7718 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-279-1414, FAX: 619-279-1126; FSC No.: 34538; Empl.: 10

ELECTRO-SUPPORT SYSTEMS, 43445 Business Park Dr., Temecula, CA 92390, Tel: 714-676-2751, FAX: 714-694-0097; FSC No.: 66760; Empl.: 37; *Sls. Mgr.:* Don Pretot

ELECTROSWITCH, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, Tel: 617-335-5200, FAX: 617-335-4253; FSC No.: 82121; Empl.: 290; *Sls. Mgr.:* W. M. Mello ..... **B•1694**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Irvine, Vale Elctrns.	714-551-4004
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Vale Elctrns.	619-693-0113
CA	San Diego, Wiley Co.	619-453-9018
CA	San Ramon, W. Nott & Co.	415-820-8102
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Apopka, Floritronics	407-886-4818
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NH	Salem, Sales Engrg. Co.	603-893-5521
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KS	Wichita, Dytec/South	316-263-7090
KS	Wichita, Dytec/Souyh, Inc.	316-263-7090
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MI	Madison Heights, WKM Assocs.	313-588-2300
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NM	Albuquerque, Gary Brooks	505-884-3444
NY	Great Neck, RTI	516-829-3770
NY	Syracuse, Labtronics	315-455-7314
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CA	Santa Clara, Ward Davis Assocs.	408-245-3700
CO	Englewood, Tech. Mktg. Spec.	303-781-8819
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GA	Atlanta, Beacon	404-256-9640
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NM	Albuquerque, Gary Brooks	505-884-3444
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NC Cary, Hughes Assoc 919-467-7029
TN Knoxville, Hughes Assoc. 615-558-0283
TX Arlington, T-Tec Sls. 817-429-9151
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PA Downington, Grasso & Assoc. 215-458-8967
PA Pipersville, Yax & Assoc. 215-766-2100

E/M CORPORATION, 2801 Kent Avenue, P.O. Box 2400, W. Lafayette, IN 47906, Tel: 317-497-6346, FAX: 317-497-6348; FSC No.: 11770; Empl.: 300; *Sls. Mgr.:* Nathan B. Barlow; *Dist. Mgr.:* Nathan B. Barlow

EMCOR PRODUCTS, Crenlo, Inc., 1600 Fourth Ave. NW, Rochester, MN 55901, Tel: 507-289-3371, FAX: 507-287-3405; *Sls. Mgr.:* Dan Estes ..... **C•1043**

EMC TECHNOLOGY INC, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034, Tel: 609-429-7800, FAX: 609-429-6814; FSC No.: 24602; Empl.: 70; *Sls. Mgr.:* Peter Semitschew

EMDS

FAX: 301-840-8589

EMDS, INC., 16618 Oakmont Ave., Gaithersburg, MD 20877, Tel: 301-840-5710; *Sls. Mgr.:* Patrick E. Roney ..... **D•1245**

EMERSON COMPUTER POWER, 15041 Bake Parkway No. L, Irvine, CA 92718, Tel: 714-380-1005, FAX: 714-380-0456; Empl.: 50; *Sls. Mgr.:* R.L. Calvin; *Dist. Mgr.:* R. Braud

Please call factory for sales offices and nearest reps.

EMHART CANADA, LTD., See Mallory Components Div.

EMICO INC., Box 368, Dublin, PA 18917, Tel: 215-249-9330, FAX: 215-249-9336; FSC No.: 85925; Empl.: 100; *Sls. Mgr.:* C. Davis

EMI GENCOM INC., See THORN EMI Gencom Inc.

EMI TECHNOLOGY INC., See THORN EMI Technology Inc.

EMM SEMI, SUB OF EM & M, See GTE Microcircuits

EMPIRE MAGNETICS, 5780 B LaBath Ave, Rohnert Park, CA 94928, Tel: 707-584-2801, FAX: 707-584-3418; Empl.: 10

Empro SHUNTS ®

FAX: 317-823-4835

EMPRO MANUFACTURING COMPANY, INC., P.O. Box 26060, Indianapolis, IN 46226, Tel: 317-823-4478; Empl.: 25 ..... **D•1246**

Local Sales Offices & Reps

CA	Montrose, Signal Entprs. Inc.	818-957-0640
GA	Atlanta, Brownell Electro Inc.	404-362-9009
IL	Chicago, Best Rep Co.	708-632-0473
MA	Burlington, E.I.L. Instr.	617-272-9450
NJ	Franklin, D. F. Tobias & Co.	201-209-8825
OH	Cleveland, Weschler Elec. Corp.	216-238-2550
OK	Portland, Westcon, Inc.	503-283-0132
PA	Philadelphia, Sunshine Sci. Instr. Inc.	215-673-5600
TX	Houston, Ev Smith Sls.	713-931-0403
WA	Seattle, Branom Instr. Co.	206-762-6050

Local Distributors

CA	Glendale, Instr. Meter Specialties	818-243-0416
CA	Livermore, Std. Meter Lab	415-449-0220
CA	S. Pasadena, Dae Instr. & Svc., Inc.	213-942-8843
LA	Harahan, Indl. Instrs. Works	504-733-8355
MD	Sparks, E.I.L. Instrs.	301-771-4800
NJ	Belleville, Miscorp	201-751-1190
PA	Norristown, Kimberly-James	215-666-7286
TX	Beaumont, Straughn Elctrns.	409-838-4563
TX	Houston, American Analog	713-941-7265
TX	Houston, Meters & Instrs.	713-644-1631
WA	Seattle, Branom Instr. Co.	206-762-6050
WI	Milwaukee, E-M Instrs.	414-272-7799

EMS

FAX: 714-838-2967

E.M.S., Div. of Sandberg Industries, 14251 Chambers Rd., Tustin, CA 92680, Tel: 714-669-9473; Empl.: 125; *Sls. Mgr.:* Duane Halverson, VP Sls.; *Dist. Mgr.:* Bruce Flemming ..... **C•1682**

E M S DEVELOPMENT CORP., 100 Sea La., Farmingdale, NY 11735, Tel: 516-293-7900, FAX: 516-694-1093; FSC No.: 51435; Empl.: 100

ET
Emulation Technology, inc.

FAX: 408-982-0664

EMULATION TECHNOLOGY, INC., 2344 Walsh Ave., Bldg. F, Santa Clara, CA 95051, Tel: 408-982-0660, TELEX: 981866; Empl.: 18; *Sls. Mgr.:* Joseph J. Bagliere, Jr. ..... **C•1358**

Local Distributors

CO	Denver, Alliance Elctrns. CO	303-433-1648
MI	Bloomfield Hills, Mackellar Assocs.	313-335-4440
NJ	Union, Meridian Supply Co.	201-687-6220
TX	Allen, Prime Distributing Co.	214-231-0170
TX	Richardson, Off The Shelf Comps., Inc.	214-238-0808

ENCLOSURE CORP., 2900 Wharton Rd., Bristol, PA 19007, Tel: 215-785-2900, FAX: 215-785-2960; FSC No.: 32360; Empl.: 75; *Sls. Mgr.:* Gene Goldner

ENCODER DIV., LITTON SYSTEMS, INC., See Litton Encoder Div.

ENCODER PRODUCTS, 1601 B Dover Rd.-Hwy.2, Sandpoint, ID 83864, Tel: 208-263-8541, FAX: 208-263-0541; Empl.: 100; *Sls. Mgr.:* Jim Burcham; *Dist. Mgr.:* Jim Burcham

ENCORE ELECTRONICS, INC., 4400 Route 50, Saratoga Springs, NY 12866, Tel: 518-584-5354, FAX: 518-584-5963; Empl.: 20

ENDEVCO CORPORATION, Allied Signal Aerospace Co., 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675, Tel: 714-493-8181, TELEX: 68-5608, TWX: 910-596-1415, FAX: 714-661-7231; FSC No.: 95411; Empl.: 400; *Sls. Mgr.:* D. McMahon

ENDICOTT COIL CO., INC., 24 Charlotte St., Binghamton, NY 13905, Tel: 607-797-1263, FAX: 607-797-0151; Empl.: 110; *Sls. Mgr.:* Thomas E. Frank

ERG™ Endicott Research Group, Inc.

FAX: 607-754-9255

ENDICOTT RESEARCH GROUP, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, Tel: 607-754-9187; FSC No.: 63312; Empl.: 120 ... **B•1066-1067, 1151; D•1740-1741**

Local Sales Offices & Reps

AZ	Phoenix, Finn-Pat Co., Inc.	602-954-0301
CA	Saratoga, Testco	408-253-1900
CO	Littleton, MRC	303-794-4684
CT	Bloomfield, Sands Co./Sir Assocs.	203-243-9343
FL	Maitland, EIR, Inc.	407-660-9600
GA	Atlanta, Wallace Electronics	800-334-3518
IL	Elk Grove Village, Carlson Elctrn. Sls.	708-956-8240
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-378-1450
MA	Westford, SIR Assocs.	617-692-2500
MI	West Bloomfield, Granneman & Mize	317-849-2000
MN	Minneapolis, OEM Prods.	612-831-7373
NC	Kernersville, Wallace Electronics	919-996-2742
OH	Dayton, Elctrn. Sls. & Technlg.	513-433-2800
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
UT	Salt Lake City, MRC	303-794-4684
WA	Bellevue, Testco	206-454-7422
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790
Can	Toronto, Ont., Norgay Entprs., Ltd.	416-259-9663

ENEGREN ELECTRONICS, INC., 15605-C S. Keeler Terr., Olathe, KS 66062, Tel: 913-782-4720, FAX: 913-782-4752; Empl.: 7; *Sls. Mgr.:* Floyd Enegren ..... **A•2210**

ENERCO, INC., 9615 W. Marginal Way S., Seattle, WA 98108, Tel: 206-762-1422; Empl.: 5; *Sls. Mgr.:* Lee Rabie

ENERGY

FAX: 301-699-8107

ENERGY, LTD., 4714 Upshur Street, Bladensburg, MD 20710, Tel: 301-699-1144; Empl.: 10 ..... **D•2194**

Local Sales Offices & Reps

MD	Bladensburg, Energy, Ltd.	301-699-1144

Local Distributors

MD	Bladensburg, Energy, Ltd.	301-699-1144

ENERGY SYSTEMS, 12004 NE 95th St., No. 840, Vancouver, WA 98682, Tel: 206-896-8310, FAX: 206-896-8457; Empl.: 25 ..... **D•1247**

ENGINEERED ASSEMBLIES & COMPONENTS CORP., 380 North St., Teterboro, NJ 07608, Tel: 201-288-4477, 800-447-5639, FAX: 201-288-1515; Empl.: 100; *Sls. Mgr.:* John Deleodice; *Dist. Mgr.:* P. Teen ..... **D•1452-1455**

Local Sales Offices & Reps

FL	Orlando, Engrd. Assemblies & Comp. Corp.	407-291-6710
GA	Atlanta, Engrd. Assemblies & Comp. Corp.	404-525-0676
MA	Boston, Engrd. Assemblies & Comp. Corp.	407-291-6710
NC	Raleigh, Engrd. Assemblies & Comp. Corp.	919-790-9700

ENGINEERED COMPONENTS CO., P. O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-3800, FAX: 805-544-8091; FSC No.: 32440; Empl.: 193

ENGINEERED MAGNETICS, INC., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-635-9555, TWX: 910-325-6208, FAX: 213-631-0313; FSC No.: 06509; Empl.: 200; *Sls. Mgr.:* S. Miller

ENGINEERING DESIGN & SLS., One E.D.S. Way, Danville, VA 24541, Tel: 804-792-6405, FAX: 804-792-6415; Empl.: 75; *Sls. Mgr.:* Mark Gignac

ENGLER INSTRUMENTS OPERATION, See Stemco Instruments, Colt Inds.

ENI, DIV. OF ASTEC AMERICA, INC., 100 Highpower Road, Rochester, NY 14623, Tel: 716-427-8300, FAX: 716-427-7839; Empl.: 390

ENM COMPANY, 5617 Northwest Highway, Chicago, IL 60646, Tel: 312-775-8400, TELEX: 25-4068, FAX: 312-775-5968; Empl.: 100; *Sls. Mgr.:* Lee Bryant

ENNOVATION OF WISCONSIN, INC., 806 Elm St.-P.O. Box 258, Watertown, WI 53094, Tel: 414-261-2996, FAX: 414-261-3432; Empl.: 5; *Sls. Mgr.:* Enno Knief; *Dist. Mgr.:* Enno Knief

ENPROTECH CORP., 445 West Michigan Ave., Kalamazoo, MI 49007, Tel: 616-381-0665, FAX: 616-381-9810; Empl.: 125

ENSIGN CORP., 7960 S. Madison Street, Burr Ridge, IL 60521, Tel: 708-325-9343, FAX: 708-789-3206; Empl.: 150; *Sls. Mgr.:* D. Brent Ensign

ENTECH CORPORATION, 17A Herman Drive, Simsbury, CT 06070, Tel: 203-658-2740, 203-651-9557, FAX: 203-658-2740

ENTECH SYSTEMS, INC., 17B Herman Dr., Simsbury, CT 06070, Tel: 203-651-9557, FAX: 203-658-2740; *Sls. Mgr.:* A. D. Jorczak

ENTERPRISE SYSTEMS CORP., PO Box 698, Dover, NH 03820, Tel: 603-742-7363, FAX: 603-742-9284; FSC No.: 79543; Empl.: 5; *Sls. Mgr.:* George Perrine

ENTRA CORPORATION, 8651 Castle Park Drive, Indianapolis, IN 46256, Tel: 317-849-8270, FAX: 317-849-7041; Empl.: 75; *Sls. Mgr.:* F. Paul McDonald

Entran

FAX: 201-227-6865

ENTRAN DEVICES, 10 Washington Ave., Fairfield, NJ 07004, Tel: 201-227-1002, 800-635-0650, TELEX: 130-361; *Sls. Mgr.:* Robert L. Morrell ..... **B•1892-1901**

Local Sales Offices & Reps

AZ	Phoenix, J. Smith & Assocs.	602-267-0981
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Mtn. View, Saber Entprs.	415-968-0427
CA	San Diego, Saber Entprs.	619-271-1523
CO	Colorado Springs, J. Smith & Assoc.	719-597-5343
CT	Wallingford, Pond Tech. Sls.	203-284-1500,
FL	Indian Rocks Bch., PAR Assocs.	813-596-8841
GA	Atlanta, PAR Assocs.	404-391-9117
IL	Woodstock, TMI Inc.	815-385-2212
ME	North Windham, Pond Tech. Sls.	207-892-9629
MA	Waltham, Pond Tech. Sls.	617-890-5535,
MI	St. Clair Shores, Stress Analysis Svcs.	313-776-9734

MN Eden Prairie, TMI Inc. 612-934-8665
NJ Budd Lake, Measurements, Inc. 201-770-1281
NM Albuquerque, J. Smith & Assocs. 505-345-6501,
NY Clarence, Trott Elctrns./E.I.L. 716-634-8500
NY Pittsford, Trott Elctrns./E.I.L. 716-586-8251
NC Charlotte, PAR Assocs. 704-535-9858
OH Bellbrook, Stress Analysis Svcs. 513-848-8215
OH Cincinnati, Stress Analysis Svs. 513-521-3967
OH Maumee, Stress Analysis Svs. 419-893-4591
OH Medina, Stress Analysis Svc. 216-725-7733
PA Exton, Measurements, Inc. 215-524-0310
PA Murrysville, Stress Analysis 412-733-1766
TX Dallas, Pace Tech. Sls. 214-368-0135
VA Fredericksburg, Measurements, Inc. ... 703-373-5520
WA Renton, Westech 206-271-5490
WI Oregon, TMI Inc. 608-835-5527
Can Ontario, Intertechnology 416-445-5500

ENTRELEC DIV/GEC ALSTHOM INTERNATIONAL, INC., 1950 Hurd Drive, Irving, TX 75038, Tel: 214-550-9025, FAX: 214-550-9215; Empl.: 50; *Sls. Mgr.:* F. D. Leynaert

ENVIRONMENTAL CONTAINER SYS., INC., See ECS Composites

ENVIRONMENTAL STRESS SYSTEMS, INC., 16310 N. Morris Rd., Sonora, CA 95370, Tel: 209-928-4900, FAX: 209-928-1117; *Sls. Mgr.:* Gino DiBartolomeo; *Dist. Mgr.:* Gino DiBartolomeo ..... **D•1200**

Local Sales Offices & Reps
AZ Chandler, Blackhart Assocs. 602-893-3488
CA San Jose, Microwave Meas. 415-846-0377
FL Ft. Lauderdale, Sun Elctrn. Sys. 305-587-5577
NY Stony Brook, LI., Gama Metro 516-751-2072
PA North Wales, Scientific Dvcs. 215-699-7707
TX Dallas, Textec 214-233-1928
EXP Santa Cruz, CA, Step Elctrns. 408-423-8722

ENVIRONMENTAL TELESIS & CONTROLS, P.O. Box 180206, Austin, TX 78718, Tel: 512-835-0330, TWX: 910-350-5536, FAX: 512-832-1775; Empl.: 12; *Sls. Mgr.:* Sharon Grimm

ENVIROPLAN, 3 Becker Farm Rd., Roseland, NJ 07068, Tel: 201-994-2300, FAX: 201-994-5100; Empl.: 50; *Sls. Mgr.:* Robert Mullowney

EOG, INC., OMX, INC., 10947 Golden West Drive, Hunt Valley, MD 21030, Tel: 301-785-3000, FAX: 301-771-5814; FSC No.: 17521; Empl.: 130; *Sls. Mgr.:* Arthur C. Rutledge, Jr.; *Dist. Mgr.:* Arthur C. Rutledge, Jr.

EPC IDENTIFICATION SYS., 505 Martin Ave., Rohnert Park, CA 94928, Tel: 707-585-8811, TWX: 910-3382-311, FAX: 707-585-8688; FSC No.: 67041; Empl.: 16; *Sls. Mgr.:* William Bolster; *Dist. Mgr.:* William Bolster

EPCO PRODUCTS INC., P.O. Box N. Cottage St., WAllkill, NY 12589, Tel: 914-895-2033, FAX: 914-895-2279; Empl.: 45; *Sls. Mgr.:* Mark Giegel

E.P.D./GENERAL POWER CORP., 1045 So. East Street, Anaheim, CA 92805-8508, Tel: 714-520-0881, 1-800-343-1813, TELEX: 678870 ATTN:EPD, FAX: 714-491-8644; Empl.: 150; *Sls. Mgr.:* Don Royer,Sls. Dir.; *Dist. Mgr.:* Connie Kouri ..... **D•1069**

Local Distributors
CA Santa Ana, Micro D 800-642-7631
IL Des Moines, United Stationers 800-323-1783
MN Edina, Radix 800-328-3004
NY Buffalo, Ingram Software 800-828-7250
NY Melville, Arrow Elctrns. 516-391-1847
NY Plainview, Global Computers 516-752-2299
TX Dallas, Hall-Mark Elctrns. 214-343-5000
TX Ft. Worth, Allied Elctrns. 817-336-5401

EPD ELECTRONICS, INC., 16921 S. Western Ave.-Bldg. 300, Gardena, CA 90247, Tel: 213-515-4996, TELEX: 691-738, FAX: 213-515-5011; Empl.: 6 ..... **D•1742**

Local Sales Offices & Reps
IA Burlington, JS Ridge Entprs., Inc. 319-754-8745
NJ Bricktown, Bryan Elctrn. Sls. Co. 201-840-8487
OR Portland, Dale G. Weber Co. 503-234-0686
TN White House, Apple Sls. & Mktg. 615-672-4498

EPE TECHNOLOGIES, INC., Subsidiary of Merlin Gerin, 1660 Scenic Avenue, Costa Mesa, CA 92626, Tel: 714-557-1636, FAX: 714-957-1103; Empl.: 350; *Sls. Mgr.:* Joe T. Amos, Jr.; *Dist. Mgr.:* Todd Hunter

EPH ENGINEERING ASSOCIATES, INC., 31 E. 400 S., Orem, UT 84058, Tel: 801-226-1383, FAX: 801-226-1437

EPIC, INC., 150 Nassau St., New York, NY 10038, Tel: 212-349-2470, FAX: 212-406-2508; Empl.: 8; *Sls. Mgr.:* Marge Couteau

EPIC RESINS, General Fiberglass Supply, Inc., 1415 Ellis St., Waukesha, WI 53186, Tel: 414-521-2255, FAX: 414-521-1320; Empl.: 20; *Sls. Mgr.:* Daniel Veenhuis

EPM CORPORATION, 8866 Kelso Dr., Baltimore, MD 21221, Tel: 301-686-7800, TELEX: 87569, FAX: 301-686-4662; Empl.: 75

EPOXY TECHNOLOGY, INC., 14 Fortune Dr., Billerica, MA 01821, Tel: 508-667-3805, 800-227-2201, TELEX: 94-7140, FAX: 508-663-9782; FSC No.: 33246; Empl.: 24

EPSCO INCORPORATED, 1115 Hilltop Dr., Unit A2, Itasca, IL 60143-1120, Tel: 708-250-0410, FAX: 708-250-0521; FSC No.: 53003; Empl.: 8; *Sls. Mgr.:* Wendie Amerena ..... **D•1743**

Local Distributors
AZ Phoenix, Fisher Sci. 602-995-1556
AR Little Rock, Carlton-Bates Co. 501-562-9100
CA San Francisco, Delray Distr. 415-861-6318
CO Denver, Sargent-Welch 303-399-8220
FL Mirimar, Aero Quality Sls. 305-432-2288
IL Carpentersville, Frank Fryer Co. 708-426-6731
IL Elmhurst, McMaster-Carr Supp. 312-834-9600
IN East Chicago, Acro Elctrns. Corp. 219-397-8681
KY Louisville, Peerless Elctrn. Equip. 502-637-7674
LA Lafayette, Ralph's Inc. 318-233-0105
MD Rockville, Capital Radio Whlsrs. 301-881-2270
MA Woburn, Rainin Instr. 617-935-3050
MI Farmington Hills, Motion Control Corp. 313-478-1640
MN Eden Prairie, Allied Elctrns. 612-829-7554
NJ Bridgeport, VWR Scientific 609-467-2600
NM Albuquerque, Walker Elec. Supp. 505-883-2992
NY Syracuse, Stewart Smith 315-437-7836
OH Warren, Rem Elctrns. Supp. 216-373-1300
PA Pittsburgh, Allied Elctrns. 412-367-4124
RI Providence, A & J Distrs., Inc. 401-421-0991
SC Charleston, Wholesale Inds. Elec. 803-722-2634
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Angie Elctrns. 713-659-8686
WA Kent, Fisher Scientific 206-872-0330
WI Milwaukee, Industrial Elctrns. Supp. ... 414-276-1212

EPSILON-LAMBDA ELCTRNS. CORP., 427 Stevens St., Geneva, IL 60134, Tel: 708-232-9611, TELEX: 708-232-9613; Empl.: 20; *Sls. Mgr.:* R. Knox

EPSON AMERICA, INC./OEM DIV., 20770 Madrona Ave., Torrance, CA 90503, Tel: 213-534-4500, FAX: 213-534-4449; Empl.: 900; *Sls. Mgr.:* John R. Confrey

EPSON

FAX: 213-782-5320

EPSON AMERICA INC., Component Sales Dept., 20770 Madrona Ave., Torrance, CA 90503, Tel: 213-787-6300; *Sls. Mgr.:* Hideo Akiyama; *Dist. Mgr.:* Craig Dyer ..... **A•1358-1363**

Local Sales Offices & Reps
AL Madison, Concord Comp Reps 205-772-8883, FAX:205-772-8262
AZ Scottsdale, Fred Board Assocs. 602-994-9388, FAX:602-994-9477
AZ Tucson, Fred Board Assocs. 602-299-1508, FAX:602-797-1683
CA Cupertino, Costar, Inc. 408-446-9339, FAX:408-446-4885
CA Encinitas, Bager Elctrns. Inc. 619-944-4108, FAX:619-632-8810
CA Woodland Hills, Bager Elctrns.Inc. 818-712-0011, FAX:818-712-0160
CO Broomfield, Western Region Mktg. 303-469-8088, FAX:303-469-8585
CO Colorado Springs, Western Region Mktg. 719-548-8282,FAX:719-548-0462
FL Casselberry, Dyne-A-Mark 407-831-2822, FAX:407-834-4524
FL Clearwater, Dyne-A-Mark 813-441-4702, FAX:813-447-4120
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501, FAX:305-772-0114
GA Norcross, Concord Comp. Reps 404-416-9597, FAX:404-441-0790
IL Itasca, LTD Technlgs. 708-773-2900, FAX:708-773-0358
IN Indianapolis, C.C. Electro Sls. 317-921-5000, FAX:317-921-5005
KS Shawnee Mission, Microtronics, Inc. 913-262-1444, FAX:913-262-1445
MD Ellicott City, Technlg. Sls. Assocs. 301-461-7802, FAX:301-461-7888
MA Needham Heights, Rosen Assocs. Inc. 617-449-4700,FAX:617-449-5245
MA Needham Heights, Rosen Assocs., Inc. 714-957-3367,FAX:714-546-2654
MN Eden Prairie, Electromark 612-944-5850, FAX:612-944-5855
NJ Parlin, JMR Sls; Inc. 201-525-8000, FAX:201-525-8805
NY Pittsford, Elcom Sls., Inc. 716-385-1400, FAX:716-248-8531
NY Skaneateles, Elcom Sls., Inc. 315-685-8967, FAX:315-685-6273
NY Wading River, Niktronics 516-929-4671, FAX:516-929-1683
NC Raleigh, WLA Assocs. 919-231-9939, FAX:919-231-9949
OH Sheffield, J.D. Babb 216-934-4454, FAX:216-934-4454
OR Tigard, Matrex Sls. 503-245-8080, FAX:503-246-1848
PA Trevose, Omega Sls. 215-244-4000, FAX:215-244-4104
TX Austin, Component Technlg. Sls. 512-250-2450, FAX:512-288-7328
TX Dallas, Component Technlg. Sls. 214-783-8831, FAX:214-783-4801
TX Houston, Component Technlg. Sls. 713-961-1262, FAX:713-462-9906
UT Salt Lake City, Western Region Mktg. 801-268-9768,FAX:801-268-9796
WA Bellevue, Matrex Sls. 206-643-0363, FAX:206-746-3672
WI Milwaukee, LTD Technlgs. 414-774-1000, FAX:414-774-0593

Local Distributors
AL Bell Inds., Inc. 205-837-1074,FAX:205-830-5598
AZ Tempe, Bell Inds., Inc. 602-966-7800, FAX:602-967-6584
CA Agoura Hills, Bell Inds., Inc. 818-706-2608, FAX:818-991-7695
CA Cypress, Bell Inds., Inc. 714-895-7801, FAX:714-891-4570
CA Irvine, IEC Irvine ... 714-837-9960,FAX:714-837-8308
CA Los Angeles, Bell Inds., Inc. 213-826-6778, FAX:213-447-3265
CA Orange, Orange Electro Mechanical ... 714-937-0714, FAX:714-937-0916
CA Rocklin, Bell Inds., Inc. 916-652-0414, FAX:916-652-0403
CA Sacramento, Integrated Elctrns. (IEC) 916-363-6030,FAX:916-362-6926
CA San Diego, Bell Inds., Inc. 619-268-1277, FAX:619-268-3733
CA San Jose, IEC San Jose 408-435-1000, FAX:408-435-8709
CA Santa Fe Springs, Cable & Comps./CCD 213-921-3611,FAX:213-921-9385
CA Santa Fe Springs, Corporate Warehouse 213-921-3611,FAX:213-921-9385
CA Santa Fe Springs, Just-In-Time 213-921-3611, FAX:213-404-0732
CA Sunnyvale, Bell Inds., Inc. 408-734-8570, FAX:408-734-8875
CO Denver, Integrated Elctrns. (IEC) 303-292-5537, FAX:303-292-0114
CO Wheatridge, Bell Inds., Inc. 303-424-1985, FAX:303-424-0932
CT Cronin Elctrns., Inc. 203-265-3134
CT Wallingford, Bell Inds., Inc. 203-269-6801, FAX:203-269-6527
CT Wallingford, Greene-Shaw Co. Inc. 203-265-3333, FAX:203-265-3583
FL Altamonte Springs, Bell Inds., Inc. 407-339-0078, FAX:407-339-0139
FL Ft. Lauderdale, Bell Inds., Inc. 305-421-1997
FL Melbourne, Greene-Shaw Co. Inc. 407-951-3636, FAX:407-951-3637
FL Tampa, Bell Inds., Inc. 813-541-4434
GA Norcross, Bell Inds., Inc. 404-662-0923, FAX:404-449-6901
IL Bensenville, Voyager Elctrns. 708-860-1300, FAX:708-860-1573
IL Elk Grove Village, Bell Inds., Inc. 708-640-1910, FAX:708-640-0474
IL Hoffman Estates, IEC IL (Hoffman Estates) 708-843-2040,FAX:708-843-2320
IL Urbana, Bell Inds., Inc. 217-328-1077, FAX:217-328-1148
IN Ft. Wayne, Bell Inds., Inc. 219-423-3422, FAX:219-424-2433
IN Indianapolis, Bell Inds., Inc. 317-875-8200, FAX:317-875-8219

IN Indianapolis, Custom Svc. Elect. 317-879-9119, FAX:317-879-9136
IN Indianapolis, Just-In-Time 317-299-5487, FAX:317-293-8256
IN Indianapolis, Mar Elctrns. 317-633-6699, FAX:317-633-6687
IA Bell Inds., Inc. 319-395-0730,FAX:319-875-8219
KS Olathe, ECS Inc. ... 913-782-7787,FAX:913-782-6991
MD Jessup, Bell Inds., Inc. 301-953-2566, FAX:301-953-0039
MA Andover, Bell Inds., Inc. 508-474-8880, FAX:508-474-8902
MA Needham, Cronin Elctrns., Inc. 617-449-5000, FAX:617-444-8395
MI Wixon, Bell Inds., Inc. 313-347-6633, FAX:313-347-3356
MN Bell Inds., Inc. 612-941-1493,FAX:612-938-7410
MN Fridley, Voyager Elctrns. Corp. 612-571-7766, FAX:612-571-9519
MO Bell Inds., Inc. 314-647-2355,FAX:317-875-8219
NH Golfstown, Key Comps. 603-626-1717, FAX:603-626-1720
NJ East Brunswick, Bell Inds., Inc. 201-613-0200, FAX:201-613-9689
NJ Hopelawn, Dove Elctrns. 201-324-7830, FAX:201-442-6789
NM Albuquerque, Bell Inds., Inc. 505-292-2700, FAX:505-275-2819
NY Bohemia, Key Comps. 516-567-7500, FAX:516-576-2920
NY Stony Brook, Dove Elctrns. 516-689-7733, FAX:516-689-7362
NC Bell Inds., Inc. 919-821-4041,FAX:919-821-4953
NC Raleigh, Greene-Shaw Co. Inc. 919-954-7138, FAX:919-954-7139
OH Dayton, Bell Inds., Inc. (Industrial) 513-435-8660, FAX:513-435-6765
OH Dayton, Bell Inds., Inc. (Military) 513-434-8231, FAX:513-434-8103
OR Beaverton, IEC Beaverton (OR) 503-641-1690, FAX:503-646-3737
OR Lake Oswego, Bell Inds., Inc. 503-635-6500, FAX:503-635-4095
PA Trevose, Bell Inds., Inc. 215-953-2899, FAX:215-364-4928
SC Bell Inds., Inc. 800-322-7908,FAX:407-339-0139
TN Bell Inds., Inc. 615-367-4400,FAX:407-339-0139
TX Austin, Norvell Austin 512-837-5555, FAX:512-837-3729
TX Austin, Omni Pro Elctrns. 512-794-9200, FAX:512-338-9576
TX Dallas, Norvell Elctrns., Inc. 214-233-0020, FAX:214-490-7245
TX Dallas, Omni Pro Elctrns. 214-233-0500, FAX:217-385-7508
TX Houston, Norvell Houston 713-462-1666, FAX:713-462-3210
TX Richardson, Bell Inds., Inc. 214-690-0466, FAX:214-690-0822
UT Midvale, Bell Inds., Inc. 801-255-9611, FAX:801-255-2477
UT West Valley City, IEC Utah (Salt Lake) 801-977-9750,FAX:801-975-1207
WA Bell Inds., Inc. 206-867-5410,FAX:206-867-5159
WA Bellevue (WA), IEC Bellevue (MA) 206-455-2727, FAX:206-453-2963
WI Waukesha, Bell Inds., Inc. 414-547-8879, FAX:414-547-6547

EQUIPMENT REMARKETING COMPANY, Boston Financial & Equity Corporation, 20 Overland Street, Boston, MA 02215, Tel: 617-267-8600, FAX: 617-267-2370

EQUIPTO, 225 S. Highland Ave., Aurora, IL 60506, Tel: 708-859-1000, 800-323-0801, TWX: 910-232-0845, FAX: 708-859-3255; Empl.: 300; *Sls. Mgr.:* Tom Nilles; *Dist. Mgr.:* Jerry Reidy

EQUIPTO ELECTRONICS CORP., 351 Woodlawn Ave., Aurora, IL 60506, Tel: 708-897-4691, FAX: 708-897-5314; FSC No.: 14002;Multiple; Empl.: 100; *Sls. Mgr.:* Kent Jarnig ..... **C•1044-1048**

ERA POLY-PLANAR DIV., See Poly-Planar, Inc.

ERASER CO., Box 4961, Syracuse, NY 13221, Tel: 315-454-3237, TELEX: 93-7442, FAX: 315-454-3090; Empl.: 45; *Sls. Mgr.:* Linda S. Cahill

ERC, See Electronic Research Co.

ERCONA, 979 North Ocean Ave., Patchogue, NY 11772, Tel: 516-758-0700, FAX: 516-758-0422; Empl.: 10; *Sls. Mgr.:* G. Moore; *Dist. Mgr.:* L. Mills

ERCON INCORPORATED, 26 Emerson Road, Waltham, MA 02154, Tel: 617-899-1497, FAX: 617-899-2650; *Sls. Mgr.:* Dennis Ehrreich

ERGOTRON, INC., 3450 Yankee Dr., Eagan, MN 55122, Tel: 612-452-8135, TELEX: 4310015, FAX: 612-452-8346; Empl.: 32; *Sls. Mgr.:* Harry C. Sweere

ERICSSON

FAX: 214-680-1059

ERICSSON COMPONENTS, INC., 403 International Parkway, Richardson, TX 75081, Tel: 214-480-8300, TELEX: 735389 ERICS RCHN ..... **D•1744-1748**

Local Sales Offices & Reps

AL Huntsville, The Novus Grp.,Inc. 205-534-0044
AZ Phoenix, CPS Assocs., Inc. 602-246-1097
CA Cupertino, PEI Assocs. Inc. 408-253-1960
CA Garden Grove, Elsco Elctrns. 714-891-4621
CA Grass Valley, Unitronics, Inc. 916-268-1737
CA San Diego, Elsco Elctrns. 619-292-1771
CO Denver, NOW Dvcs. 303-758-4884
CT Greenwich, Ericsson Comps. Inc. 203-625-7300
CT Woodbury, Power Factor & Assocs. ... 203-264-9812
FL Boynton Bch., Burke Assoc., Inc. 407-364-8203
FL Largo, Burke Assoc. Inc. 813-536-4335
FL Oldsmar, Burke Assoc. Inc. 813-786-8105
FL Winter Springs, Burke Assoc. Inc. 407-699-1888
GA Norcross, The Novus Grp., Inc. 404-263-0320
IL Elk Grove Village, Carlson Elctrns. Sls. 708-956-8240
IA Cedar Rapids, Carlson Elec. Sls. Assoc. 319-378-1450
MA Whitinsville, Power Factor & Assoc. ... 508-234-6415
MN Richfield, Clay Rep. Co. 612-861-2191
NJ Marlton, Naudain Assocs., Inc. 609-983-5300
NJ Parlin, JMR Sls., Inc. 201-525-8000
NY Fayetteville, H.C. Johnson 315-637-1143
NY Rochester, H.C. Johnson 716-586-0777
NY Wading River, Niktronics 516-929-4671
NC Cary, The Novus Grp., Inc. 919-460-7771
OH Cleveland, RK Comp. Sls., Inc. 216-642-9312
PA Glenshaw, H. C. Johnson 412-487-1246
TX Dallas, Dynamark 214-437-3333
VA Herndon, Stinson Assocs. 703-620-1331
WA Chattaroy, EMG-Elec. Mktg. Grp. 509-238-6476
WA Redmond, EMG-Elec. Mktg. Grp. 206-882-0962
WA Vancouver, EMG Elec. Mktg. Grp. 206-254-4572
WI Milwaukee, Carlson Elctrns., Sls. 414-476-2790
Can Markham, Ont., Deskin Sls. 416-475-1412

ERICSON MANUFACTURING CO., 4215 Hamann Pkwy., Willoughby, OH 44094, Tel: 216-951-8000, TELEX: 98-5390, FAX: 216-951-1867; Empl.: 110; *Sls. Mgr.:* Keith E. Wigman

ERIE TECHN. PRODS., See Murata Erie No. Amer., Inc.

ERNI COMPONENTS, 520 Southlake Blvd., Richmond, VA 23236, Tel: 804-794-6367, FAX: 804-379-2109; Empl.: 700; *Sls. Mgr.:* Thomas Noack

ESCAP PRODUCTS, 36 Central Ave., Hauppauge, NY 11788, Tel: 516-234-3900, FAX: 516-234-3986; *Sls. Mgr.:* Dave Hall

ESC ELECTRONICS CORPORATION

FAX: 201-947-0406

ESC ELECTRONICS CORP., 534 Bergen Blvd., Palisades Pk., NJ 07650, Tel: 201-947-0400; Empl.: 120 ..... **A•1558-1571, 1671, 2211**

Local Sales Offices & Reps

AL Huntsville, Murcota Corp. 205-539-8476
AZ Mesa, Sedco Sls. 602-461-9069
CA Newbury Pk., Westaironics 805-499-9844
CA Santa Clara, Rodgers Assocs. 408-984-8110
CO Denver, Donohue Sls. Co. 303-455-1719
FL Palm Harbor, Sigma Tech. Assocs. ... 813-789-5522
IL Elk Grove, Carlson Elctrn. Sls. Co. 312-956-8240
NJ Kenvil, Comps. for Elctrns., Inc. 201-927-6662
IA Cedar Rapids, Carlson Elctrn. Sls. Co. 319-378-1450
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MA Taunton, Sutton Associates 508-366-2102
MI Livonia, Electro-Mktg. Grp., Inc. 313-421-7590
MI Muskegon, Electro-Mktg. Grp. Inc. 616-798-1912
MN Minneapolis, R-J, Inc. 612-866-3661
MO Earth City, Midwest Tech. Sls. 314-298-8787
NC Winston-Salem, Murcota Corp. 919-722-9445
OH Dayton, Electro-Mktg. Grp. Inc. 513-890-8322
OH No. Royalton, Electro-Mktg. Grp. Inc. .. 216-582-0075
OR Beaverton, Ravencraft 503-646-9261
PA Ft. Washington, Simon Mktg. Consits. 215-628-3394
TX Plano, Zeus Engrg. 214-423-2027
VA Reston, Tytronics Tech. Sls. 703-620-4600
WI Milwaukee, Carlson Elctrn. Sls. Co. 414-476-2790
EXP NJ, Palisades Pk., ESC Elctrns. Corp. 201-947-0400
Can Toronto, Ont., CEA Assocs. 416-231-9717

ESE, 142 Sierra St., El Segundo, CA 90245, Tel: 213-322-2136; FSC No.: 58525; Empl.: 25; *Sls. Mgr.:* R. Mayers; *Dist. Mgr.:* R. Mayers ..... **D•1135**

Local Distributors

AL Birmingham, Midwest 0 205-942-8585
AZ Phoenix, Midwest 602-220-9440
CA Burbank, Midwest 818-954-0150
CA Hollywood, Shoreline 213-461-9800
DC Washington, Bradley Broadcast 301-948-0650
DC Washington, Midwest 301-577-4903
FL Miami, Midwest 305-592-5355
FL Ocala, Broadcast Gen. Store 904-622-9058
GA Atlanta, Midwest 404-449-0900
HI Honolulu, Midwest 808-521-4644
IL Chicago, Midwest 312-981-1107
IN Richmond, Allied 317-962-8596
IA Davenport, Video Midwest 319-322-1525
KY Edgewood, Midwest 606-331-8990
LA New Orleans, MZB/Gray 504-733-7265
MD Baltimore, Midwest 301-484-0131
MI Detroit, Midwest 313-350-3038
MN Minneapolis, Video Midwest 612-831-2248
MO St. Louis, Midwest 314-569-2240
NJ Cherry Hill, Landy 609-424-4660
NM Los Lunas, Dyma 505-865-6700
NY NYC, Midwest 212-473-6262
NY So. Glens Falls, N.E. Broadcast Labs 518-793-2181
NC Charlotte, Midwest 704-399-6336
PA Philadelphia, Pierce Phelps 215-879-7236
PA Pittsburgh, Midwest 412-364-6780
TN Nashville, Midwest 615-255-2801
TX Dallas, Midwest 214-929-6400
TX Houston, MZB/Gray 713-782-8611
VA Richmond, Midwest 804-426-8434
WA Tacoma, Broadcast Supp. West 800-426-8434
WI Milwaukee, Roscor 414-527-4200
Can Toronto, Allied Broadcast 416-731-3697

ESICO/TRITON, Triton Industries Inc., Box 247, Deep River, CT 06417, Tel: 203-526-5361, TELEX: 955439, FAX: 203-526-9524; FSC No.: 54195; *Sls. Mgr.:* Robert W. Mead

E-SQUARED TECHNOLOGY CORP., 4475 Dupont Ct 69, Ventura, CA 93003, Tel: 805-644-9544, FAX: 805-644-9584; Empl.: 19; *Sls. Mgr.:* Larry D. Emery

ESS, INC., 16310 No. Morris Rd., Sonora, CA 95370, Tel: 209-928-4900, FAX: 209-928-1117

ESTERLINE ANGUS INSTRUMENT CORP., Box 24000, Indianapolis, IN 46224, Tel: 317-244-7611, TELEX: 027-419, FAX: 317-247-4749; FSC No.: 72264; Empl.: 200; *Sls. Mgr.:* Thurman Teets, NTL. Sls. Mgr.

E-SYSTEMS, Greenville Div., P.O. Box 6056, Greenville, TX 75403-6056, Tel: 903-455-3450, FAX: 903-457-4413; *Sls. Mgr.:* C. L. Byrom

E-SYSTEMS, Melpar Div., 7700 Arlington Blvd., Falls Church, VA 22046, Tel: 703-560-5000, TELEX: 89-9494, TWX: 710-831-9802, FAX: 703-280-4627; Empl.: 2400

E-SYSTEMS, See Memcor-Truohm, Inc.

E-T-A®

FAX: 708-647-7494

E-T-A CIRCUIT BREAKERS, 7400 N. Croname Rd., Chicago, IL 60648, Tel: 708-647-8303; FSC No.: 06402; Empl.: 30; *Sls. Mgr.:* John J. Palsir ..... **B•1361-1364**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Tucson, Clemick & Assoc.	602-749-4003
CA	Los Angeles, Sierra-Pacific Eng.	714-731-3411
CA	San Francisco, Ross Mktg.	408-988-8111
CO	Denver, Candal, Inc.	303-935-7128
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Winter Springs, Sunland Assocs.	407-365-9533
GA	Atlanta, Macro Mktg.	404-662-5580
IN	Ft. Wayne, Needler Sls. Co.	219-447-2123
IN	Indianapolis, Needler Sls. Co.	317-255-8056
KS	Kansas City, Midtec Assoc.	913-541-0505
MA	Boston, Eagle Assocs.	617-444-3446
MI	Grand Haven, Hilltronics, Inc.	616-847-1010
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Minneapolis, PWC, Inc.	612-934-1409
MO	St. Louis, Midtec Assoc.	314-275-8666
NY	Islandia, Schmitt Inds.	516-582-5888
NY	Rochester, Lamb Comps.	716-272-7720
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Cleveland, Del Steffen & Assoc.	216-461-8333
OH	Columbus, Del Steffen & Assoc.	419-884-2313
OH	Dayton, Del Steffen & Assoc.	513-293-3145
OR	Portland, Eltech	503-684-3458
PA	Philadelphia, Jacobsen Assoc.	215-674-2937
PA	Pittsburgh, Del Steffen & Assoc.	412-276-7366
TX	Dallas, Delta Comps.	214-287-6333
UT	Salt Lake City, Frank Merchant	801-277-3775
VA	Sterling, Beacon North Inc.	703-478–2480
WA	Seattle, Eltech	206-643-4330
WI	Milwaukee, Star Engineering	414-645-3680

ET&T CORPORATION, 300A Redhill Ave., 5-A03, Costa Mesa, CA 92626, Tel: 714-557-2703, TELEX: 678352; Empl.: 400ò; *Sls. Mgr.:* B.A. Mylar Rao

ETA POWER, See JETA Power Systems

ETI SYSTEMS

FAX: 619-757-2305

ETI SYSTEMS, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, Tel: 619-757-7770; FSC No.: 952 762672; *Sls. Mgr.:* Bill Tice; *Dist. Mgr.:* Liane Glover ..... **A•2040-2041; B•1256-1260; D•1136**

Local Distributors

AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Fremont, Allied Elctrns.	415-770-0590
CA	S. San Francisco, Allied Elctrns.	415-952-9599
CA	San Diego	619-279-2550
CA	San Diego, Allied Elctrns.	619-279-2550
CA	Torrance, Allied Elctrns.	213-373-8828
CO	Englewood, Allied Elctrns.	303-790-1664
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Pompano Beach, Allied Elctrns.	305-978-3008
GA	Atlanta, Motion Elctrns.,Inc.	404-455-8262
GA	Norcross, Allied Elctrns.	404-446-8595
IL	Lisle, Components, Inc.	312-852-7707
IL	Wood Dale, Allied Elctrns.	708-860-0007
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Billerica, Allied Elctrns.	508-667-7921
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OK	Tulsa, Allied Elctrns.	918-664-0844
PA	Newton Square, QDI	215-359-1000
PA	Pittsburgh, Allied Elctrns.	412-367-4124
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Humble, Allied Elctrns.	713-446-8005
VA	Virginia Bch., Allied Elctrns.	804-363-8662
WA	Seattle, Allied Elctrns.	206547-2827
WI	New Berlin, Allied Elctrns.	414-796-1280
WI	Oshkosh, Electronic Inds.	414-235-4233

ETM ELECTROMATIC INC, 35451 Dumbarton Ct., Newark, CA 94560, Tel: 415-797-1100, FAX: 415-797-4358; Empl.: 85; *Sls. Mgr.:* Kenneth F. Lillis

ETRI

FAX: 704-283-7170

ETRI, INC., 1503 Rocky River Rd., North, Monroe, NC 28110, Tel: 704-289-5423; *Sls. Mgr.:* Peter Pignetti ..... **B•1261; C•1615-1620**

Local Sales Offices & Reps

CA	Irvine, Groh Assocs.	714-837-9871
CA	San Diego, Bestronics	619-693-1111
CO	Boulder, Comp. Prods. Sls.	303-530-2800
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
KS	Overland Pk., Spectrum Sls.	913-648-6811
MI	Farmington Hills, Tritech Sls., Inc.	313-553-3370
MI	Kalamazoo, Tritech Sls., Inc.	616-382-5570
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	Hazelwood, Spectrum Sls.	314-731-5151
NH	Salem, Sls. Engrg. Co.	603-893-5521
NY	Port Washington, Ashtec, Inc.	516-767-0336
OH	Cincinnati, Makin & Assocs., Inc.	513-871-2424
OH	Columbus, Makin & Assocs., Inc.	614-848-5454
OH	Solon, Makin & Assocs., Inc.	216-248-7370
WI	Janesville, Antek/Lincoln Hodges & Assocs.	608-754-4214
Can	Mississauga, Ont., R-Theta	416-890-0221

Local Distributors

AZ	Tempe, Acacia/Deanco	602-894-2874
AZ	Tempe, Harper, S.I.D.	602-967-1464
CA	Alhambra, Harper, S.I.D.	213-979-5090
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Irvine, Acacia/Deanco	714-660-0834
CA	San Diego, Acacia/Deanco	619-565-4365
CA	San Diego, Harper, S.I.D.	619-578-2500
CA	San Jose, Harper, S.I.D.	408-943-9490
CA	Santa Clara, Comp. Ctr., Inc.	408-988-3751
CA	Sunnyvale, Acacia/Deanco	408-745-7200
CO	Lakewood, Acacia/Deanco	303-232-2882
CT	Milford, Jaco Elctrns., Inc.	203-874-0006
CT	Milford, Milgray Elctrns.	203-878-5538
FL	Altamonte Springs, Pioneer Elctrns.	305-834-9090
FL	Deerfield Beach, Pioneer Elctrns.	305-428-8877
FL	Winter Park, Milgray Elctrns.	407-647-5747
GA	Norcross, Milgray Elctrns.	404-446-9777
IL	Bensenville, Milgray Elctrns.	312-350-0490
IL	Bensenville, Voyager Elctrns.	312-860-1300
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Indianapolis, Advent Elctrns.	317-872-4910
KS	Overland Park, Milgray Elctrns.	913-236-8800
MD	Columbia, Milgray Elctrns.	301-621-8169
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Wilmington, Jaco Elctrns., Inc.	617-273-1860
MA	Wilmington, MilGray Elctrns.	508-657-5900
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Minneapolis, Stark Elctrns.	612-332-1325
NH	Hudson, Bell Inds.	603-882-1133
NJ	Marlton, Milgray Elctrns.	609-983-5010
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Rochester, Milgray Elctrns.	716-235-0830
NY	Rochester, Summit Elctrns.	716-334-8110
OH	Cleveland, Milgray Elctrns.	216-447-1520
OK	Tulsa, Norvell Elctrns.	918-254-8606
OR	Beaverton, Acacia/Deanco	503-646-3377
PA	Allentown, P.A. Peters	215-434-5237
PA	Montgomeryville, Pyttronics Inds.	215-643-2850
TX	Austin, Norvell Elctrns.	512-837-5555
TX	Dallas, Milgray Elctrns.	214-248-1603
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Irving, Harper, S.I.D.	214-621-0500
UT	Midvale, Bell Inds.	801-255-9611
VA	Charlottesville, Virginia Elctrn. Comps.	804-296-4184
WI	Milwaukee, Indl. Elctrns.	414-276-1212
Can	Mississauga, Ont., R-Theta	416-890-0221
Can	Vancouver B.C., Intek Elctrns.	604-324-6831

EUBANKS ENGINEERING, 950 E. Royal Oaks Dr., Monrovia, CA 91016, Tel: 818-357-7011, TELEX: 675403, FAX: 818-357-4718; Empl.: 90; *Sls. Mgr.:* James Reed

EURO-DIP, See Preci-Dip

EURO QUARZ GMBH, See Raltron Electronics Corp.

EVANS ELECTRONICS, Box 5055, Berkeley, CA 94705, Tel: 415-653-3083

EVAPORATED COATINGS, INC., 2365 Maryland Rd., Willow Grove, PA 19090, Tel: 215-659-3080, FAX: 215-659-1275; Empl.: 31; *Sls. Mgr.:* Stephen L. Schaffer

EVENTIDE, INC., One Alsan Way, Little Ferry, NJ 07643, Tel: 201-641-1200, 800-446-7878, TWX: 710-991-8715; Empl.: 53; *Sls. Mgr.:* Gil Griffith; *Dist. Mgr.:* Gil Griffith

EVEREADY®

FAX: 314-982-4078

EVEREADY BATTERY CO. INC., Checkerboard Square, St. Louis, MO 63164, Tel: 314-982-2000 ..... **D•1456-1457**

Local Sales Offices & Reps

CA	Irvine	714-753-0588
GA	Duluth	404-279-0228
IL	Lisle	708-964-8668
MO	St. Louis	314-982-2000
NJ	Saddle Brook	201-845-5400
OH	Independence	216-447-1127
TX	Dallas	214-241-9100

EVEREST ELECTRONIC EQUIPMENT, 2683 Hamilton Mill Rd., Buford, GA 30518, Tel: 404-932-2900, FAX: 404-932-5473; Empl.: 240; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Barry Holman ..... **C•1050**

Local Sales Offices & Reps

CA	Anaheim, Everest Elctrn. Equip., Inc.	714-634-2200
FL	Longwood, Warren Peripherals	407-830-5100
GA	Buford, Everest Elctrns.	404-932-2900
IL	Elmhurst, First Rep Co.	708-530-2450
NJ	Union, Stearns Assoc.	201-686-2980
OH	Aurora, Meta Tech. Sls.	216-562-8772
PA	Mendenhall, Clark H. Bach & Assocs.	215-388-7903
TX	Plano, Digital Elctrn. Sys.	214-423-6056

Local Distributors

AZ	Phoenix, R Squared	602-966-1255
CA	Santa Monica, SE Technlg.	213-458-9866
CO	Englewood, R Squared	303-799-9292
FL	Stuart, Total Tec Sys.	407-220-9929
IL	Hoffman Estates, Datalink, Inc.	708-822-1244
KS	Overland Park, R Squared	800-937-3478
MD	Gaithersburg, Total Tec Sys.	301-590-9304
MA	Wakefield, Total Tec Sys.	617-246-5525
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AL Huntsville, L & D 205-837-1469
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CA San Diego, Texel 619-576-2162
CA San Jose, Texel/North 408-272-6836
CA Seal Beach, Texel 213-596-9411
CO Denver, West Inc. 303-477-8180
FL Ft. Lauderdale, Hughes Assoc. 305-720-1674
GA Atlanta, L & D 404-395-7079
IL Rolling Meadows, Sumer, Inc. 708-991-8500
IN Indianapolis, John H. Weaver Co. Inc. 317-257-7661
MD Baltimore, Bernard White 301-484-5400
MA Canton, New England Elctrn. Sls. 617-828-4835
MI Birmingham, Forand Sls. 313-644-0087
MN St. Paul, Countryman Assoc. 612-645-9151
NC Raleigh, L & D 919-876-5301
NC Wilmington, L & D 919-256-8110
OH Cleveland, C. J. Voneman Co. 216-226-8000
OR Portland, General Elctrns. 503-297-8500
PA Hatboro, Joe Oberlies Co. 215-675-4226
TX Dallas, Comp. Tech. 214-783-8831
TX El Paso, Alexander Entprs. 915-591-3142
TX Houston, Comp. Tech. 713-961-1262
UT Centerville, West, Inc. 208-888-6227
WA Renton, General Elctrns. 206-864-0969
WI Brookfield, Sumer, Inc. 414-784-6641
Can Don Mills, Ont., R.D. Assocs. 416-444-0959

FERROXCUBE, See Philips Components Discrete Products Division

FIBERGUIDE INDUSTRIES INC., 1 Bay St., Stirling, NJ 07980, Tel: 908-647-6601, FAX: 908-647-8464; Empl.: 80; *Sls. Mgr.:* Sharon Venzke, Ind.

FIBEROPTICS TECHNOLOGY, INC., Quassett Rd., Pomfret, CT 06258, Tel: 203-928-0443, 800-433-5248, FAX: 203-928-7664, 800-543-2558

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FAX: 301-881-0530

FIC CORP., 12216 Parklawn Dr., Rockville, MD 20852, Tel: 301-881-8124, 800-638-6594, TWX: 710-828-9809; FSC No.: 3613; Empl.: 46; *Sls. Mgr.:* Robert E. Frye, V.P.; *Dist. Mgr.:* Robert E. Frye, V.P. ..... **B•1365**

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FAX: 609-599-9508

FIFTH DIMENSION, INC., 801 New York Ave., Trenton, NJ 08638, Tel: 609-393-8350, TWX: 510-681-8412; Empl.: 60; *Sls. Mgr.:* Dick Clawges, Prod. Mgr. ..... **B•1268-1269, 1468-1469, 1696-1697**

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FIL-COIL COMPANY, INC., 800 Axinn Ave., Garden City, NY 11530, Tel: 516-228-9445, TELEX: 960127 SWIFT NYK, FAX: 516-228-9064; FSC No.: 56528; Empl.: 85; *Sls. Mgr.:* William Goldman

FILM MICROELECTRONICS, See General Microcircuits

FILM MICROELECTRONICS INC., 10 B Centennial Drive, Peabody, MA 01960, Tel: 508-532-9913, FAX: 508-532-9954; FSC No.: 27851; Empl.: 101; *Sls. Mgr.:* Karl Cyr

FILTER CONCEPTS INC., 2624 S. Rousselle, Santa Ana, CA 92707, Tel: 714-545-7003, FAX: 714-545-4607; *Sls. Mgr.:* Les Edelberg ..... **A•1620-1623**

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610 E. 10th St., Oakland, CA 94606
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(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

FILTER PRODUCTS, Rockwell International, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532(COLLINS CSMA), FAX: 714-641-5320; FSC No.: 2X491; Empl.: 60; *Sls. Mgr.:* Bob Johnson

FILTRON CO., INC., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, Tel: 516-752-1144, FAX: 516-752-0905; FSC No.: 81831; Empl.: 90; *Sls. Mgr.:* Richard Michelson ..... **A•1673**

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CA	Felton, Gilland Mtkg.	408-335-3884
CA	La Habra, Cygnus	213-691-2993
CO	Boulder, A. Bissell Co.	303-444-1173
OH	Kettering, J. May Assocs.	513-296-1746
PA	Furlong, Avenir, Inc.	215-348-8290
IL	Palatine, Technical Sls. Assoc.	312-991-6600
MD	Baltimore, Bernard White & Co.	301-484-5400
MA	North Andover, Russet	508-794-4995
NY	E. Syracuse, Matl. Svcs.	315-437-7093
NY	Melville, Carnes Assoc.	516-694-1600
NY	Melville, Carnes Assocs.	516-694-1600
OH	Kettering, J. May Assocs.	513-296-1746
NY	Syracuse, Material Svcs.	315-437-7093
PA	Furlong, Avenir, Inc.	215-348-8290
TX	Bedford, De Armond Ent.	817-267-2048
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WA	Mercer Island, Eagle Enterprises	206-232-7401

FILTRONICS, INC., 6010 Parretta, Kansas City, MO 64120, Tel: 816-231-7375, FAX: 816-241-0368; FSC No.: 53733; Empl.: 70; *Sls. Mgr.:* Brenda Gabbert

FINISHERS, INC., 517 Aldo Avenue, Santa Clara, CA 94054, Tel: 408-988-0222; Empl.: 10; *Sls. Mgr.:* Denise Firebaugh

THE FIRST ELECTRONICS CORP., 71 Von Hillern St., Boston, MA 02125, Tel: 617-288-2430, FAX: 617-288-0332; FSC No.: 14532; Empl.: 65; *Sls. Mgr.:* Chris Nastopoulos

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FISCHER CONNECTORS, 28245 Avenue Crocker, Valencia, CA 91355, Tel: 805-295-0600, 1-800-344-0445, TELEX: 499-4182 ..... **C•1365-1371**

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CA	Fairfield, Baribeault Assocs.	707-428-6095, FAX:707-428-6099
CA	Mission Viejo, Wayne Champa Assocs.	714-581-3459,FAX:714-581-2432
CA	Moorpark, Interconn Tech. Mktg.	805-523-1582, FAX:805-523-1583
CA	Valencia, Fischer Connectors, Inc.	805-295-0600, FAX:805-295-0090
CO	Golden, J.F. Hurlbut Co.	303-279-7796, FAX:303-278-9909
FL	Indian Harbour Bch., Bill Toy & Assocs.	407-773-5805,FAX:407-773-4961
IN	Greenwood, Valentine & Assocs.	317-888-2260, FAX:317-881-4904
MD	Baltimore, Chesapeake Indl. Mktg.	301-653-0476, FAX:301-653-4675
MA	Newton, M. A. Olson Assocs. Inc.	617-244-4030, FAX:617-244-6572
MI	Madison Heights, Pine Sls., Inc.	313-589-0350, FAX:313-589-3420
MN	Minneapolis, Electro-Tec Assocs.	612-853-0242, FAX:612-854-8601
NJ	Corbin City, Brown Assocs.	609-628-3434, FAX:609-628-4012
NJ	Wayne, G.T. Assocs., Inc.	201-694-6040, FAX:201-694-6493
NY	Unadilla, J.E.F. Assocs.	607-369-9239, FAX:607-369-5056
OH	Cleveland, KT/DEPCO	216-442-6200, FAX:216-461-2101
TX	Irving, Aid Elctrns., Inc.	214-790-4761, FAX:214-790-9792
WA	Redmond, Eclipse Mktg.	206-885-6991, FAX:206-883-9481
Can	Richmond Hill, Ont., Renmark Elctrns. Ltd.	416-881-8844,FAX:416-881-8848

FISHER-BAKER CORP., 3108 Industrial 31st, Fort Pierce, FLA 34957, Tel: 407-466-0750, FAX: 407-466-7679; *Sls. Mgr.:* R. Peck

FISHERCAST, Fisher Gauge Limited, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, FAX: 705-745-8818; Empl.: 180ò; *Sls. Mgr.:* Larry Hatfield

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FISONS INSTRUMENTS, 24911 Stanford Ave., Valencia, CA 91355, Tel: 805-295-0019, TELEX: 4720130, FAX: 805-295-0419; Empl.: 200; *Sls. Mgr.:* Robert Boyd

FITCHBURG COATED PRODUCTS, Technographics, Inc., P.O. Box 1106, Scranton, PA 18501, Tel: 717-347-2035; Empl.: 300

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FJA INDUSTRIES, P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, TWX: 910-338-0260; *Sls. Mgr.:* Frank J. Ardezzone

FLANN MICROWAVE INC., Ste. 2200, One Kendall Square, Cambridge, MA 02139, Tel: 1-800-937-3772, FAX: 617-577-8234; *Sls. Mgr.:* Lawrie Lansdell

FLEX-CORE DIV., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43235, Tel: 614-889-6152, FAX: 614-876-8538; Empl.: 10; *Sls. Mgr.:* D. Morlan ..... **A•2228**

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FLEXIBLE FURNITURE DIVISION, Metal Components, Inc., 323 Acorn Street, Plainwell, MI 49080, Tel: 616-685-6831; Empl.: 32; *Sls. Mgr.:* Lynn D. Middlebrook ..... **C•1053**

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MN	Minneapolis, Haldeman-Homme Co.	612-331-4880
NJ	Ringwood, Eastern Scientific Prods.	201-728-7200
OH	Medina, Danco Equip.	216-723-3233
VA	Vienna, Morgan Scientific	703-893-4306

FLEXIBLE TECHNOLOGIES, Arlon, P. O. Box 4305, 199 Amaral St., E. Providence, RI 02914, Tel: 401-434-2340, TELEX: 6972602, FAX: 401-434-2557; Empl.: 65; *Sls. Mgr.:* Herb Howard

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MD	Hunt Valley, Marktron	301-628-1111
MI	Birmingham, Riley-Cotter Sls.	616-264-5744
NY	Huntington, J. A. Keeneth Co.	516-351-7008

FLEX-LINK PRODUCTS, INC., 599 Fourth St., San Fernando, CA 91340, Tel: 818-898-1451, FAX: 818-365-3022; FSC No.: 6Z867; Empl.: 80; *Sls. Mgr.:* Al Wasserzug

FLEXSTAR CORP., 2040 Fortune Dr., No. 101, San Jose, CA 95131-1823, Tel: 408-433-0770, FAX: 408-433-1766; Empl.: 57; *Sls. Mgr.:* Michael Witte, Dir. Sls./Mktg.

FLEXTRONICS INTERNATIONAL, 48001 Fremont Blvd., Fremont, CA 94538, Tel: 510-226-3539, FAX: 510-226-3535; Empl.: 1800

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JOHN FLUKE MFG. CO., INC., 6920 Seaway Blvd., Everett, Wa 98206, WA 98203, Tel: 206-347-6100, TELEX: 185102, TWX: 810-445-2943, FAX: 206-356-5962; Empl.: 2400; *Sls. Mgr.:* R. Wambolt; *Dist. Mgr.:* R. Mewett ..... **D•1248-1249, 1408-1409**

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CO	Denver, John Fluke Mfg. Co., Inc.	303-695-1000
CT	Hartford, John Fluke Mfg. Co., Inc.	203-659-3541
DC	Washington, John Fluke Mfg. Co., Inc.	301-770-1570
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FORTRON/SOURCE CORP., Power Supplies, 6818-G Patterson Pass Rd., Livermore, CA 94550, Tel: 415-373-1008, TELEX: 559291 FORTRON UD, FAX: 415-373-1168; Empl.: 150; *Sls. Mgr.:* Louie Aldama

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CA	Sunnyvale, Foxconn	408-749-1228
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WA	Seattle, Hallmark Elctrns.	205-547-0415

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CA	Canoga Park, Groh Assocs.	818-884-9550
CA	Irvine, Groh Assocs.	714-837-9871
CA	Mt View, Brooks Tech. Grp.	415-960-3880
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CA	Poway, Groh Assocs.	619-673-4321
CA	San Clemente, Groh Assocs.	714-361-2321
CA	San Clemente, Groh Assocs.	714-498-6568
CA	West Covina, Groh Assocs.	818-926-8579
CO	Littleton, Megatronix	303-730-6262
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Spring, Semtronic Assocs.	407-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
GA	Lawrenceville, Southeast Tech. Grp.	404-979-2055
IL	Itaska, Janus Inc.	708-250-9650
IN	Indianapolis, Wilson Tech. Sls. Inc.	317-872-2513
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland, Spectrum Sls.	913-648-6811

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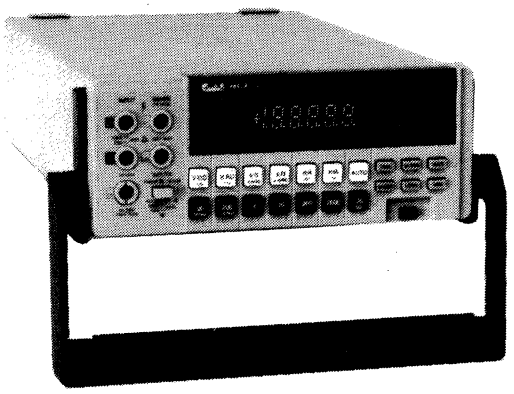



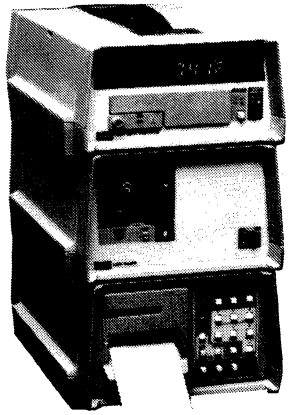

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MO	Florissant, Spectrum Sls.	314-921-1313
MO	Hazelwood, Spectrum Sls.	314-731-5151
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NJ	Medford, Component Consultants	609-654-5300
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NY	Northport, HLM	516-757-1606
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NY	Williamsville, Pi Tronics	716-689-7638
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OH	Centerville, Bear Mktg. Inc.	513-436-2061
OH	Richfield, Bear Mktg. Inc.	216-659-3131
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Can	Rexdale, ON, Electro Source, Inc.	416-675-4490
Can	Vancouver, BC, Electro Source, Inc.	604-435-8066

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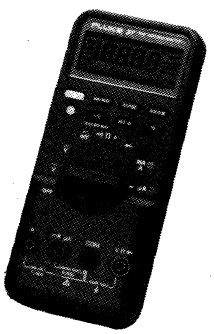

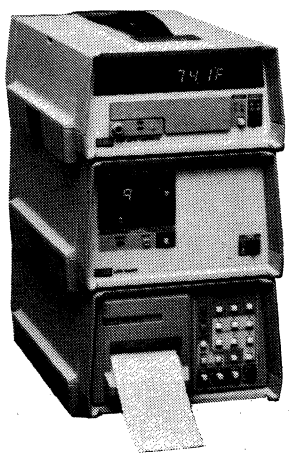

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MO	St. Louis, A.E.M. Inc.	314-298-9900
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NC	Charlotte, C.S.R. Elec.	704-847-5806
NC	Raleigh, C.S.R. Elctrn.	919-878-9200
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TN	Knoxville, C.S.R. Elctrn.	615-689-7911
TX	Carrollton, Tech. Mktg. Inc.	214-387-3605
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UT	Salt Lake City, Marshall Inds.	801-266-2428
UT	Salt Lake City, Marshall Inds.	801-485-1551
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Can	Ottawa, Ont., Semad Sys.	613-727-8325
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Can	Vancouver, Future Elctrns.	604-294-1166
Can	Willowdale, Ont., Milgray Elctrns.	416-756-4481

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CA	Santa Clara, Norcomp	408-727-7707
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IL Itasca, Beta Technlg. 708-256-9586
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NJ Mt. Laurel, Fujitsu Microelctrns. 609-727-9700
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NH Merrimack, Callahan Assocs. 603-424-5700
NJ Totowa, Tech Mktg. Assocs. 201-812-0356

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NY Smithtown, T&K Sls. 516-724-3546
NM Albuquerque, Cleveland Entprs. 505-265-7893

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GA Atlanta 404-446-8090
IL Itasca 708-250-0989

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GBC, INC., Lamp Division, P.O. Box 2205, Ocean, NJ 07712, Tel: 908-774-8502, FAX: 908-774-8041; Empl.: 25; *Sls. Mgr.:* W. Savage

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TX	Brownsville, R.O. Whitesell and Assoc.	512-542-1718
TX	Grand Prairie, Ion Assoc.	214-647-8225
TX	Houston, Ion Assoc.	713-537-7717
TX	Richardson, GC Intl.	214-234-3240
WI	Milwaukee, KMA Sls.	414-259-1771

Local Distributors

CT	Danbury, Pilgrim Elctrns.	203-792-7274
RI	Westerly, Promege Sls.	401-348-1037

GC-THORSEN, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209, Tel: 815-968-9661, FAX: 815-968-9731; Empl.: 260; *Sls. Mgr.:* Alan Walter, VP Mktg.; *Dist. Mgr.:* Vito Giovingo

GEC-MARCONI ELECTRONIC SYSTEMS CORP., 164 Totowa Rd., P.O.Box 975, Wayne, NJ 07474-0975, Tel: 201-633-6000, FAX: 201-633-6167; FSC No.: 0D0D0; Empl.: 2030; *Sls. Mgr.:* M. G. Gordon, VP

GECO, 145 Penn St., Millheim, PA 16854, Tel: 814-349-5555, FAX: 814-349-5657; Empl.: 20

GE FANUC AUTOMATION NORTH AMERICA INC., P.O. Box 8106, Charlottesville, VA 22906, Tel: 804-978-5000, 800-648-2001, FAX: 804-978-5205

FAX: 507-263-5987

GEMINI INC., 103 Mensing Way, Cannon Falls, MN 55009, Tel: 507-263-3957, 800-533-3631; *Sls. Mgr.:* Jim Weinel ..... **C•1054-1055**

Local Sales Offices & Reps

AR	Taylor, Gemini Inc.	512-352-5027
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CA	Upland, Gemini Inc.	714-920-3442
FL	Orlando, Gemini Inc.	404-299-3330
IL	Palatine, JRS Assocs.	708-991-6626
IN	Noblesville, R & D Elctrns.	317-849-2026
IA	Cannon Falls, Gemini Inc.	800-533-3631
KS	Lenexa, Gemini Inc.	913-492-8267
MA	Brookline, Harman Assocs.	617-232-6687
MI	Dearborn, Pitcher-Poulin, Inc.	315-582-5450
MN	Cannon Falls, Gemini Inc.	507-263-3957
NY	Endwell, Reagan Compar Inc.	607-754-2171
NC	Kernersville, Wallace ELctrns. Sls.	800-334-3518
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
PA	Plymouth Meeting, Gemini Inc.	215-825-6736
TX	Carrolltown, Multi Line	214-242-9093
TX	Taylor, Gemini, Inc.	512-352-5207
WI	Wauwatosa, Larsen Assocs.	414-258-0529

GEMS SENSORS DIVISION, Div. of IMO Industries Inc., Cowles Rd, Plainville, CT 06062-1198, Tel: 203-677-1311, TELEX: 99-306, FAX: 203-747-4244; FSC No.: 04034; Empl.: 233; *Sls. Mgr.:* M. W. Brown; *Dist. Mgr.:* M. W. Brown

Local Sales Offices & Reps

CA	Sante Fe Springs, IMO Inds. Inc.	213-868-2268
CT	Rocky Hill, IMO Inds. Inc.	203-563-3737
GA	Atlanta, IMO Inds.Inc.	404-261-7063
OH	Cleveland, IMO Inds. Inc.	216-333-1805
Can	Mississauga, Ont., IMO Inds. (Canada) Inc.	416-678-6141

GEN/COMP INC., 6 Algonquin Rd., Canton, MA 02021, Tel: 617-828-2008; *Sls. Mgr.:* G. Nutter

GENERAL AUTOMATIC CORP., See E-Tron Corp.

GENERAL AUTOMATION, A Div. of 769442 Ont. Ltd., RR No. 4 McMullen Rd., Kemptville, Ont., Canada KOG 1JO, Tel: 613-724-1993, FAX: 613-258-4701; FSC No.: 1429-1592; Empl.: 4-6; *Sls. Mgr.:* Bruce Murison

GENERAL CABLE CO., Fiber Optics Div., 1 Cragwood Rd., S. Plainfield, NJ 07080, Tel: 201-769-3200, TELEX: 642892; *Sls. Mgr.:* Pieter deBruijn

GENERAL CABLE CO., 250 Overton Dr., Kenly, NC 27542, Tel: 919-284-5144, FAX: 919-284-5148; *Sls. Mgr.:* Dee Stinnette

GENERAL CABLE CO., Guardian Prods. Div., 411 West Putnam Ave., Greenwich, CT 06830, Tel: 800-243-8020, 203-661-0100, FAX: 203-661-4366; *Dist. Mgr.:* Mr. E.A. Luciano ..... **C•1753**

Local Sales Offices & Reps

AZ	Phoenix, Verlin Cink	602-997-4568
CA	Commerce, Michel Brothers	213-887-9383
CO	Denver, Trilogy Mktg.	303-989-0378
FL	Orlando, Hytech Sls.	407-578-3667
GA	Atlanta, Cenco	404-446-1787
IL	Niles, Bensdorf & Johnson	708-647-8512
MD	Gaithersburg, Mitchell Sls.	301-670-0022
MA	Braintree, Century Cable Sls.	617-843-5100
MN	Minneapolis, Rouser Sls.	612-544-3145
MS	Pearl, GS & G Sls. Assoc.	601-932-3720
MO	St. Louis, Jones Electl. Sls.	314-428-5665
NJ	Bridgeton, Harvey Assocs.	609-451-8785
OR	Portland, Pacific Western Agcy.	503-227-5555
TN	Memphis, J. C. Woollums & Assoc.	901-323-0024
TX	Dallas, Brenner Sls.	214-247-4545
WA	Seattle, Pacific Western Agcy.	206-763-1802

GENERAL CHEMICAL CORPORATION, 400 Nichols Road, Pittsburg, CA 94565, Tel: 415-685-1450, FAX: 415-458-9271

GENERAL CONTROLS, INC., 2350 Brickvale Ave., Elk Grove Village, IL 60007, Tel: 312-595-2152, FAX: 312-595-2271

GENERAL DEVICES
Electronic Hardware Manufacturers

FAX: 317-898-2917

GENERAL DEVICES CO., INC., Box 39100, Indianapolis, IN 46239-9632, Tel: 317-897-7000; Empl.: 250; *Sls. Mgr.:* Jack Bradford; *Dist. Mgr.:* Dan McCauley ..... **C•1056**

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg., Inc.	205-539-1485
AZ	Phoenix, Snyder Engrg.	602-279-2010
CA	Canoga Park, Groh Assocs.	818-884-9550
CA	Irvine, Groh Assoc.	714-837-9871
CA	North Hollywood, Groh Assocs.	818-509-9111
CA	Poway, Groh Assocs.	619-673-4321
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CA	West Covina, Groh Assocs.	818-337-7831
CO	Broomfield, Summitwest Mktg.	303-460-9600
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Deerfield Beach, J. Krutek & Assoc.	305-427-4202
FL	Maitland, J. Krutek & Assoc.	305-628-4837
GA	Duluth, Dixie Tech. Mktg., Inc.	404-381-5592
IL	Northbrook, Howard Benjamin	708-272-2900
IN	Fishers, R & D Elctrns., Inc.	317-849-2026
IA	Cedar Rapids, Thomas Dowell & Assocs.	319-364-3880
KS	Overland Pk., Thomas Dowell & Assocs.	913-599-1100
MD	Towson, Arbotek, Inc.	301-825-0775
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MA	West Bridgewater, Coakley, Boyd & Abbett	508-559-6700
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	South St. Paul, Northport Engrg.	612-457-8000
MS	Dixie Tech. Mktg.	404-381-5592
MO	St. Louis, Thomas Dowell & Assocs.	314-849-4234
NJ	Mountainside, Henry G. Ritcher, Inc.	201-233-4615
NY	Fayetteville, Henry G. Ritcher, Inc.	315-637-6713
NC	Raleigh, Dixie Tech. Mktg., Inc.	919-781-7004
OH	Burton, Electronic Comps.,Inc.	216-834-0011
OH	Cleveland, Electronic Comps., Inc.	216-331-5330
OH	Columbus, Electronic Comps.,Inc.	614-231-2318
OH	Dayton, Electronic Comps., Inc.	513-866-3340
OK	Tulsa, Advance Tech. Sls.	918-664-0482
TN	Tazwell, Dixie Tech. Mktg., Inc.	615-626-6009
TX	Austin, Advance Tech. Sls.	512-467-9209
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	El Paso, ATS-Alexander Entprs.	915-591-3142
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Olympia, Bergford & Assocs.	206-866-2001
Can	Kanata, Ontario, Birde Mktg.,Inc.	613-592-5411
Can	Markham, Ontario, Birde Mktg.,Inc.	416-477-7722
Can	Saint Laurent, Quebec, Birde Mktg.,Inc.	514-335-4050

Local Distributors

AZ	Tempe, Acacia/Deanco	602-894-2874
CA	Irvine, Acacia/Deanco	714-660-0834
CA	San Diego, Acacia/Deanco	619-565-4365
IL	Chicago, Newark Elctrns.	312-784-5100
MA	Westborough, In-Stock Products Co.	508-870-5750
MO	Maryland Heights, French Gerleman Elec. Co.	314-569-3122
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
Can	Markham,Ontario, Birde Mktg.,Inc.	416-477-7722

GENERAL DIGITAL CORP., 198 Freshwater Blvd., Enfield, CT 06082, Tel: 203-741-7171, FAX: 203-741-7071; Empl.: 50

GENERAL ELECTRIC CO., Accessory Equipment Plant, 1285 Boston Ave., Bldg. 25BE, Bridgeport, CT 06602, Tel: 203-382-3023, FAX: 203-382-2739; Empl.: 250; *Sls. Mgr.:* J. M. Collins

GENERAL ELEC. CO., Electromaterials Dept., 1350 South Second Street, Coshocton, OH 43812, Tel: 614-622-5310, TELEX: 810-255-2921; Empl.: 600; *Sls. Mgr.:* D.E. Allen

GENERAL ELECTRIC CO., Instrument Prods. Section, See Yokogawa Corp. of America

GE MICROELECTRONICS CENTER, GE Aerospace, P.O. Box 13049, Research Triangle Park, NC 27709, Tel: 919-549-3100, FAX: 919-549-3598; FSC No.: 1HL38; Empl.: 400; *Sls. Mgr.:* Donald B. Dickerman, Jr.

GENERAL ELECTRIC CO., RELAY OPERATION, See Genicom Corp.

GENERAL ELECTRIC MATERIALS TECHNOLOGY, 6161 Lincoln Ave., Suite 12B, Buena Park, CA 90620, Tel: 714-761-5684, FAX: 714-761-8257; Empl.: 12; *Sls. Mgr.:* Jerry Wang; *Dist. Mgr.:* George Olenczuk

GENERAL FIBER OPTICS, INC., 98 Commerce Rd., Cedar Grove, NJ 07009, Tel: 201-239-3400, FAX: 201-239-4258; *Sls. Mgr.:* Hugh Felger

GENERAL HARDWARE MFG., 80 White St., New York, NY 10013, Tel: 212-431-6100, FAX: 212-431-6499; *Sls. Mgr.:* Tom McGannon

GENERAL INDUSTRIES, Taylor & Olive St., Elyria, OH 44035, Tel: 216-323-3136, FAX: 216-323-4017; Empl.: 1000

GENERAL INSTRUMENT, Govt. Systems, 600 W. John St., C. S. 710, Hicksville, NY 11802-0709, Tel: 516-933-3000, TELEX: 311512, TWX: 510-221-1865, FAX: 516-933-3432; Empl.: 548; *Sls. Mgr.:* T.Turco/J.Zielezienski

GENERAL INSTRUMENT, Power Semiconductor Div., 600 W. John St., Hicksville, NY 11802, Tel: 516-933-3333, FAX: 516-933-3881; *Sls. Mgr.:* Tony Solla, Natl. Sls. Mgr.; *Dist. Mgr.:* Robert Graziano

GENERAL LASER, INC., 7950 E. Redfield Rd., Scottsdale, AZ 85260, Tel: 602-991-0674, FAX: 602-991-1462

GENERAL MANUFACTURING, 724 Ruberta Ave., Glendale, CA 91201, Tel: 818-243-2069; FSC No.: 10454

GENERAL MIRCOCIRCUITS, 780 Boston Rd., Billerica, MA 01821, Tel: 508-663-9101, FAX: 508-663-9132; Empl.: 25; *Sls. Mgr.:* Michael Lioz

FAX: 516-226-8966

GENERAL MICROWAVE CORPORATION, 5500 New Horizons Blvd., Amityville, NY 11701, Tel: 516-226-8900, TELEX: 310-287-780; FSC No.: 11332; Empl.: 200 ..... **A•1749; D•1251**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
CA	Los Angeles, RF Assocs.	213-478-1586
CA	Palo Alto, RF Assocs. North	415-494-3331
FL	Apopka, Saber Assocs.	800-432-6288
FL	Melbourne, Saber Assocs.	800-432-6288
IL	Mt. Prospect, Cain Forlaw	708-253-3578
MA	Billerica, Microwave Mktg. Specialists	508-667-1440
NJ	West Orange, EF Tech. Sls.	201-731-7203
NY	Plainview, EF Tech. Sls.	516-942-7400
NY	Rochester, TCS (Technical Comp. Sls.)	716-342-2406
NC	Clayton, Saber Assocs.	800-327-0853
OH	Worthington, Cain Forlaw	614-436-3004
TX	Dallas, Cain & Co.	214-247-3901

GENERAL NUMERIC CORPORATION, 390 Kent Avenue, Elk Grove Village, IL 60007, Tel: 708-640-1595, TELEX: 210036, FAX: 708-228-5490; Empl.: 125; *Sls. Mgr.:* James Scott

GENERAL POWER CORPORATION, 1045 S. East St., P.O. Box 65008, Anaheim, CA 92815, Tel: 714-956-9321, FAX: 714-491-8644; FSC No.: 04801; Empl.: 75; *Sls. Mgr.:* Ernest R. Murillo; *Dist. Mgr.:* Ernest R. Murillo

GENERAL PROTECTION CO., INC., Circuit Protection Group, 6149 N. Talman Ave., Chicago, IL 60659, Tel: 312-761-0403, FAX: 312-262-9605; Empl.: 15; *Sls. Mgr.:* N.Pierson; *Dist. Mgr.:* N.Pierson

GENERAL RESISTANCE, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 05591; Empl.: 60; *Sls. Mgr.:* J. L. Jamiesen; *Dist. Mgr.:* Keith MacDowall ..... **A•1913; D•1252-1253**

All States Not Listed Consult Factory, N. Branford, NJ 203-481-5721

Local Sales Offices & Reps

CA	Mountain View, Saber Entprs.	415-968-0427
NV	Clark County, Qualtech	602-967-4655
TX	Austin, Inotek	512-892-2490
EXP	Rajajinagar, Banaglore, Elctrns. Continental Instruments	366665
AZ	Tempe, Qualtech, Inc.	602-967-4655
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Mountain View, Saber Entprs.	415-968-0427
CO	Littleton, Radco	303-794-4279
CT	Watertown, May Technlg.	203-274-3777
IL	Des Plaines, Marsland Assocs.	312-298-2620
LA	Baton Rouge, Inotek	512-892-2490
MD	Joppa, Please Consult Factory	203-481-5721
MA	Reading, May Technlg.	617-942-7135
MO	St. Louis, Marsland Assocs.	312-298-2620
NJ	Branchville, CB Associates	201-948-5100
NY	Schenectady, CB Assocs.	201-948-5100
NY	Whitney Point, TAE-REP, Inc.	607-692-3705
OH	Dayton, RIXAN Assocs.	513-278-4216
TN	Hixson, Inotek	512-892-2490
TX	Austin, Inotek	512-892-2490
TX	Plano, Qualtech	602-967-4655
VA	Dumfries, Consult Factory	203-481-5721
WA	Seattle, Datacom Assocs.	206-285-2525
WI	New Berlin, Marsland Assocs.	312-298-2620
	Components	
AZ	Tempe, Qualtech, Inc.	602-967-4655
CA	Saratoga, TESTCO	408-253-1900
CO	Golden, J. F. Hurlbut Co.	303-279-7796
MD	Randallstown, Beacon North, Inc.	703-478-2480
MI	Farmington, W. R. Hummon & Assoc.	313-474-0661
OH	Dayton, RIXAN Assocs.	513-278-4216
TX	Dallas, Blackburn Assocs.	214-750-8927
VA	Sterling, Beacon North, Inc.	703-478-2480
	Local Distributors	
CA	Saratoga, TESTCO	408-253-1900
OH	Dayton, RIXAN Assocs.	513-278-4216

GENERAL SCANNING RECORDER PRODUCTS DIVISION, 37 Broadway, Arlington, MA 02174, Tel: 617-641-2702, TELEX: 212838, FAX: 617-648-4906; *Sls. Mgr.:* Donald Follansbee ..... **D•1419**

GENERAL SECURITY INC., 16 Newtown Plaza, Plainview, NY 11803, Tel: 516-753-0700, ESYLNK: 800-572-8989, FAX: 516-753-0839; Empl.: 10; *Sls. Mgr.:* J.N. Benjamin

GENERAL SEMICONDUCTOR IND., INC., Square D Company, 2001 W. 10th Place, Tempe, AZ 85281, Tel: 602-968-3101, FAX: 602-966-6396; FSC No.: 24444;19500; Empl.: 591; *Sls. Mgr.:* William Hennigan; *Dist. Mgr.:* Christopher Dingley

GENERAL TECHNOLOGY CORP., 6816 Washington Avenue, NE, Albuquerque, NM 87109, Tel: 505-345-5591, FAX: 505-344-3227; Empl.: 150; *Sls. Mgr.:* Ralph H. Anderson

GENERAL TRANSISTOR CORP., GTC, 216 W. Florence Av., Inglewood, CA 90301, Tel: 213-673-8422, FAX: 213-672-2905; FSC No.: 04662; Empl.: 66

GENERAL VIBRATIONS MFG. CO., 422 North Main St, Manchester, CT 06040, Tel: 203-646-0090, FAX: 203-643-8913; Empl.: 4

GENERAL WIRE PRODUCTS, INC., 425 Shrewsbury Street, Worcester, MA 01604, Tel: 617-752-8260, FAX: 617-753-2173; FSC No.: 5F262; Empl.: 58; *Sls. Mgr.:* Thomas P. Andrews, Jr.

GENICOM

FAX: 703-949-1416

GENICOM CORP., 1 Genicom Dr., Waynesboro, VA 22980, Tel: 703-949-1471, TWX: 710-839-0407; FSC No.: 01526; Empl.: 3000; *Sls. Mgr.:* G.F. Peltier ..... **B•1012-1014, 1482-1485**

Local Sales Offices & Reps

CA	Santa Ana, Genicom Corp.	714-549-5101
CT	Suffield, Genicom Corp.	203-668-6530
FL	Bonita Springs, Genicom, Corp.	813-947-5622
VA	Waynesboro, Genicom Corp.	703-949-1666
	Local Distributors	
CA	San Jose, JACO/Distel Inc.	408-432-9290
CA	Santa Ana, Norstan	800-854-8344
CA	Tustin, JACO/Distel Inc.	714-258-9003
CA	Westlake Village, JACO/Distel Inc.	800-824-0151
FL	Boca Raton, JACO/QC	407-241-7950
FL	Orlando, T & T Prods., Inc.	305-857-2282
GA	Norcross, JACO/QC	404-449-9508
MD	Baltimore, Elctrn. Comp. Sls.	301-728-2772
MA	Columbia, JACO Elctrns. Inc.	301-995-6620
MA	Tewksbury, JACO Elctrns. Inc.	508-640-0010
NY	Hauppauge, JACO/Elctrns. Inc.	516-273-5500
NC	Charlotte, Electronics Mktg. Corp.	704-394-6195
NC	Raleigh, JACO/QC	919-876-7767
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Dayton, Elctrns Mktg. Corp.	513-278-5745
OH	Highland Heights, Electronics Mktg. Corp.	216-442-3441
TX	Addison, JACO/QC	214-733-4300
TX	Austin, JACO/QC	512-835-0220
TX	Dallas, Associated Aircraft Supp. Co.	214-331-4381
TX	Sugarland, JACO/QC	713-240-2255
WA	Redmond, Pan Pacific Elctrns., Inc.	206-881-7252

FAX: 619-661-5120

GENISCO ELECTRONICS CORPORATION, 1657 Pacific Rim Court, San Diego, CA 92173, Tel: 619-661-5100; FSC No.: 07294; Empl.: 100; *Sls. Mgr.:* Dick Gurena ..... **A•1624-1625, 1677; B•1153**

Local Sales Offices & Reps

AL	Birmingham, Electro-South Inc.	205-822-5713
AL	Huntsville, EMA	205-830-4030
AZ	Phoenix, Mayco	602-867-3076
CA	Claremont, Cook Entprs.	714-626-3997
CA	San Jose, Kottmeier Assoc. Inc.	408-371-8700
CA	Sunnyvale, DJM Elctrns.	408-749-8936
CA	Valencia, DJM Elctrns.	805-254-2677
CA	Vista, DJM Elctrns.	619-726-1266
CO	Englewood, R.A. Mays Co.	303-761-9447
GA	Roswell, E M A	404-992-7240
KS	Lenexa, Midtech Assoc.	913-541-0505
MD	Baltimore, Eastern Comps.	301-788-7050
NH	Brookline, EMC Sls.	603-672-4455
NM	Mayco	505-299-4002
NY	Roslyn Hgts., November Elctrn. Sls.	516-621-6378
OH	Dayton, Jay Engrg.	513-253-2151
PA	W. Conshohocken, Eastern Comps.	215-825-8610
WA	Bellevue, Underwood-Hanify Inc.	206-643-1793

GENISCO TECHNOLOGY CORP., 14930 E. Alondra Blvd., La Mirada, CA 90638, Tel: 714-523-7001, TWX: 910-346-6773, FAX: 714-522-1058; FSC No.: 07249; Empl.: 450; *Sls. Mgr.:* Rita Deidrich

GENISCO TECHNOLOGY CORP., 14930 E. Alondra Blvd., La Mirada, CA 90638, Tel: 714-523-7001, TWX: 910-346-6773, FAX: 714-522-1058; FSC No.: 07294; Empl.: 380

GENNUM CORPORATION, Linear Technology Inc., P.O. Box 489, Sta. A, Burlington, ON, Canada L7R 3Y3, Tel: 800-263-9353, 416-632-2996, TELEX: 061-8525, FAX: 416-632-2055; Empl.: 180; *Sls. Mgr.:* C. Marshall/I. H. Scott

GENROCO, INC., 205 Kettle Moraine Drive North, Slinger, WI 53086-9407, Tel: 414-644-8700, TELEX: 158279420, FAX: 414-644-6667; *Sls. Mgr.:* Donald D. Woelz; *Dist. Mgr.:* Barbara Pick

GENSTAR RENTAL ELECTRONICS, INC., 6307 De Soto Ave., Suite J, Woodland Hills, CA 91367, Tel: 800-331-3440 (in CA), 800-227-8409, FAX: 818-715-9249

GENTRON CORPORATION, 7345 E. Acoma, Ste. 101, Scottsdale, AZ 85260, Tel: 602-443-1288, FAX: 602-443-1408; Empl.: 50; *Sls. Mgr.:* Rick Heinz; *Dist. Mgr.:* Rick Heinz

GEOPHYSICAL SURVEY SYSTEMS, INC., 13 Klein Dr., North Salem, NH 03073-0097, Tel: 603-893-1109, FAX: 603-889-3984; FSC No.: 02-0278634; Empl.: 50; *Sls. Mgr.:* J. V. Rosetta, Jr.

GEORATOR CORP., Box 70, Manassas, VA 22110-0070, Tel: 800-523-9938, FAX: 703-368-1078; FSC No.: 91723; *Sls. Mgr.:* Jay Gormley ..... **D•2195-2198**

FAX: 308-235-2609

GEORGE RISK INDUSTRIES, INC., 802 S. Elm St., Kimball, NE 69145, Tel: 308-235-4645; FSC No.: 24229; Empl.: 135; *Sls. Mgr.:* Mohammed A. Ghani; *Dist. Mgr.:* Mohammed A. Ghani ..... **B•1809**

Local Sales Offices & Reps

OR	Portland, Adapt Elctrns.	503-297-2151
AZ	Phoenix, J. F. Hurlbut Co.	602-997-7285
VA	Alexandria, Tech-Reps, Inc.	703-370-2600
CA	Sunnyvale, W.W. Posey Co.	408-746-0771
Can	Toronto, Reptech Elctrns. & Design	416-863-9510
FL	Deerfield Beach, Newell-Hynes Assocs.	305-429-3207
IL	Wheaton, CS Tech. Sls.	708-653-8126
MA	Lexington, Jodan Technlg.	617-863-8898
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Eden Prairie, O'Reilly Assocs.	612-941-6480
MO	St. Charles, Buckman & Assocs.	314-946-6201
NY	Huntington Station, Morgan Elctrns.	516-549-5180
CA	Orange, VR Elctrns.	714-532-3730
PA	Horsham, Jacobsen Assocs.	215-674-2937
TX	Dallas, Barry Sls.	214-234-0255
GA	Deluth, Stelmack Comps.	404-441-7927
CO	Golden, J. F. Hurlbut Co.	303-279-7796

GERMANIUM POWER DEVICES, Box 3065, Shawsheen Village Sta., Andover, MA 01810-3065, Tel: 508-475-5982, TELEX: 94-7150, FAX: 508-470-1512; FSC No.: 53399; Empl.: 100; *Sls. Mgr.:* R. W. Kassiotis

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GETTYSBURG TRANSFORMER CORPORATION, 1380 Old Harrisburg Rd., P.O. Box 4356, Gettysburg, PA 17325, Tel: 717-334-2191, FAX: 717-334-4961; Empl.: 65; *Sls. Mgr.:* Charles A. Ritter

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GFC POWER LTD., 95 Curtis Drive, Guelph, CAN N1K 1E1, Tel: 519-763-3051, FAX: 519-822-9537; Empl.: 80; *Sls. Mgr.:* David Oliver; *Dist. Mgr.:* David Oliver

GGB INDUSTRIES, INC., Picoprobe Division, PO Box 10958, Naples, FL 33941, Tel: 813-643-4400, TELEX: 136692 GGB, FAX: 813-643-4403; *Sls. Mgr.:* Greg Boll

GHIELMETTI, INC., 30961 West Aguora Rd., Ste. 309, Westlake Village, CA 91361, Tel: 800-228-1097, FAX: 818-707-1754; Empl.: 4; *Sls. Mgr.:* Rick Odorfer

GIANNINI INSTITUTE, 51-555 Madison St., Indio, CA 92201, Tel: 619-347-2833, FAX: 619-342-4006; FSC No.: 24727; Empl.: 10; *Sls. Mgr.:* John Phillips

GIBSON/EGAN, See Textool Test & Interconnect Prods. Dept., 3M, Electronic Prods. Div.

GIC THERMODYNAMICS, 2611 Parmenter, Royal Oak, MI 48073, Tel: 313-280-1648, FAX: 313-280-0998; Empl.: 20; *Sls. Mgr.:* Denny Desmond

GIDDINGS & LEWIS-NEXES AUTOMATION, Giddings & Lewis, Inc., 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54936-1658, Tel: 414-921-7100, TELEX: 26-2722, TWX: 910-275-1100; Empl.: 175

Gilway Technical Lamp

FAX: 617-938-5867

GILWAY TECHNICAL LAMP, 800 W. Cummings Pk., Woburn, MA 01801, Tel: 617-935-4442; FSC No.: 3T059; Empl.: 17; *Sls. Mgr.:* Clark Benjamin III; *Dist. Mgr.:* Erin Hurley ..... **B•1155-1163**

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GLASGAL COMMUNICATIONS, INC., 151 Veterans Dr., Northvale, NJ 07647, Tel: 201-768-8082, FAX: 201-768-2947; Empl.: 130; *Sls. Mgr.:* Ingemar Sjunnemark

GLASSMAN EUROPE LIMITED, Studio 4 Intec 2 Wade Rd., Basingstoke, Hampshire RG24 0NE, Tel: (0256) 810808, FAX: (0256) 810815; Empl.: 60; *Sls. Mgr.:* J. Ellis

FAX: 908-534-5672

GLASSMAN HIGH VOLTAGE INC., P.O. Box 551, Salem Indl. Pk., Rte. 22 (East), Whitehouse Sta., NJ 08889, Tel: 908-534-9007, TWX: 710-480-2839; Empl.: 60; *Sls. Mgr.:* John R. Belden ..... **D•1762-1773**

GLASSMAN JAPAN HIGH VOLTAGE LTD., Tiara Bldg. 1-17, Tiara 1-Chome, Miyamae-Ky, Kawasaki 213 Japan, Tel: (044) 877-4546, FAX: (044) 877-3395

GLATZER INDUSTRIES CORP., 15 River St., New Rochelle, NY 10801, Tel: 914-576-2700, FAX: 914-576-7075; Empl.: 25; *Sls. Mgr.:* Patricia M. Wyllie

GLENAIR INC., 1211 Air Way, Glendale, CA 91201-2497, Tel: 818-247-6000, TELEX: 67-3485, TWX: 910-437-2066, FAX: 818-500-9912; FSC No.: 06324; Empl.: 485; *Sls. Mgr.:* Ronald E. Platz

GLENMARC MANUFACTURING INC., 970 Woodlands Pkwy., Vernon Hills, IL 60061, Tel: 708-634-6080, FAX: 708-634-9527; Empl.: 13; *Sls. Mgr.:* David Greenwood

GLEN MILLS INC., 203 Brookdale St., Maywood, NJ 07607, Tel: 201-845-4665, TELEX: 134 656, FAX: 201-487-8469; Empl.: 11; *Sls. Mgr.:* Stanley I. Goldberg

GLENRO, INC., 39 McBride Ave., Paterson, NJ 07501-1715, Tel: 201-279-5900, 800-922-0106, FAX: 201-279-9103; Empl.: 50; *Sls. Mgr.:* Sterling Pitt

GLOBAL COMPONENTS & CONTROLS, 1 Main Street Ste. 210, Eatontown, NJ 07724, Tel: 201-389-1470, FAX: 201-389-8781; Empl.: 4; *Sls. Mgr.:* John M. Chapski

GLOBAL SPECIALTIES, Interplex Electronics, Inc., 70 Fulton Terrace, P.O. Box 1942, New Haven, CT 06509, Tel: 203-624-3103, FAX: 203-468-0060; Empl.: 50; *Sls. Mgr.:* Rachael Fernicola; *Dist. Mgr.:* Rachael Fernicola

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SC	Greenville, EMSCO	813-233-4121
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TX	Irving, Specialized Prods.	214-550-1923
WA	Seattle, Radar Elctrns.	206-282-2511
Can	Willowdale, Ont., Electro Sonic	416-494-1666

GLOBE BATTERY DIV., See Johnson Controls, Globe Battery Div.

GLOBE MOTORS, 2275 Stanley Avenue, Dayton, OH 45404, Tel: 513-228-3171, TELEX: 288-224, TWX: 810-459-1642, FAX: 513-229-8531; Empl.: 580; *Dist. Mgr.:* Derek Keegan

GLOBE UNION, See Johnson Controls, Globe Battery Div.

GlobTek

FAX: 201-861-0740

GLOBTEK, INC., 7700 Marine Rd., N. Bergen, NJ 07047, Tel: 201-861-0246, TELEX: 755579; Empl.: 20; *Sls. Mgr.:* Eugene Goldberg; *Dist. Mgr.:* Tom Devaney ... **A•2229; B•1367; C•1386, 1754; D•1775**

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CT	Ridgefield, Harbor Elctrns.	203-438-9625
IL	Alsip, M & E Comps.	708-396-0700
IA	Cedar Rapids, Technical Elctrns.	319-366-5443
MD	Lisbon, S. K. MacDonald	301-982-1088
MA	Topsfield, Whitehead Assoc. Inc.	508-887-8050
MN	Golden Valley, Highland Elctrns.	612-546-2123
MO	St. Louis, MPC Mktg.	314-652-0139
TX	Dallas, Comp. Technlg.	214-783-8837
TX	Dallas, Exel Tech	214-239-3935
Can	St. Laurent, Que., Componetics	514-331-9930

Glowlite

FAX: 405-238-3029

GLOLITE SALES LTD/GLOWLITE DIV., PO Box 688 Hwy 77 South, Pauls Valley, OK 73075, Tel: 405-238-5541, 800-654-3662; Empl.: 77; *Sls. Mgr.:* John Crego; *Dist. Mgr.:* Stan Ferrell ..... **B•1154, 1811**

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IN	Indianapolis, Schank Elctrn. Mktg.	317-842-6204
KS	Kansas City, E.P.I. Inc.	816-523-8911
MD	Randallstown, Chesapeake Indl. Mktg.	301-653-0476
MA	Tyngsboro, Comptech	508-649-3030
MI	Farmington Hills, Schank Elctrn. Mktg.	313-626-2551
MN	Hopkins, Pathway Sls. Inc.	612-933-8267
MS	Jackson, Doby Assocs.	601-981-1138
MO	St. Louis, E.P.I. Inc.	314-962-1411
NM	Albuquerque, Sytech Mktg. Sys.	505-266-7951
NY	Hauppauge, Aurora-Schmitt Assocs.	516-434-1313
NC	Raleigh, Vantage Mktg.	919-870-7123
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
SC	Greenville, Vantage Mktg.	803-268-2186
TX	Hurst, El-Tec Sls.	817-268-2896
UT	Salt Lake City, Butterworth Mktg.	801-969-5566
Can	Aurora, Ont., JRL Assocs.	416-727-1452

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AL	Huntsville, Resistor Cap Elctrn.	205-883-4270
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LA	Shreveport, Carlton Bates	318-636-9975
MD	Columbia, SHP Elctrns.	301-290-8770
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MN	Plymouth, Leeds Electro Comps.	612-557-1277
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OK	Tulsa, Carlton Bates	918-250-1626
PA	Lancaster, Advacom Elctrns.	717-741-9277
PA	McKean, Advacom Elctrns.	814-476-7774
TN	Memhpis, Carlton Bates	901-365-3539
TN	Nashville, Carlton Bates	615-244-3562
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TX	Ft. Worth, Tandy Nat. Pts.	817-870-5600
WI	Grafton, Lakeview Elctrns.	414-377-8250
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GME SYSTEMS, INC., 12300 Perry Highway, Pittsburgh, PA 15090, Tel: 412-935-0440, FAX: 412-935-9640; Empl.: 7; *Sls. Mgr.:* Bjorn Karlstrom

GML CHIP COMPONENTS LIMITED, Hig, Phasell, Block 2 Flat 16 Baghlingampally, Hyderabad A.P., India 500 044, Tel: (91) 842-60106, 61593, TELEX: 0425-2105 GML IN, FAX: (91) 842-61484; Empl.: 50

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GMR CO., 804 Main St, Venice, CA 90291, Tel: 213-399-1490, TELEX: 499 2468; Empl.: 93; *Sls. Mgr.:* Harvey Mushman

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GPE

FAX: 714-993-6023

GOLDEN PACIFIC ELECTRONICS, INC, 560 S. Melrose St, Placentia, CA 92670, Tel: 714-993-6970; Empl.: 15; *Sls. Mgr.:* James Au; *Dist. Mgr.:* James Au ..... **D•1032-1035, 1776-1777**

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OR	Beaverton, Core II Mktg	503-641-0877

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GOLDSTAR PRECISION CO. LTD., Lucky Goldstar, 13013 E. 166th St, Cerritos, CA 90701, Tel: 213-404-0101, TELEX: 910-583-5719, FAX: 213-926-0849; Empl.: 12; *Sls. Mgr.:* Reginald Bale; *Dist. Mgr.:* Reginald Bale

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GORDON CO.:WATLOW, 5710 Kenosha St., Richmond, IL 60071, Tel: 815-678-2211, TELEX: 72-2427, FAX: 815-678-3961; Empl.: 300

GORDON INSTRUMENTS, INC., 3645 California Rd., Orchard Park, NY 14127, Tel: 716-662-5353, 1-800-333-2672, FAX: 716-662-7839; Empl.: 20; *Sls. Mgr.:* John Savage

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CA	Tustin, Schoenbachler-Dobson	714-544-1888
CO	Arvada, Gemini Elctrns.	303-428-5600
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FL	Tampa, Florida Comps., Inc.	813-873-3622
GA	Atlanta, Elctrn. Mktg. Assoc.	404-448-1215
IL	Schaumberg, Martan, Inc.	708-303-5660
IN	Indianapolis, Hy-Tek Sls. Co.	317-887-2564
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MI	Troy, Pyramid Integrated Control Sys.	313-528-8040
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TX	Dallas, Advanced Tech. Sls.	214-340-1300
TX	Houston, Advanced Tech. Sls.	713-440-3888
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GA	Columbus, Interstate Elctrl. Supp.	404-324-1000
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GA	Norcross, Time Elctrns.	404-448-4448
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IL	Wood Dale, Time Elctrns.	312-350-0610
IN	Indianapolis, Control Design	317-788-4614
IA	Cedar Rapids, Control Design	319-373-2923
IA	Marion, Control Design	319-373-2923
KS	Kansas City, Control Design	913-362-4248
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MI	Farmington Hills, Control Design	313-473-0220
MI	Flint, Fischer-Flack	313-235-6420
MI	Kalamazoo, Pyramid Controls Inc.	616-327-3733
MI	Madsion Hgts., McNaughton-McKay Elec. Co.	313-399-7500
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MI	Saginaw, Fischer-Flack	517-752-4181
MN	Bloomington, Time Elctrns.	612-944-9192
MN	Eden Prairie, Future	612-944-2200
MN	Eden Prairie, JE Braas	617-937-8902
MN	Minneapolis, Control Design	612-721-1628
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Chesterfield, Advanced Ind. Sys. Inc.	314-532-2477
MO	Kansas City, L Comp	816-221-2400
MI	Midland, Fischer-Flack	517-496-3600
MO	St. Louis, Control Design	314-426-3160
MO	St. Louis, Future	314-537-0688
MO	St. Louis, L Comp	314-291-6200
MO	St. Louis, Time Elctrns.	314-391-6444
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NJ	Fair Lawn, Relay Specialties	201-337-1000
NJ	Fairfield, Future	201-227-4346
NJ	Mt. Laurel, Future	609-778-7600
NM	Albuquerque, Elctrn. Dvcs.	505-884-2950
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summitt	716-884-3450
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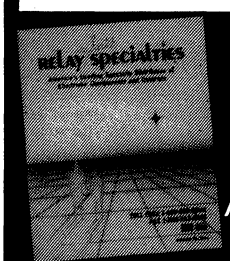

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NY	Syracuse, Time Elctrns.	315-432-1355
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OR	Beaverton, Cascade Data Mktg.	503-641-9266
OR	Beaverton, Future	503-645-9454
OR	Beaverton, Integrated Elctrns.	503-641-1690
OR	Portland, Time Elctrns.	503-684-3780
PA	Bristol, Aim Elctrns.	215-785-3500
PA	King of Prussia, Time Elctrns.	215-337-0900
PA	Malvern, Control Design	215-296-0150
PA	Newton Sq., QDI	215-359-1000
PA	Philadelphia, Future	609-778-7600
PA	York, Elctrn. Comps.	717-846-5334
SC	Greenville, Ensco (Hammon)	803-233-4121
SC	Spartanburg, Roberts Elec. Supp. Inc.	803-574-0350
SC	Taylors, Cantrel Wholesale Prods., Inc.	803-268-1194
TN	Knoxville, Traver	615-531-2255
TN	Nashville, AA Elec.	615-832-6632
TX	Addison, Jaco	214-733-4300
TX	Austin, Omni Pro Elctrns.	512-794-9200
TX	Carrollton, Time Elctrns.	214-241-7441
TX	Dallas, Control Design	214-358-0489
TX	Dallas, GEA of TX	214-233-0337
TX	Dallas, Newark Elctrns.	214-340-3585
TX	Dallas, Omni Pro Elctrns.	214-233-0500
TX	Houston, AAA Bearing	713-924-6072
TX	Houston, GEA of TX	713-781-3005
TX	Houston, Newark Elctrns.	713-782-4800
TX	Houston, Omni Pro Elctrns.	713-270-1700
TX	Houston, Time Elctrns.	713-530-0800
TX	Houston, Tristrar Elctrns.	713-667-7200
TX	Richardson, Future	214-437-2437
UT	N. Salt Lake City, Integrated Elctrns.	801-298-1869
UT	Nephi, Control Design	801-623-2909
UT	Salt Lake City, Future	801-972-8489
UT	Salt Lake City, Time Elctrns.	801-973-8181
VA	Chester, Virginia Control Equip. Co.	804-796-3081
WI	Appleton, JE Braas	414-730-8856
WA	Bellevue, Cascade Data Mktg.	206-747-6190
WA	Bellevue, Future	206-881-8199
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Bellevue, Time Elctrns.	206-641-3640
WA	Redmond, Time Elctrns.	206-882-1600
WI	Milwaukee, Indl. Elctrns.	414-276-1212
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Control Design	414-784-1016
WI	New Berlin, JE Braas	414-782-0180
WI	W. Allis, Pyramid Controls	414-476-3711
Can	Calgary, Alberta, Future Elctrns.	403-235-5325
Can	Edmonton, Alberta, Future Elctrns.	403-438-2858
Can	Mississauga, Ont., Newark	416-629-2266
Can	Montreal, Que., Future Elctrns.	514-694-7710
Can	Orlando, Time Elctrns.	305-841-6565
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Rexdale, Ont., Newark	416-675-4555
Can	St. Laurent, Que., Zanin Elctrns.	514-342-6211
Can	Toronto, Ont., Future Elctrns.	416-638-4771
Can	Vancouver, B.C., Future Elctrns.	604-294-1166
Can	Winnipeg, Manitoba, Future Elctrns.	204-339-0554

W. L. GORE & ASSOCS., INC., 4755 E. Beautiful Lane, Phoenix, AZ 85044, Tel: 602-438-2017, FAX: 602-431-1512

W.L. GORE & ASSOCS., 555 Paper Mill Rd., Newark, DE 19714, Tel: 302-738-4880, FAX: 510-666-0825; Empl.: 2000; *Sls. Mgr.:* Daniel D. Johnson

GORMAN MACHINE CORP., 7 Burke Dr., Brockton, MA 02401, Tel: 508-588-2900, TWX: 710-345-0679, FAX: 508-588-9560; Empl.: 25; *Sls. Mgr.:* Kenneth P. Gorman

GORMAN-REDLICH MFG. CO., 257 W. Union St., Athens, OH 45701, Tel: 614-593-3150, FAX: 614-592-3898; Empl.: 4; *Sls. Mgr.:* Jim Gorman

GOSSEN

FAX: 619-598-9828

GOSSEN/TEXMATE, 995 Park Center Dr., Vista, CA 92083-8397, Tel: 619-598-9899 ..... **D•1382, 1385-1386, 2075**

GO SWITCH, P.O. Box 37290, Louisville, KY 40233, Tel: 502-969-2386, FAX: 502-969-5911; Empl.: 60; *Sls. Mgr.:* David Lambert

GOULD AMI, Gould, 2300 Buckskin Road, Pocatello, ID 83201, Tel: 208-233-4690, FAX: 208-234-6796; Empl.: 1700; *Sls. Mgr.:* Harold Blomquist; *Dist. Mgr.:* Harold Blomquist

GOULD INC., Corporate Headquarters, 35129 Curtis Blvd., Eastlake, OH 44094, Tel: 216-953-5000, TELEX: 687-3157, FAX: 216-953-5050; Empl.: 8000 .... **D•1466**

POWERDEX®

FAX: 216-953-5152

GOULD INC., Foil Div., 35129 Curtis Blvd., Eastlake, OH 44095, Tel: 216-953-5065; Empl.: 15 ..... **D•1466**

Local Sales Offices & Reps

CA	Hayward, Pacific Mktg., Inc.	415-887-1620
CA	San Diego, Hadden Assocs., Inc.	619-565-9444
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Greenfield, France Entprs.	317-462-6098
MA	Waltham, Powercard Corp.	617-890-6789
MN	Minneapolis, International Elctrns.	612-571-0000
VA	Arlington, Gans & Pugh Assocs.	703-709-0305
WA	Redmond, VMI Inc.	206-882-2999

GOULD INC., POWER CONVERSION DIV., See RTE Deltic Corporation 4c

GOULD INC., Semiconductor Division, 2300 Buckskin Rd., Pocatello, ID 83201, Tel: 208-233-4690, TWX: 910-977-5752; Empl.: 1500; *Dist. Mgr.:* Richard Brown

GOULD INC., Test and Measurement Group, 8333 Rockside Rd., Valley View, OH 44125, Tel: 216-328-7000, TELEX: 196113GLD RS UT, FAX: 216-328-7400; FSC No.: 96795; Empl.: 550; *Sls. Mgr.:* C. Nazelli, Sls. V.P.

GOULD SHAWMUT, 374 Merrimac St., Newburyport, MA 01950, Tel: 508-462-6662/3131, FAX: 508-465-6419; FSC No.: 71424; *Sls. Mgr.:* Charles Beadle

GOWANDA ELECTRONICS CORP., 1 Industrial Pl., Gowanda, NY 14070, Tel: 716-532-2234, TWX: 710-529-1211, FAX: 716-532-2702; FSC No.: 24226;15305; Empl.: 250; *Sls. Mgr.:* K. Strohmeyer; *Dist. Mgr.:* K. Strohmeyer ..... **A•1208**

Local Sales Offices & Reps

AL	Huntsville, L&D, Inc.	205-837-1469
AZ	Mesa, Sys. Sls. of AZ Inc.	602-464-9989
NM	Albuquerque, Sys. Sls. of N.M.	505-889-2901
OH	Columbus, Stegman Blaine Mktg.	614-457-2358
CA	Fremont, William Parks Assocs.	415-770-9058
CA	San Diego, Earle & Assocs.	619-278-5441
CA	Torrance, Orion-Eclipse	213-326-0999
CO	Westminster, Western Region Mktg.	303-469-8088
FL	Longwood, NSL Assocs.	305-629-5226
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Niles, W. F. Hamilton Co.	708-965-8757
IA	Cedar Rapids, Snider Sls. Co.	319-362-4410
KS	Overland Park, Barnes MidWest Sls.	913-469-9688
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	N. Reading, Lincoln Assocs.	508-664-6800
MI	St. Clair Shores, D.E.M. Sls.	313-777-1750
MN	Chanhassen, Barnes Sls. Assocs.	612-934-2907
NJ	Whippany, Robert Smith Assocs.	201-540-0204
NY	Pittsford, Andres Comps.	716-385-3818
NY	Plainview, Robert Smith Assocs.	516-681-3155
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OH	Cleveland, Stegman Blaine Mktg.	216-572-0003
PA	Exton, Linear Sls.	215-524-8080
TX	Dallas, Scanlon, Hughes & Assocs.	214-739-2888
UT	Salt Lake City, Western Region Mktg. of Utah	801-268-9768
WA	Olympia, Bergford & Assocs.	206-866-2001
Can	St. Laurent, Componetics	514-331-9930

Local Distributors

CA	Chatsworth, Passive Comps.	818-700-8838
NJ	E. Brunswick, Brothers Electrns.	201-238-2200
CA	Fremont, KEA Elctrns.	415-651-2600
CA	Stanton, Inductive Comps. & Crystal	714-828-4320
CT	Bridgeport, Park Distributors	203-366-7200
MN	Chanhassen, G&F Distribution	612-934-2907
NY	Hauppauge, Broadline Electric	516-231-4100
PA	Exton, VSH Elctrns.	215-363-2250
VA	Charlottesville, Va. Elctrn. Comps.	804-296-4184
Can	Montreal Quebec, Ferro Technique	514-341-3450

GOW-MAC INSTR. CO., P.O. Box 32, Bound Brook, NJ 08805, Tel: 908-560-0600, TELEX: 833-174, FAX: 908-271-2782; Empl.: 50; *Sls. Mgr.:* Jeff Lawson

GP:50 NEW YORK, 2770 Long Rd., Grand Island, NY 14072, Tel: 716-773-9300, FAX: 716-773-5019; Empl.: 18; *Sls. Mgr.:* Pat Murphy

GP TRAINING SYSTEMS, Div. of General Physics Corp., 1566 Medical Dr., Pottstown, PA 19464, Tel: 215-327-3550, FAX: 215-327-1158; Empl.: 1681; *Sls. Mgr.:* Richard Smith; *Dist. Mgr.:* Joe Latham

GRADO LABORATORIES, 4614 Seventh Ave., Brooklyn, NY 11220, Tel: 718-435-5340, FAX: 718-633-6941

GRAFOPLAST S.P.A., Wiremarkers, 13, Via Arrivabene, Genova, Italy 16154, Tel: ò10. 621687, TELEX: ò283828, FAX: ò10. 674448; Empl.: 45; *Sls. Mgr.:* Giorgio Patrone

Local Distributors

TX	Dallas, Sunbelt Elctrn. Assoc.	214-247-0071

Graham Electronics Manufacturing, Inc.

FAX: 619-747-9326

GRAHAM ELECTRONIC MANUFACTURING INC., 109-State Pl., Escondido, CA 92025, Tel: 619-747-9177, 800-628-4095; Empl.: 14; *Sls. Mgr.:* Samuel L. Band ..... **C•1057**

GRALEX INDUSTRIES, 70 Oak St., Ste. 204, Norwood, NJ 07648, Tel: 800-486-4499, FAX: 201-767-7015; FSC No.: 11332; Empl.: 15; *Dist. Mgr.:* Pat Jackson ..... **D•1348-1349**

Local Sales Offices & Reps

CA	San Leandro, Coast	415-483-3774
IL	Franklin Park, Alca	708-451-6644
NJ	Norwood, Gralex Inds., Inc.	800-486-4499

Local Distributors

AZ	Phoenix, Metermaster	602-243-4111
AZ	Tempe, CMI Metermaster	602-431-0880
CA	Los Angeles, Crompton Metermaster	714-921-2101
CA	Los Angeles, Metermaster	213-685-4340
CA	Palo Alto, CMI Metermaster	415-960-8500
CA	Palo Alto, Metermaster	415-968-0313
CA	San Diego, Metermaster	619-560-4841
GA	Atlanta, Metermaster	404-446-0166
GA	Atlanta, Metermaster	404-446-0188
IL	Chicago, Metermaster	312-593-8650
IL	Glendale Hgts., Crompton Metermaster	312-351-4554
MA	Billerica, Electra Test, Inc.	617-667-8541
MA	Boston, Calibron	617-894-6440
MA	N.Billerica, Electra Test, Inc.	508-667-8541
MA	Waltham, Calibron Instrs.	617-894-6440
NJ	Somerset, CMI Metermaster	201-271-1277
NY	Great Neck, Instr. Mart Inc.	516-487-7430
NY	Great Neck, Instrument Mart	516-487-7430
OH	Cleveland, Crompton Metermaster	216-651-4100
OH	Cleveland, Metermaster	216-651-4100
TX	Dallas, Metermaster	214-271-5671
TX	Houston, Meters & Instrs.	713-644-1631

GRAND TRANSFORMERS, INC., 1500 Marion St., Grand Haven, MI 49417, Tel: 616-842-5430; Empl.: 125; *Sls. Mgr.:* G. V. Retzlaff

GRANT HARDWARE CO., A Mobex Company, High Street, West Nyack, NY 10994, Tel: 914-358-4400, FAX: 914-358-1703; FSC No.: 83508; Empl.: 490; *Sls. Mgr.:* Tony DiSantis

GRAPHICODE, INC., 19101 36th Ave. W., Ste.204, Lynnwood, WA 98036, Tel: 206-672-1980, FAX: 206-672-2705; Empl.: 5; *Sls. Mgr.:* Douglas M. Pratt

GRAPHICS MICROSYSTEMS, INC., 10375 Brockwood Rd., Dallas, TX 75225, Tel: 214-340-4584, 800-527-1207, TELEX: 506973; FSC No.: 20891; Empl.: 50; *Sls. Mgr.:* Eddie Deering

THE GRAPHICS TECHNOLOGY CO., 5524 Bee Caves Rd. Building L, Austin, TX 78746, Tel: 512-328-9284, FAX: 800-962-3860; Empl.: 35; *Sls. Mgr.:* Joanna Howerton

Local Sales Offices & Reps

CA Milpitas, Telesis Sls. Grp. 408-946-7300
IL Wilmette, Engineered Prods. 708-251-1154
MA Medfield, Nortech Engrg. Sls., Inc. 508-359-6063

GRAPHIC STRATEGIES, INC., 549 East Weddell Drive, Sunnyvale, CA 94089, Tel: 408-745-6500, FAX: 408-744-0235; Empl.: 7; *Sls. Mgr.:* Gary Baughn

GRAPHITE METALLIZING CORP., 1036 Nepperhan Ave., P.O. Box 110, Yonkers, NY 10702, Tel: 914-968-8400, TELEX: 13-1571, FAX: 914-968-8468; Empl.: 178; *Sls. Mgr.:* E. Walker ..... **B•1271**

Local Sales Offices & Reps

OR Beaverton, Graphite Metallizing 503-646-9964

GRASSLIN CONTROLS CORP.:GRASSLIN GMBH & CO., K.G., 45 Spear Rd., Ramsey, NJ 07446, Tel: 201-825-9696, FAX: 201-825-8694; Empl.: 5

GRAYHILL INC., 561 Hillgrove Ave., La Grange, IL 60525, Tel: 708-354-1040, FAX: 708-354-2820; FSC No.: 5930; Empl.: 850; *Sls. Mgr.:* Richard K. Neumann; *Dist. Mgr.:* Robert J. Ferrel ..... **B•1489-1491, 1698-1705, 1812-1813; C•1387**

Industrial Distrs. (Solid State Only)

Local Sales Offices & Reps

AL Huntsville, Rep, Inc. 205-881-9270
AZ Phoenix, Mercury Engrg. Sls. 602-265-0344
CA Irvine, Quadrep Southern Inc. 714-727-4222
CA San Jose, Quadrep, Inc. 408-432-3300
CO Denver, Lindberg Co. 303-758-9033
CT Branford, Coakley Boyd & Abbett 203-481-2218
FL Ft. Lauderdale, Sunland Assocs. 305-561-1303
FL Largo, Sunland Assocs. 813-536-2955
FL Winter Springs, Sunland Assocs. 407-365-9533
GA Tucker, Rep, Inc. 404-938-4358
IL Itasca, LTD Elctrns. 708-773-2900
IN Ft. Wayne, Menze Sls. 219-747-5616
IA Cedar Rapids, Lorenz Sls. 319-377-4666
KS Overland Pk., Spectrum Sls. 913-648-6811
MD Gaithersburg, Naudain Assocs. Southern 301-258-5040
MA Framingham, Coakley Boyd & Abbett 508-820-0800
MI Royal Oak, Hilltronics Inc. 313-435-0920
MN S. St. Paul, Northport Engrg. 612-457-8000
MO Florissant, Spectrum Sls. 314-921-1313
NE Lincoln, Lorenz Sls., Inc. 402-475-4660
NJ Hackensack, Coakley Boyd Abbett/Metro Div. 201-440-4114
NJ Marlton, Naudain Assocs. 609-983-5300
NM Albuquerque, Lindberg Co. 505-881-1006
NY Ithaca, Bob Dean, Inc. 607-257-1111
NY Wantagh, Coakley Boyd Abbett/Tylinski 516-783-4101
NY Wappingers Falls, Bob Dean, Inc. 914-297-6406
NC Charlotte, R. W. Chapman & Co. 704-525-2421
NC Raleigh, R. W. Chapman 919-782-2624
OH Centerville, Bear Mktg. Inc. 513-436-2061
OH Richfield, Bear Mktg., Inc. 216-659-3131
OR Tigard, Eltech, Inc. 503-684-3458
PA Allison Park, Bear Mktg. 412-531-2002
SC Greenville, Robert W. Chapman & Co. 803-288-8821
TN Jefferson City, Rep, Inc. 615-475-9012
TX Austin, W. Pat Fralia Co. 512-835-7911
TX Euless, W. Pat Fralia Co. 817-267-3577
TX Houston, W. Pat Fralia Co. 713-772-1572
UT Salt Lake City, Lindberg Co. 801-484-8689
WA Bellevue, Eltech, Inc. 206-643-4330
WI Mequon, Badgerep 414-241-9200
Can Burnaby, BC, A.C. Simmonds & Sons Ltd. 604-438-5267
Can Nova Scotia, A.C. Simmonds & Sons Ltd. 902-865-1889
Can Pickering, Ont., A. C. Simmonds & Sons Ltd. 416-839-8041
Can Ville LeMoyne, Quebec, A.C. Simmonds & Sons Ltd. 514-466-5250

Local Distributors

AL Birmingham, Regan Controls 205-991-1799
AL Huntsville, Powell Elctrns. 205-837-5300
AL Mobile, Indl. Elect. Sply. 205-341-0544
AZ Gilbert, Harper SID 602-967-1464
AZ Phoenix, Sterling Elctrns. 602-437-5565
AZ Tempe, LCOMP Inc. 602-730-1633
AR Little Rock, Carlton-Bates Co. 501-562-9100
CA Compton, Harper SID 213-979-5090
CA Garden Grove, Richey/Impact Elctrns. 800-227-0060
CA Gardena, Calif. Switch & Signal 213-770-2330
CA Inglewood, Newark Elect. 213-671-7377
CA Los Angeles, Electric Switches 213-660-1310
CA Riverside, Electronic Supply 714-683-7300
CA San Diego, Electronic Supply 619-693-8222
CA San Diego, Harper S.I.D. 619-578-2500
CA San Diego, Richey/Impact Elctrns. 619-271-4511
CA San Jose, Harper SID 408-943-9490
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Richey/Impact Elctrns. 408-432-7100
CA Santa Clara, Cypress Elctrns. 408-980-8400
CO Denver, CSID, Inc. 303-292-9594
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Cypress 303-792-5829
CO Englewood, Shelley Ragon, Inc. 303-762-0670
CT Southington, Electro Mechanical Drives, Inc. 203-621-7335
CT Wallingford, GRS Midan Elctrns. 203-265-2077
CT Wallingford, Sager 203-265-4600
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
FL Largo, Lodan Elctrns. 813-586-2851
FL Orlando, Hammond Elctrns., Inc. 407-849-6060
FL Pompano Beach, Peerless Radio 305-973-4141
GA Norcross, Hammond Elctrns., Inc. 404-449-1996
GA Norcross, Pioneer Technlgs./Georgia 404-448-1711
ID Couer D' Alene, A-I Consolidated 800-635-1545
ID Meridian, Pacific Control Sply. 208-286-7404
IL Bensenville, Goold Elctrn. 708-860-7171
IL Chicago, Newark Elctrns. 312-784-5100
IL Chicago, Waldom Elctrns. 312-585-1212
IL Northbrook, Classic Comp. Supp. 708-272-9650
IL Palatine, Ohm Elctrn. 708-359-5500
IN Fort Wayne, Bell Inds./Graham Div. 219-423-3422
IN Indianapolis, Bell Ind./Graham Div. 317-875-8200
IN Indianapolis, Pioneer Standard 317-573-0880
IN Indianapolis, Process Automation Devs. 317-879-1100
IN Indianapolis, PEI/Genesis 317-879-0700
IN South Bend, Pei/Genesis 219-287-2911
IA Bettendorf, Kim Controls, Inc. 319-359-5581
IA Cedar Rapids, Advent Elctrns. 319-363-0221
IA Des Moines, Kim Controls, Inc. 515-274-9194
KY Belle Chasse, Indl. Elec. Sply. 504-340-7934
KY Lexington, Richard Equip. 606-272-9210
KY Louisville, Richard Equip. 502-499-7667
MD Annapolis Jct., Powell Elctrns. 301-953-3435
MD Baltimore, Resco/Baltimore 301-931-8200
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
MD Kensington, Marine Air Supp. 301-949-9560
MA Hingham, Sager Elctrns. 617-749-6700
MA Norwood, Gerber Elctrns. 617-329-2400
MI Battle Creek, Great Lakes Elctrns. 616-963-6282
MI Livonia, Pioneer/STD Elctrns. 313-525-1800
MI Livonia, R.S. Elctrns. 313-525-1155
MI Oak Park, Newark/Detroit Elctrns. 313-967-1570
MI St. Clair Shores, Spemco 313-771-2700
MN Blaine, Kim Controls, Inc. 612-780-2991
MN Minneapolis, Newark Elec. 612-331-6350
MN St. Paul, Gopher Elctrns. 612-483-4450
MN St. Paul, Shelley-Ragon, Inc. 612-642-2828
MO Kansas City, LComp, Inc. 816-241-0111
MO Maryland Hgts., LComp, Inc. 314-291-6200
MO St. Charles, Finnigan Elctrns., Inc. 314-946-6201
NH Nashua, Brevan Elctrns., Inc. 603-889-7230
NJ East Hanover, State Elctrn. Corp. 201-887-2550
NJ Kenilworth, Federated Purch. 201-272-0505
NJ West Berlin, General Comps. 609-768-6767
NM Albuquerque, Walker Elctrn. Supply Co. 505-883-2992
NY Binghamton, Pioneer STD Elctrns. 607-722-9300
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Buffalo, Summit Distrs. 716-887-2800
NY Endwell, ASI Elctrns. 607-754-3823
NY Fairport, Pioneer-Standard Elctrns., Inc. 716-381-7070
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Lynbrook, Peerless Radio 516-593-2121
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rome, Rome Elctrns. 315-337-5400
NC Cary, Powell Elec. 919-467-1212
NC Charlotte, Regan Controls 704-523-9137
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Regan Controls 919-790-0811
NC Raleigh, Sager Elctrns. 919-850-9550
OH Chesterland, EQS Systems 216-729-2222
OH Cincinnati, Richard Equip. 800-543-0350
OH Cincinnati, URI Elctrns. 800-582-7080
OH Cleveland, Pioneer STD Cleveland 216-587-3600
OH Columbus, Hughes-Peters 614-294-5351
OH Dayton, Pioneer STD Elctrns. 513-236-9900
OH Dayton, Stotts-Friedman Co., Inc. 513-298-5555
MI Grand Rapids, Pioneer STD 616-698-1800
OH Valley View, Newark Elect. Cleveland 216-447-8860
OH Willoughby, Gateway Megatech 216-953-0333
OK Tulsa, Norvell 918-254-8606
OR Beaverton, Component Resources 800-547-1861
OR Eugene, Pacific Control Sply 503-342-7294
OR Portland, Pacific Control Supply, Inc. 503-249-2033
OR Portland, Radar Elec. Co. 503-232-3404
PA Harrisburg, Cumberland Elctrns. Inc. 717-232-5999
PA King of Prussia, Applied Controls, Inc. 215-265-3832
PA Mars, Almo Elctrns., Inc. 412-931-5990
PA McKean, Advacom 814-476-7774
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, Pioneer STD Elctrns. Inc. 412-782-2300
PA Trevose, ALMO Elctrns., Inc. 215-953-2800
RI Pawtucket, Major/Edwards 401-725-7400
SC Columbia, Dixie Elctrns. 803-779-5332
SC Gaffney, Newark Elect. Gaffney 803-487-3739
SC Greenville, EMSCO, Div. of Hammond Elctrns. 803-233-4121
TN Memphis, Bluff City 901-345-9500
TX Austin, Norvell Elctrns. 512-837-5555
TX Dallas, Associated Aircraft 214-331-4381
TX Dallas, Harrison Equip. 214-239-2750
TX Dallas, Norvell Elctrns. 214-233-0020
TX Ft. Worth, Allied Elctrns. 817-595-3500
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Newark Elect.Houston 713-270-4800
TX Houston, Norvell Elctrns. 713-462-1666
TX Irving, Cypress Elctrns. 214-255-0065
TX Stafford, Harrison Equip. 713-879-2600
UT Salt Lake City, Standard Supp. 801-486-3371
WA Kent, Component Resources, Inc. 800-547-6523
WA Redmond, Cascade Controls 206-881-8843
WA Seattle, Radar Elect. Co., Inc. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Milwaukee, Progressive Image 414-321-4722
WI New Berlin, Classic Comps. 414-786-5300
Can Burnaby, BC, ITT Multicomps. 604-291-8866
Can Calgary, AL, Cardinal Ind'l. Elect. 403-259-6817
SC Columbia, Regan Controls 803-736-3404
Can Concord, Ont., ITT Multicomps. 416-736-1144
Can Don Mills, Ont., Saynor Varah, Inc. 416-445-0723
Can Edmonton, AL, Cardinal Ind'l. Elect. 403-483-6266
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GREEN ENGINEERING, 78 Stone Place, Melrose, MA 02176, Tel: 617-665-8994, FAX: 617-665-8255; Empl.: 5

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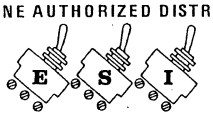

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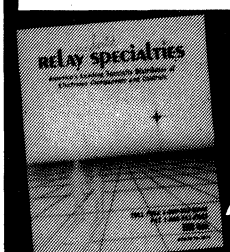
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GTE TESTMARK LABS, GTE Industry Sls., 220 E. Las Colinas Blvd. MC, T11090, Irving, TX 75039, Tel: 214-718-3647, FAX: 214-718-7783; Empl.: 800; *Sls. Mgr.:* Clifton E. Miller

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THE HALL COMPANY, 420 East Water St, Urbana, OH 43078, Tel: 513-652-1376, FAX: 513-653-7447; Empl.: 75

HALLMARK TECHNOLOGIES, 1717 East Lincoln Ave., Mt. Dora, FL 32757, Tel: 800-874-9063, FAX: 904-383-8146; Empl.: 90; *Sls. Mgr.:* John Santiago

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HAMAMATSU PHOTONICS K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, Japan, Tel: 0534-52-2141, FAX: 0534-56-7889; Empl.: 1200; *Sls. Mgr.:* H. Hiruma

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HAMEG INSTRUMENTS, 1939 Plaza Real, Oceanside, CA 92056, Tel: 619-630-4080, FAX: 619-630-6507; Empl.: 20; *Sls. Mgr.:* Michael Silverstein

HAMILTON AVNET, 10950 West Washington, Culver City, CA 90230, Tel: 213-558-2645

HAMILTON METALCRAFT, 848 N. Fair Oaks Ave., Pasadena, CA 91103, Tel: 818-795-4811, FAX: 818-795-9705; *Sls. Mgr.:* Mel Stahler

HAMILTON STANDARD CONTROLS/STANCOR, See Stancor/Hamilton Standard Controls

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GA	Norcross, Electramark	404-446-7915
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IN	Fort Wayne, TMC	219-432-5553
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TX	Dallas, Allied Comps.	214-238-0408
TX	Hurst, Allied Comps.	817-589-0456
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WI	Watertown, Deaken Tech.	414-261-7600
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Can	Richmond, B.C., Blackwood Elctrn.	604-273-9910

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CO	Littleton, Indelco	303-795-3431
FL	Orlando, Hammond Elctrn.	407-849-6060
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Gaithersburg, Pioneer/Wash.	301-921-0660
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AR	Little Rock, Carlton Bates	501-562-9100
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CA	Manhattan Beach, Prime Electro	213-379-3642
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CA	Redwood City, H.D.B.	415-368-1388
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CA	San Jose, Con. Parts, Inc.	408-435-1200
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Santa Ana, ITT Multicomponents	714-727-4001
CO	Denver, Fistell Elctrns.	303-629-1312
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CT	Hartford, Hatry Elec.	203-527-1881
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CT	Wallingford, Midstate Elec.	203-265-9900
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FL	Tampa, EMSCO	813-253-2684
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GA	Norcross, Wholesale Inds. Elec.	404-447-8431
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MD	Beltsville, Mark Elctrns.	301-595-5040
MD	Gaithersburg, M. S. Elec.	301-921-0200
MA	Haverhill, Spartan Elctrns.	508-373-1200
MA	Lynn, Land Elec. Supp.	617-592-2220
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MA	Wellesley Hills, Target Elctrns. Supp.	617-235-2545
MA	Woburn, Abbott Elec.	617-935-2040
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OH	Columbus, Thompson Elec. Supp.	614-228-6191
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OK	Tulsa, Radio, Inc.	918-587-9123
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PA	McKean, Advacom	814-476-7774
PA	Wayne, Peak Elec.	215-293-9000
RI	Pawtucket, Major Elec. Supp.	401-725-7400
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SC	Greenville, EMSCO	803-233-4121
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WI	Mequon, Taylor Elec.	414-241-4321
WI	Oshkosh, Elctrn. Inds.	414-235-8930
WI	Racine, Badger Elctrn. Supp.	414-637-1256

HANCOCK ELECTRONICS CORP., 75 Terry Drive, Hingham, MA 02043, Tel: 617-740-4190, FAX: 617-740-4192; FSC No.: 66851; Empl.: 8; *Sls. Mgr.:* Robert H. Sturdy

HAND HELD PRODUCTS, INC., 8008 Corporate Center Dr., Charlotte, NC 28226, Tel: 704-541-1380, TWX: 810-621-0380 PROTECH, FAX: 704-541-1333; *Sls. Mgr.:* Jim Trautwein; *Dist. Mgr.:* Jim Trautwein

H & L INSTRUMENTS, 1440 Rollins Road, Burlingame, CA 94010, Tel: 415-342-7850, FAX: 415-347-1065; Empl.: 7; *Sls. Mgr.:* Jenifer H. Landman

HANDY & HARMAN ELCTRN. MATLS. CORP., 72 Elm St., N. Attleboro, MA 02760, Tel: 508-695-1401, FAX: 508-695-7565; Empl.: 300; *Sls. Mgr.:* T. Longo

HANKSCRAFT MOTORS, Div. of Gerber Prods. Co., P.O. Box 120, Reedsburg, WI 53959, Tel: 608-524-4341, FAX: 608-524-6779; Empl.: 550

HANOVIA, Canrad, 100 Chestnut St., Newark, NJ 07105, Tel: 201-589-4300, TELEX: 13-8531, FAX: 201-589-4430; Empl.: 250; *Sls. Mgr.:* Dennis M. Priscandaro; *Dist. Mgr.:* Dennis M. Priscandaro

HANSCOM, H. F., CO., INC., 225 Chapman St, Providence, RI 02905, Tel: 401-941-1455, FAX: 401-781-8835; Empl.: 50; *Sls. Mgr.:* John E. Christiansen

HANSEN MANUFACTURING COMPANY, INC., Subsidiary of IMC Magnetics Corp., Box 23, Princeton, IN 47670-0023, Tel: 812-385-3415, FAX: 812-385-3013; Empl.: 400; *Sls. Mgr.:* George A. Gilbert

HANTRONIX

FAX: 408-749-0477

HANTRONIX, INC., Liquid Crystal Display, 250 Santa Ana Ct., Sunnyvale, CA 94086, Tel: 408-736-3191, TELEX: 880165; Empl.: 25; *Sls. Mgr.:* David Kim; *Dist. Mgr.:* Jake B. Yu ..... **B•1078-1079**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Carlsbad, Zerimar Sls.	619-436-3379
CA	Laguna Hills, 4 Star Elctrn. Sls.	714-583-9781
CA	Los Gatos, Luscombe Engrg. of S.F.	408-370-2020
CO	Longmont, Butler Tech. Sls.	303-651-7703
CT	Bethel, Ray Perron & Co., Inc.	203-798-0261
CT	Farmington, Ray Perron & Co., Inc.	203-673-4825
FL	Melbourne, Synergistic Tech. Sls.	407-242-9661
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Arlington Heights, Phoenix Elctrn. Sls.	708-394-4422
KS	Prairie Village, Crosslink	913-649-7100
MD	Ellicot City, Technology Sls.	301-461-7802
MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MN	Minneapolis, Technical Comp. Grp.	612-536-9512
MO	St. Louis, Reptronics	314-576-9816
NY	Coram, Sylvester Assocs. Sls. Inc.	516-473-2018
NY	Webster, Impaq Elctrns., Inc.	716-265-0995
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OH	Columbus, Scientific Sys.	614-861-0129
OR	Hillsboro, Temco Northwest	503-645-2030
PA	Hatboro, Delta Tech. Sls.	215-957-0600
TX	Austin, RAm Elctrn. Sls., Inc.	512-345-2982
TX	Plano, RAM Elctrn. Sls. Inc.	214-424-4455
WA	Birch Bay, Temco Northwest	206-371-0423
WA	Bothell, Temco Northwest	206-481-6150
WA	Spokane, Temco Northwest	509-927-9392

Local Distributors

CA	Industry, Ital Elctrns Sls.	818-968-8515
CA	Mission Viejo, Opto Plus	714-380-8654
CA	San Jose, Spectra Elctrn. Inc.	408-452-1590
CO	Littleton, Displays Plus	303-730-7333
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620
NJ	Rockaway, Tonar Inds., Inc.	201-586-9000
TX	Austin, Omni Pro Elctrns.	512-794-9200
TX	Dallas, Omni Pro Elctrns.	214-233-0500
WI	New Berlin, Classic Comps.	414-786-5300
Can	Nippean, Ont., Carsten Elctrns. Ltd.	613-726-9250
Can	Scottsborough, Ont., Carsten Elctrn. Ltd.	416-495-9999

HARBOUR IND. (CANADA) LTD., 1365 Industriel Blvd., Farnham, Quebec, Canada J2N 2X3, Tel: 514-293-5304, FAX: 514-293-2421; Empl.: 31; *Sls. Mgr.:* Marc Longpre

HARDIGG

FAX: 413-665-4801

HARDIGG INDS., INC., 393 N. Main St. P.O. Box 201, South Deerfield, MA 01373, Tel: 413-665-2163; FSC No.: 11214; Empl.: 200; *Sls. Mgr.:* Stanley J. Morgan ..... **C•1059-1061**

HARDMAN INC. A HARCROS CHEMICAL GROUP COMPANY, 600 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-3000, FAX: 201-751-8407; Empl.: 85

HAROWE SERVO CONTROLS, INC.:A FASCO CO., 110 Westtown Rd. P.O. Box 547, West Chester, PA 19380, Tel: 215-692-2700, TELEX: 685-1176; FSC No.: 06989; Empl.: 300; *Sls. Mgr.:* Clayton A. Walters

HARREL, INC., 16 Fitch St, E. Norwalk, CT 06855, Tel: 203-866-2573; *Sls. Mgr.:* Richard Decew

HARRIS CORP., Dracon Div., 809 Calle Plano, Camarillo, CA 93012, Tel: 805-987-9511, TELEX: 182327; Empl.: 350; *Sls. Mgr.:* Tom Erdmann; *Dist. Mgr.:* Keith Boutillier

HARRIS MICROWAVE SEMICONDUCTOR, Harris Semiconductor, 1530 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2222, TWX: 910-338-2247, FAX: 408-432-3268; *Sls. Mgr.:* Vic Kovacevic

HARRIS SEMICONDUCTOR, Box 883, Melbourne, FL 32902, Tel: 305-724-7400, TWX: 510-959-6259; FSC No.: 34371; Empl.: 2300; *Sls. Mgr.:* Gary Pinelli; *Dist. Mgr.:* George Giozinski

HARTING ELEKTRONIK, INC., 2155 Stonington Ave., Ste. 212, Hoffman Estates, IL 60195, Tel: 708-519-7700, FAX: 708-519-9771; Empl.: 15; *Sls. Mgr.:* Donald G. Blummer

HARTLEY PRODUCTS, 1200 N. 23rd St., Ste. 105, Wilmington, NC 28405, Tel: 919-763-7422, FAX: 919-763-7422; *Sls. Mgr.:* R. Schmetterer

HARWIL, 1548 17th St., Santa Monica, CA 90404, Tel: 213-829-2310, FAX: 213-829-2259; Empl.: 10

HASCO COMPONENTS INTERNATIONAL CO., 247-40 Jericho Tpke., Bellrose Village, NY 11001, Tel: 516-328-9292, FAX: 516-326-9125; Empl.: 30; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Christa Mundelos ..... **B•1494-1500, 1707**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AL	Huntsville, Rick Burns Assocs.	800-852-5050
AK	Anchorage, Hasco Comps.	800-852-5050
AZ	Phoenix, Sanford Sls.	602-957-3570
AZ	Phoenix, Sanford Sls.	800-852-5050
CA	Irvine, Groh Assocs.	714-837-9871
CA	Los Angeles, RD&D	800-852-5050
CA	San Francisco, Silicon Valley	800-852-5050
CT	Hartford, Gallagher Assoc.	800-852-5050
GA	Atlanta, Rick Burns Assoc.	800-852-5050
IL	Chicago, Rendell Sls.	312-852-5050
KS	Kansas City, Logsden Assoc.	800-852-5050
LA	New Orleans, TANE	800-852-5050
MA	Framingham, Gallagher	800-852-5050
MO	Kansas City, Logsdan	800-852-5050
NM	Albuquerque, Sanford	800-852-5050
NY	Port Washington, Ashtec	800-852-5050
NY	Rochester, Andres	800-852-5050
NC	Raleigh, Rick Burns Assoc.	800-852-5050
OH	Cleveland	800-852-5050
TX	Dallas, Sls. Assoc.	800-852-5050
VA	Charlottesville, Pacesetter	800-852-5050
WA	Seattle, Jensen Sls.	800-852-5050
WI	Milwaukee, Rendell Sls.	800-852-5050

HATHAWAY CORPORATION:MOTION CONTROL DIV., 10837 E. Marshall, Tulsa, OK 74116, Tel: 918-438-7800, FAX: 918-438-7629; Empl.: 80; *Sls. Mgr.:* David Richards

Local Sales Offices & Reps

CA	Los Angeles, Hathaway: Motion Control Div.	213-398-5369
MA	Boston, Hathaway:Motion Control Div.	617-469-5054

HAUMAN, INC., 2031 Ringwood Avenue, San Jose, CA 95131, Tel: 408-434-0888, TELEX: 510-101-2820, TWX: 408-434-9832; *Sls. Mgr.:* Willis Yeh ..... **D•1782-1783**

Local Sales Offices & Reps

AL	Huntsville, B & C Instruments, Inc.	205-883-6530
CA	Canoga Pk., RAG Elctrns., Inc.	818-998-6500
CA	San Diego, Instr. Engrs.	619-268-8344
CO	Broomfield, Instr. Repair Labs.	303-469-5375
CT	Newtown, Connecticut Cal Labs	203-270-1263
FL	Tampa, Tampa Instrmn.	813-623-3979
GA	Norcross, Allied Elctrns.	404-446-8595
IN	Indianapolis, Loren Green	317-293-9827
MN	Minneapolis, Tonka Tech. Labs.	612-593-1770
NY	Great Neck, Instr. Mart	516-487-7430
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OR	Portland, Westcon Inc.	503-283-0132
PA	New Hope, John Bell	215-862-3762
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Garland, Tucker Elctrns.	214-348-8800
WA	Bellevue, Vetco	206-869-7025

Local Distributors

AK	Anchorage, Alaska Elctrnc. Supp.	907-563-3774
MD	Columbia, Allied Elctrns.	301-381-1560
PA	Pittsburgh, Allied Elctrns.	412-367-4124
WA	Seattle, Allied Elctrns.	206-547-2827

HAVERLY SYSTEMS, INC., 12 Hinchman Ave., Box 919, Denville, NJ 07834, Tel: 201-627-1424, FAX: 201-625-2296; Empl.: 33; *Sls. Mgr.:* Ken Spencer

HAYDON SWITCH & INSTRUMENT, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-756-7441, TELEX: 643852-HSIINTLWBY, FAX: 203-756-8724; FSC No.: 02005; Empl.: 100

HAYES INSTRUMENT SERVICE INC., 530 Boston Rd., Billercia, MA 01821, Tel: 508-663-4800, FAX: 508-663-3812; Empl.: 45; *Sls. Mgr.:* Alan Brown; *Dist. Mgr.:* Alan Brown

HBM, INC., 19 Bartlett Street, Marlboro, MA 01752, Tel: 508-624-4500, FAX: 508-485-7480; Empl.: 200; *Sls. Mgr.:* Robert Gray

HBS EQUIPMENT CORPORATION, 3000 Supply Ave., Los Angeles, CA 90040, Tel: 213-726-3033, FAX: 213-888-9982; Empl.: 60; *Sls. Mgr.:* Mark Pedersen

HC Power, inc.

FAX: 714-261-6584

HC POWER INC., 17032 Armstrong Ave., Irvine, CA 92714-5716, Tel: 714-261-2200; FSC No.: 0D6P8; *Sls. Mgr.:* Jack Graham ..... **D•1784-1785**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Phoenix, Morrison & Fern	602-296-8181
CA	Laguna Hills, Electro Venture	714-581-9244
CA	Santa Clara, Electro Venture	408-727-1553
CA	Woodland Hills, Electro Venture	818-884-6574
CO	Englewood, Taylor Mktg.	303-850-0207
CO	Littleton, Taylor Mktg.	303-850-0207
FL	Largo, Graham Assoc.	813-539-6779
FL	Melbourne, Graham Assoc.	407-773-6631
FL	Orlando, Graham Assoc.	407-299-1001
FL	Palm Beach Gardens, Graham Assoc.	407-622-4049
FL	Winter Garden, Graham Assoc.	407-656-9369
IL	Barrington, Omni	708-381-9087
IN	Indianapolis, JC Hofstetter	317-897-7914
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MA	Franklin, OEM Mktg. & Sls.	508-528-4983
MN	Minneapolis, Electro-Serv	612-338-3475
MO	St. Louis, The Beams Co.	314-434-8448
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NC	Winston-Salem, Murcota	919-722-9445
OH	Dayton, JC Hofstetter	513-296-1010
OH	Medina, JC Hofstetter	216-725-4477
OR	Portland, Power Factor Assocs.	503-233-6969
PA	Pittsburg, JC Hofstetter	412-356-2305
TX	Dallas, Dynamark	214-437-3333
UT	Ogden, Taylor Mktg.	801-546-9570
NY	Spring Valley, Powertronics	914-735-3775
Can	Lachine, Digidyne	514-631-1891
Can	Napean, Digidyne	613-727-5632
Can	Toronto, Digidyne	416-674-0444

HDR POWER SYSTEMS, INC., 4242 Reynolds Dr., Hilliard, OH 43026, Tel: 614-771-5500, FAX: 614-771-7219; Empl.: 90; *Sls. Mgr.:* Harlan W. Bates

HDS INC., 12310 Pinecrest Rd., Reston, VA 22091, Tel: 703-620-6200, TELEX: 64585, FAX: 703-620-3169; Empl.: 120

H D SYSTEMS, INC., 89 Cabot Court, Hauppauge, NY 11788, Tel: 516-231-6630, FAX: 516-231-6803; Empl.: 5; *Sls. Mgr.:* Tetsuo Ikuta

HEADWAY RESEARCH, INC., 3713 Forest La., Garland, TX 75042, Tel: 214-272-5431, FAX: 214-272-7817; Empl.: 45

HEATH CO., Hilltop Road, St. Joseph, MI 49085, Tel: 616-982-3200, TELEX: 72-9421; Empl.: 2000

HEAT SYSTEM, INC., 1938 New Hwy., Farmingdale, NY 11735, Tel: 516-694-9555, TELEX: 825-339; Empl.: 35; *Sls. Mgr.:* Irwin Leibson

HEDRICH USA, INC., 684 N. Spence Ave., Goldsboro, NC 27534, Tel: 919-751-1144, FAX: 919-751-0215

HEEGER, INC., 6400 Fleet St., City of Commerce, CA 90040, Tel: 213-728-5108, 728-4729, 728-6913, FAX: 213-728-4740; Empl.: 10; *Sls. Mgr.:* Robert A. Heeger

HEI CORPORATION, P.O. Box 88806, Carol Stream, IL 60188, Tel: 708-665-5500, FAX: 708-665-5769; Empl.: 20

HEIDENHAIN CORP., 115 Commerce Dr., Schaumberg, IL 60173, Tel: 708-490-1191, FAX: 708-490-3931; Empl.: 72; *Sls. Mgr.:* Thomas Wyatt; *Dist. Mgr.:* Rick Glos

HEI, INC., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, Tel: 612-443-2500, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 200; *Sls. Mgr.:* Leonard Klun ..... **A•1726**

Local Sales Offices & Reps

MN	Victoria, HEI Inc.	612-443-2500

HEI, INC., Optoelectronics Div., 1495 Steiger Lake La.,P.O.Box 5000, Victoria, MN 55386, Tel: 612-443-2500, TWX: 510-601-7785, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 150; *Sls. Mgr.:* Dale Nordquist

HEINEMANN ELECTRIC CO., 2630 Brunswick Pike, Aft. Rte. 1, P.O. Box 6800, Lawrenceville, NJ 08648-0800, Tel: 609-882-4800, TELEX: 843431; FSC No.: 74193; Empl.: 350 ..... **B•1368-1371**

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs. SW	602-944-9542
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	San Jose, O'Donnell Assocs. No.	408-456-2950
CA	Torrance, O'Donnell Assocs., Inc.	213-539-9664
CO	Englewood, CompuTech Mktg.	303-773-3981
FL	Oviedo, Conley & Assocs.	407-365-3283
FL	Wellington, Conley & Assocs., Inc.	407-790-3926
GA	Duluth, Dixie Mktg.	404-381-5592
IL	Northbrook, D. Dolin Sls.	708-498-6770
IN	Ft. Wayne, O.H. Bromberg & Assocs.	219-456-6010
IA	Hiawatha, Ard Sls. Co.	319-393-6392
KY	Alexandria, O.H. Bromberg & Assoc.	606-635-3063
KY	Louisville, O.H. Bromberg & Assocs.	502-456-1498
MD	Upperco, Imagitron Sls. Co., Inc.	301-374-5600
MA	Southboro, Sullivan Tech. Sls.	617-485-2215
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Minneapolis, Furber Sls. Co., Inc.	612-881-3620
MO	Kansas City, Hill & Co.	816-361-1669
MO	St. Louis, Hill & Co.	314-432-1136
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NM	Albuquerque, O'Donnell Assocs. SW	505-889-4522
NY	Farmington, R. M. Scanlon & Assocs.	716-924-7450
NY	Syracuse, R.M. Scanlon & Assoc., Inc.	315-463-7682
NC	Charlotte, J. Rudisill Assocs.	704-377-6901
OH	Cleveland, Brown Elect. Prod.	216-331-2072
OH	Dayton, KW Elctrn. Sls.	513-890-2150
OH	Dayton, O. H. Bromberg & Assocs.	513-434-8788
FL	Wellington, Conley & Assoc., Inc.	305-790-3926
NJ	Lawrenceville, DVS Co.	609-896-1112
PA	Pittsburgh, KW Electrn. Sls.	412-366-9396
TX	Dallas, Glidden Electro Equip.	214-341-0610
TX	Houston, Glidden Electro Equip.	713-681-1415
WI	Milwaukee, Key Entpr.	414-762-2323

Local Distributors

AL	Montgomery, Southern Controls	205-277-5030
CA	Chatsworth, POCO Sls.	818-700-8727
CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Oakland, Brill Elctrns.	415-834-5888
CA	San Carlos, Campbell & George	415-594-1994
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Van Nuys, Fuses, Unltd.	818-786-8111
CO	Aurora, Jet Elctrns.	303-364-1000
CO	Denver, CSID Inc.	303-292-9594
CO	Denver, Newark Elctrns.	303-757-3351
CT	Hartford, L. E. Whelan Co.	203-296-5000
CT	Wallingford, Green Shaw Co.	203-265-3333
FL	Oviedo, Dixie Sls.	407-365-5211
GA	Atlanta, Georgia Control Cen.	404-876-8833
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Morton Grove, Nedco Elctrns.	312-967-0500
IL	Northbrook, Classic Comps. Supp.	312-272-9650
IN	Indianapolis, Bell Inds.	317-875-8200
KS	Edwardville, C. Tennant & Sons	913-441-1801
MD	Columbia, DK Elctrns., Inc.	301-995-1950
MD	Crofton, Custom Marine Svcs.	301-793-3955
MA	Needham, Power Electro Supp.	617-444-6866
MA	Newton, Green Shaw Co.	617-969-8900
MA	Woburn, Apparatus Svc.	617-933-5999
MI	Oak Pk., Newark Elctrns.	313-967-1570
MI	Southfield, Michigan Lectrols Corp.	313-353-1350
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Maryland Heights, Lcomp, Inc.	314-291-6200
NH	Hudson, Bell Inds.	508-474-8880
NJ	Lawrenceville, Riverside Comps. Supp.	609-896-1611
NY	Johnson City, Help Elctrns., Inc.	607-729-3528
NY	Ronkonkoma, Arrow Elctrns.	516-467-1000
NY	Roslyn, I/O Corp. of NY	516-625-1040
NY	Whitestone, Power Electro Supp. Co.	212-767-1447
NC	Charlotte, Motionex Inc.	704-377-1555
NC	Raleigh, Greene-Shaw Co.	919-954-7138
OH	Cleveland, I/O Corp. of Cleveland	216-642-7300
OH	Dayton, Duellman Elec.	513-461-8000
OH	Dayton, Stotts Friedman Co.	513-298-5555
PA	Pittsburgh, Circuit Breakers, Inc.	412-366-9542
OH	Shandon, Cartessa Corp.	513-738-4477
OH	Valley View, Newark Elctrns.	216-447-8860
OR	Portland, Taylor Elec.	503-233-5321
PA	Conshohocken, I/O Corp. of Phila.	215-825-4610
PA	Erie, REM Elctrns.	814-453-5626
PA	West Chester, West Chester Elec. & Electrn.	215-696-7500
TN	Chattanooga, Techni-Tronics, Inc.	615-332-2119
TX	Dallas, Geeco Sls. Co.	214-341-2626
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Newark Elctrns.	713-782-4800
VA	Ashland, Hanover Controls & Supp. Corp.	804-550-2449
VA	Charlottesville, Va. Elctrn. Comps.	804-296-4184
WA	Seattle, H. C. Campbell Co.	206-433-1900
WI	Milwaukee, Hunt Co.	414-383-1781

HEITZ, KARL, INC., P.O. Box 427, Woodside, NY 11377, Tel: 718-565-0004, FAX: 718-565-2582; Empl.: 15

HELICAL PRODS. CO., INC., Box 1069, Santa Maria, CA 93456-1069, Tel: 805-928-3851, FAX: 805-928-2369; FSC No.: 13201; Empl.: 85; *Sls. Mgr.:* John Ricker

HELM INSTRUMENT CO., INC., 1387 Dussel Drive, Maumee, OH 43537, Tel: 419-893-4356, FAX: 419-893-1371; Empl.: 55; *Sls. Mgr.:* M. Wilhelm; *Dist. Mgr.:* N. Phillips

HELWIG CARBON PRODUCTS, INC., 8900 W. Tower Ave., Milwaukee, WI 53224, Tel: 414-354-2411, FAX: 414-354-2421; FSC No.: SIC 3624; Empl.: 280; *Sls. Mgr.:* John E. Koenitzer

HERBERT PRODS. INC., 180 Linden Ave., Westbury, NY 11590-0384, Tel: 516-334-6500, TWX: 510-222-5963, FAX: 516-334-6538; Empl.: 94; *Sls. Mgr.:* B. J. Simmons

HERGA INC. HERGA ELECTRIC LIMITED, 602 Brandywine Parkway, West Chester, PA 19380, Tel: 215-430-1970, FAX: 215-430-7785; Empl.: 5

HERITAGE METAL FINISHING INC., 800 S. Market St. P.O. Box 446, Elizabethtown, PA 17022, Tel: 717-367-1561, FAX: 717-367-2474; Empl.: 43; *Sls. Mgr.:* Terry L. Rinesmith ..... **D•2235**

Local Sales Offices & Reps

PA	Elizabethtown, Heritage Metal Finishing Inc.	717-367-1561

HERMETIC SEAL CORP., 4232 Temple City Blvd, Rosemead, CA 91770, Tel: 213-283-0411, TWX: 910-587-3352, FAX: 818-443-6610; FSC No.: 04820; Empl.: 200

HERMETIC SWITCH, Box 1325, Hwy. 92, Chickasha, OK 73018, Tel: 405-224-4046, TELEX: 796125 Hermetic CKSA, FAX: 405-224-9423; FSC No.: 65623; Empl.: 150; *Sls. Mgr.:* R. Helms, Kim Baker .... **B•1708, 1904-1905**

Local Sales Offices & Reps

CA	Arcadia, V. Gott & Assocs.	818-445-9729
CA	San Diego, V. Gott & Assocs.	619-489-0893
GA	Atlanta, Electro Technig. Prods.	404-262-1522
IL	Lemont, Trend-Tronics, Inc.	708-972-1166
KS	Lenexa, Midtec Assocs.	913-541-0505
MA	Canton, New England Elctrn. Sls.	617-828-4835
MN	Minneapolis, Peterson Sls. & Assocs.	612-835-5281
MO	St. Louis, Midtec Assocs.	314-275-8666
NY	Oceanside, Current Inds.	516-678-3895
OR	Beaverton, LD Elctrns.	503-684-8221
PA	Furlong, Avenir	215-348-8290
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-890-8810
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883

Local Distributors

TX	Ft.Worth, Allied Elctrns. Inc.	817-595-3500

HERSEY MEASUREMENT CO., A Miller Industries Co., P.O. Box 4585, Spartanburg, SC 29305, Tel: 803-574-8960, 1-800-845-2102, FAX: 803-578-7308; Empl.: 80; *Sls. Mgr.:* Don McLellan

HERSTAL AUTOMATION LTD., 3171 W. Twelve Mile, Berkley, MI 48072, Tel: 313-548-2001, FAX: 313-548-2010; Empl.: 14; *Sls. Mgr.:* Randall M. Elliott

HERTNER DIV.:EXIDE CORP., 12690 Elmwood Ave., Cleveland, OH 44111, Tel: 216-252-4242, FAX: 216-941-4330; FSC No.: 28398; Empl.: 100; *Sls. Mgr.:* R.C. Wright

HERTZ FILTER, 3 Aerial Way, Syosset, NY 11791, Tel: 516-822-4770; Empl.: 22

HEURISTICS INCORPORATED, 9845 Horn Rd., Ste. 170, Sacramento, CA 95827, Tel: 916-369-6606, TELEX: 4940010, FAX: 916-369-6175; Empl.: 70; *Sls. Mgr.:* Mike McMann, Genl. Mgr.

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HEWLETT-PACKARD CO., 19310 Pruneridge Ave. Customer Information Ctr., Cupertino, CA 95014, Tel: 800-752-0900; Empl.: 91,000 ..... **D•1786-1787**

Local Sales Offices & Reps

AL	Birmingham	205-988-0547
AL	Huntsville	205-830-2000
AK	Anchorage	907-563-8855
AZ	Phoenix	602-273-8000
AZ	Tucson	602-573-7400
AR	Little Rock, Hewlett-Packard Co.	501-225-7178
CA	Calabasas	818-880-3400
CA	Carson	213-834-6312
CA	Foster City	415-378-8400
CA	Fresno	209-252-9652
CA	Fullerton	714-999-6700
CA	Goleta	805-685-6100
CA	Irvine	714-472-3000
CA	Los Angeles	213-337-8000
CA	Mountain View	415-694-2000
CA	N. Hollywood	818-509-2300
CA	Pleasanton	415-460-0282
CA	Sacramento	916-929-7222
CA	San Diego	619-279-3200
CA	San Francisco	415-882-6800
CA	Santa Clara	408-988-7000
CA	Santa Rosa	707-578-8888
CA	Ventura	805-658-6898
CO	Boulder	303-938-3065
CO	Englewood	303-649-5000
CT	Darien	203-656-0040
CT	Glastonbury	203-633-8100
FL	Ft. Lauderdale	305-938-9800
FL	Jacksonville	904-296-0252
FL	Melbourne	407-729-0704
FL	Orlando	407-859-2900
FL	Pensacola	904-476-8422
FL	Tampa	813-884-3282
GA	Atlanta	404-955-1500
GA	Norcross	404-448-1894
HI	Honolulu	808-526-1555
ID	Boise	208-323-2700
IL	Bloomington	309-662-9411
IL	Chicago	312-930-0010
IL	Naperville	708-505-9800
IL	Rolling Meadows	708-255-9800
IN	Carmel	317-844-4100
IN	Ft. Wayne	219-482-4283
IA	Cedar Rapids	319-393-0606
IA	West Des Moines	515-224-1435
KS	Wichita	316-636-4040
KY	Louisville	502-426-0100
LA	St. Rose	504-467-4100
MD	Baltimore	301-644-5800
MD	Rockville	301-948-6370
MA	Andover	508-682-1500
MA	Burlington	617-270-7000
MI	Flint	313-733-6556
MI	Grand Rapids	616-957-1970
MI	Novi	313-349-9200
MI	Troy	313-362-5180
MN	St. Paul	612-644-1100
MO	Kansas City	816-737-0071
MO	St. Louis	314-542-1500
MT	Billings	406-259-5615
NE	Omaha	402-493-0300
NV	Las Vegas	702-792-3900
NJ	Paramus	201-599-5000
NJ	Piscataway	201-562-6100
NM	Albuquerque	505-823-6100
NM	Los Alamos	505-662-6700
NY	Albany	518-458-1550
NY	Amherst	716-689-3003
NY	Fairport	716-223-9950
NY	Liverpool	315-451-1820
NY	Manhattan	212-971-0800
NY	Melville	516-753-0555
NY	Purchase	914-935-6300
NY	Wappinger Falls	914-298-9125
NC	Cary	919-467-6600
NC	Charlotte	704-527-8780
NC	Greensboro	919-665-1800
OH	Akron	216-666-7771
OH	Cincinnati	513-891-9870
OH	Dayton	513-433-2223
OH	Strongsville	216-243-7300
OH	Toledo	419-242-2200
OH	Westerville	614-891-3344
OK	Oklahoma City	405-946-9499
OK	Tulsa	918-481-6700
OR	Wilsonville	503-682-8000
PA	Harrisburg	717-657-5900
PA	Pittsburgh	412-782-0400
PA	Valley Forge	215-666-9000
SC	Columbia	803-732-0400
SC	Greenville	803-232-8002
TN	Knoxville	615-966-4747
TN	Memphis	901-763-4747
TN	Nashville	615-255-1271
TX	Austin	512-346-3855
TX	Corpus Christi	512-289-8271
TX	El Paso	915-833-4400
TX	Houston	713-776-6400
TX	Irvine	214-869-3377
TX	McAllen	512-630-3030
TX	Richardson	214-231-6101
TX	San Antonio	512-494-9336
UT	Salt Lake City	801-974-1700
VA	Chesapeake	804-424-7105
VA	Falls Church	703-204-2100
VA	Glen Allen	804-747-7750
VA	Roanoke	703-774-3444
WA	Bellevue	206-643-4000
WA	Spokane	509-922-7000
WV	Charleston	304-925-0492
WI	Brookfield	414-792-8800
Can	Burlington, Ont.	416-335-8644
Can	Calgary, Alberta	403-235-3100
Can	Dartmouth, Nova Scotia	902-468-4725
Can	Edmonton, Alberta	403-486-6666
Can	Kirkland, Que.	514-697-4232
Can	London, Ont.	519-686-9181
Can	Markham	410-479-1770
Can	Mississauga, Ont.	416-678-9430
Can	Ottawa, Ont.	613-820-6483
Can	Quebec City, Que.	418-648-0726
Can	Richmond, B.C.	604-270-2277
Can	Saskatoon, Saskatche	306-242-3702
Can	St. John's	709-754-0763
Can	Winnipeg, Manitoba	204-694-2777

HEXACON ELECTRIC CO., 161 W. Clay Ave., Roselle Park, NJ 07204, Tel: 908-245-6200, TELEX: 13-8812, FAX: 908-245-6176; Empl.: 150; *Sls. Mgr.:* Robert L. Miller

FAX: 908-245-3238

HEYCO MOLDED PRODUCTS, INC., Box 160, Kenilworth, NJ 07033, Tel: 908-245-0033, 800-526-4182; FSC No.: 28520; Empl.: 135 ..... **C•1758**

Local Distributors

CA	Garden Grove, HW Eckhardt	800-221-8761
CA	Hayward, Arow Fasteners	800-227-2901
CA	Riverside, Elctrns. Supp.	714-787-9220
CA	San Jose, Pro Fasteners	408-943-9177
IL	Shaumberg, Engrd. Fasteners	312-980-4082
IN	Elkhart, La Vanture Prods. Co.	219-264-0658
MD	Baltimore, Jandorf Elec. & Mfg.	301-358-5550
MA	Newton, In-Stock Prods.	617-964-6200
MN	St. Paul, Arden Fasteners	612-483-6681
MO	St. Louis, Engrd. Fastener Co.	314-434-2888
NY	Amityville, Yorkville Inds. Inc.	516-225-2100
OK	Oklahoma City, Wesco	405-232-5521
TN	Nashville, Arden Fasteners	615-889-7043
TX	Houston, Rainbow	713-957-0500
WI	Waukesha, Cable Comps.	800-558-4388

HEYCO STAMPED PRODUCTS, See Cabletest International.

HH CONTROLS CO., INC., 16 Frost St., Arlington, MA 02174, Tel: 617-646-2626; Empl.: 13

HIBBING ELECTRONICS CORP., 3125 E. 14th St., Hibbing, MN 55746, Tel: 218-263-8971, FAX: 218-263-8970; Empl.: 440; *Sls. Mgr.:* Michael Walsh

HICKOK ELECTRICAL INSTRUMENT COMPANY, 10514 Dupont Ave., Cleveland, OH 44108, Tel: 216-541-8060, FAX: 216-761-9879; FSC No.: 28569; Empl.: 230; *Sls. Mgr.:* Bob Fiorille

HICO HORIZONS INTL. CO., See Maxon Precision Motors

HI-G COMPANY SUB. OF NYTRONICS, See Stuthers-Dunn, Inc. and Hi-G Co., Inc., Sub. of Nytronics.

HIGH ENERGY, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365, Tel: 215-593-2800, TELEX: 759888, FAX: 215-593-2985; FSC No.: 21052; Empl.: 50; *Sls. Mgr.:* Joseph F. Quinn

HIGHLAND TECHNOLOGY, INC., 320 Judah Street, San Francisco, CA 94122, Tel: 415-753-5814, FAX: 415-753-3301; Empl.: 8; *Sls. Mgr.:* Hugh Callahan

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HIGH TECHNOLOGY SENSORS, INC., 262 E. Hornbeam Dr., Longwood, FL 32779, Tel: 407-884-7722; Empl.: 7; *Sls. Mgr.:* R. M. Mindock

HIGH VOLTAGE SYSTEMS, INC., P.O. Box 649, Chappaqua, NY 10514, Tel: 914-238-9057, FAX: 914-238-9057; Empl.: 15; *Sls. Mgr.:* Vincent A. Gianguzzi

HVT

FAX: 914-968-0347

HIGH VOLTAGE TECHNOLOGY INC., 71 Alexander St., Yonkers, NY 10701, Tel: 914-423-6636; Empl.: 12; *Sls. Mgr.:* Edith Schmelzer ..... **D•1788-1791**

Local Sales Offices & Reps

CA	El Cajon, Atronix Technlg. Inc.	619-444-1501
CA	Solvang, Atronix Technlg. Inc.	805-686-4366
NJ	Hillside, Irwin Brill	201-677-0653
NM	Albuquerque, IMEC	505-883-9010

Local Distributors

Intl	Yokohama, Japan, Hivic Inc.	044-64-3294
Can	Ontario, QPL Elctrns.	416-674-8858

HILEVEL TECHNOLOGY, 31 Technology Drive, Irvine, CA 92718, Tel: 714-727-2100, TELEX: 655316, FAX: 714-727-2101; Empl.: 82; *Sls. Mgr.:* Dan Riordan

HILTON INDUSTRIES, INC., Subsidiary of Core Industries, 1177 Cattlemen Road, Sarasota, FL 34232, Tel: 813-371-2600, FAX: 813-371-7750; Empl.: 137; *Sls. Mgr.:* Larry Copenhaver; *Dist. Mgr.:* Larry Copenhaver

Hipotronics

FAX: 914-279-2467

HIPOTRONICS INC., Rte. 22, P.O. Drawer A, Brewster, NY 10509, Tel: 914-279-8091, TELEX: 425476, TWX: 710-574-2420; FSC No.: 25284; Empl.: 245; *Sls. Mgr.:* Robert Schlesinger ..... **A•2230-2233; D•1254-1257, 1792-1793, 2200-2201**

Local Sales Offices & Reps

AL	Birmingham, Spader & Assocs.	205-979-5500
AZ	Litchfield Pk., S.W. Elctrl. Sls.	602-935-7292
CA	San Diego, RDX Corp.	619-581-0077
CA	San Dimas, RDX Corp.	714-599-0985
CA	Sunnyvale, RDX Corp.	408-734-4500
CO	Parker, Equal Elec. Inc.	303-841-8982
CT	Branford, Abbott Allison Co.	203-481-0405
FL	Daytona Bch. Shores, W. Rihm Assocs.	904-761-7130
GA	Atlanta, Productive Technlg.	404-939-7027
HI	Honolulu, B. F. Wittenberg	808-696-5538
IL	Hawthorne Woods, Ryan & Assocs.	708-438-2905
MO	St. Louis, Fitzgerald Sls. Co.	314-862-1660
MN	Minnetonka, Lee-Noonan Co.	612-938-1112
NJ	Union, Friedman Assocs., Inc.	201-964-6200
NM	Albuquerque, Brytec Sls. Inc.	505-884-1123
NY	Le Roy, Hasgo Power Equip.	716-768-8500
OH	Vermilion, Robert S. Howley	216-967-8787
PA	Downingtown, Kenn Ebert-Hipotronics	215-269-5898
UT	Salt Lake City, Riter Engrg. Co.	801-973-9063
WA	Redmond, Gore Elec. Co.	206-883-4505
PR	Santurce, Mario R. Franceschini Inc.	809-725-7080
Can	Burnaby, B.C., C. D. Nova	604-430-5612
Can	Halifax, N.S., D. C. Keddy Ltd.	902-453-1711
Can	Quebec, J46 1L9, Tremcour Elctrn.,Inc.	514-522-7757
Can	Weston, Ont., U-Tek Svcs. & Supp.	416-747-1879

HI-Q CRYSTALS, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-4544, TWX: 910-743-0029, FAX: 913-764-6400; Empl.: 20; *Sls. Mgr.:* Abdul Ghafoor ..... **A•1372**

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HIRAM JONES ELECTRONICS, 11607 Vanowen St., No. Hollywood, CA 91605, Tel: 213-875-0213; FSC No.: 04867; Empl.: 8 ..... **C•1388-1392**

Local Distributors

TX	Houston, Lenert Co.	713-225-1465

HRS

FAX: 805-522-3217

HIROSE ELECTRIC U.S.A., INC. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), 2685-C Park Center Drive, Simi Valley, CA 93065, Tel: 805-522-7958; Empl.: 70 ..... **C•1394-1397**

RICHARD HIRSCHMANN OF AMERICA INC., Industrial Row, P.O. Box 229, Riverdale, NJ 07457, Tel: 201-835-5002, FAX: 201-835-8354; *Sls. Mgr.:* C. Patten ..... **C•1398**

Local Distributors

CA	San Diego, Instr. Engrs.	619-268-8344
CT	Bridgeport, Park Distrs.	203-366-7200
IL	Bensenville, Magnuson Elctrns.	312-595-7575
IN	Indianapolis, Magnuson Elctrns.	317-247-5108
MA	Canton, EPC Elctrns., Inc.	617-821-2111
NJ	Union, Meridian Supp. Co.	201-687-6220
NY	Bohemia, Key Comps., Inc.	516-567-7500
NY	Mamaroneck, Rye Inds., Inc.	914-698-0080
OH	Highland Hgts., Major Electronix, Inc.	216-461-2100
SC	Spartanburg, Harley's Whlsle. Elctrns.	803-585-4860
TX	Richardson, Centurion Mktg.	214-783-6762

HISONIC, INC., 310 North Marion, P.O. Box 1130, Olathe, KS 66061, Tel: 913-782-0012, FAX: 913-782-0562; FSC No.: 11402; Empl.: 185; *Sls. Mgr.:* Jack O. Cooper III ..... **A•2234**

Local Sales Offices & Reps

AL	Huntsville, MacKay, Smith & Assocs.	205-539-8000
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
FL	Ft. Lauderdale, MacKay, Smith & Assocs.	305-467-3888
FL	Orlando, MacKay, Smith & Assocs.	407-277-1513
FL	St. Petersburg, MacKay, Smith & Assocs.	813-530-1873
GA	Atlanta, MacKay, Smith & Assocs.	404-496-9913
KS	Shawnee Mission, Florence & Meyer	913-722-5210
MO	St. Louis, Florence & Meyer	913-722-5210
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
NC	Raleigh, MacKay, Smith & Assocs.	919-847-2277
TX	Austin, Aid Elctrns.	512-836-6724
TX	Irving, AID Elctrns.	214-259-4761

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HITACHI AMERICA, LTD., Electron Tube Division, 300 N. Martindale Rd., Ste. 600, Schaumburg, IL 60173, Tel: 708-517-1144; Empl.: 50; *Sls. Mgr.:* Tim Patton; *Dist. Mgr.:* Katherine Behm ..... **B•1080-1083**

Local Sales Offices & Reps

AL	Huntsville, Technlg. Mktg. Assoc.	205-883-7893
AZ	Mesa, System Sls. of Arizona	602-464-9989
CA	Irvine, Quadrep	714-527-4222
CA	San Jose, Quadrep	408-432-3300
CO	Parker, Parker Webster	303-841-4888
CT	Wallingford, Technlg. Sls., Inc.	203-269-8853
FL	Orlando, Technlg. Mktg. Assoc.	407-857-3760
GA	Atlanta, Technlg. Mktg. Assoc.	404-446-3565
IL	Chicago, Sumer Inc.	312-991-8500
IN	Indianapolis, Elctrn. Sls. & Engrg.	317-849-4260
IA	Cedar Rapids, Barnes Wes-Tech	319-393-9790
IA	Cedar Rapids, Barnes Westech	319-393-9790

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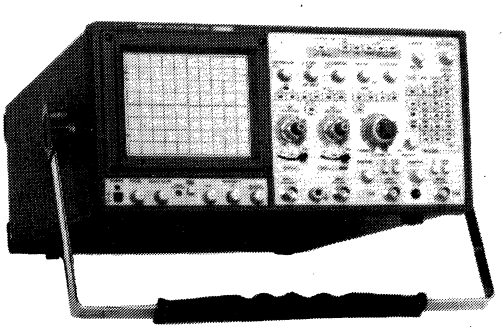

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MD	Columbia, Robert Elctrn. Sls.	301-995-1900
MA	Waltham, Technig. Sls. Inc.	617-890-5700
MI	Plymouth, Jay Mktg.	313-459-1200
MN	Bloomington, Tek Rep Inc.	612-832-0277
NJ	Teaneck, Strategic Sls., Inc.	201-833-0099
NM	Albuquerque, System Sls. of AZ	505-889-2901
NY	Fairport, Technig. Sls., Inc.	716-223-7500
NC	Raleigh, Robert Elctrn. Sls.	919-878-4465
OH	Dayton, Thompson & Assocs.	513-435-7733
OK	Tulsa, West & Assocs.	918-665-3465
OR	Portland, Crown Elctrns.	503-620-8320
PA	Willow Grove, Technig. Sls., Inc.	215-784-0170
TX	Richardson, West & Assocs.	214-680-2800
UT	Murray, Parker Webster	801-266-9939
WA	Bellevue, Crown Elctrns.	206-453-5100
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Mississuaga, Ont., Longman Sls.	416-670-8100
	Local Distributors	
AL	Huntsville, Marshall	205-881-9235
AZ	Phoenix, Marshall	602-496-0290
AZ	Phoenix, Sterling	602-268-2121
CA	Angora Hills, Western Micro	818-707-0377
CA	Chatsworth, Marshall	818-407-4100
CA	Irvine, ITT	714-727-4001
CA	Irvine, Marshall	714-458-5301
CA	Irvine, Western Micro	714-637-0200
CA	Sacramento, IEC	916-424-5297
CA	San Diego, Marshall	619-578-9600
CA	San Jose, IEC	408-435-1000
CA	San Jose, ITT	408-453-1404
CA	San Jose, Marshall	408-942-4600
CA	Saratoga, Western Micro	408-725-1660
CO	Denver, IEC	303-292-6121
CO	Denver, Marshall	303-451-8383
CO	Englewood, Sterling	303-792-3939
CT	Milford, Milgray	203-878-5538
CT	Wallingford, Cronin	203-265-3134
CT	Wallingford, Marshall	203-265-3822
FL	Deerfield Beach, Vantage	305-429-1001
FL	Ft. Lauderdale, Marshall	305-977-4880
FL	Ft. Lauderdale, Reptron	305-735-1112
FL	Orlando, Marshall	407-767-8585
FL	Orlando, Milgray	407-647-5747
FL	Tampa, Reptron	813-855-4656
GA	Atlanta, Marshall	404-923-5750
GA	Atlanta, Milgray	404-446-9777
GA	Norcross, Reptron	404-446-1300
IL	Arlington Hgts., Milgray	312-253-1212
IL	Chicago, Marshall	312-490-0155
IL	Hoffman Estates, IEC	312-843-2040
IL	Schaumburg, Reptron	312-882-1700
IN	Indianapolis, Marshall	317-297-0483
KS	Kansas City, Marshall	913-492-3121
KS	Kansas City, Milgray	913-236-8800
KS	Kansas City, Sterling	913-492-5406
MD	Baltimore, Resco	301-529-0500
MD	Columbia, Milgray	301-995-6169
MD	Columbia, Vantage	301-720-5100
MD	Silver Springs, Marshall	301-622-1118
MA	Boston, Western Micro	508-273-2800
MA	Needham, Cronin	617-449-5000
MA	New England, Milgray	508-657-5900
MA	Wilmington, Marshall	508-658-0810
MI	Livonia, Marshall	313-525-5850
MI	Livonia, Reptron	313-525-2700
MN	Minneapolis, Marshall	612-559-2211
MN	Minneapolis, Sterling	612-831-2666
MN	Minnetonka, Reptron	612-938-0000
MO	St. Louis, Marshall	314-291-4650
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NJ	Mt. Laurel, Marshall	609-234-9100
NJ	N. New Jersey, Marshall	201-882-0320
NJ	Parsippany, Milgray	201-335-1766
NJ	S. Plainfield, Sterling	201-769-7000
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NY	Binghamton, Marshall	607-798-1611
NY	Farmingdale, Milgray	516-420-9800
NY	Long Island, Marshall	516-273-2424
NY	Rochester, Marshall	716-235-7620
NY	Rochester, Milgray	716-235-0830
NY	Smithtown, Vantage	516-543-2000
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OH	Solon, Marshall	216-248-1788
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TX	Austin, Sterling	512-836-1341
TX	Dallas, Marshall	214-233-5200
TX	Dallas, Sterling	214-243-1600
TX	Houston, Marshall	713-895-9200
TX	Houston, Sterling	713-627-9800
UT	No. Salt Lake City, IEC	801-298-1869
UT	Salt Lake City, Marshall	801-485-1551
UT	Salt Lake City, Milgray	801-272-4999
VA	Richmond, Sterling	804-226-2190
VA	Washington/ Baltimore, Sterling	703-742-8400
WA	Bellevue, IEC	303-292-5537
WA	Redmond, Western Micro	206-881-6737
WA	Seattle, Marshall	206-747-9100
WI	Milwaukee, Marsh	414-475-6000
WI	Waukesha, Marshall	414-797-8400
Can	Alberta, ITT	403-251-5888
Can	Alberta, ITT	403-451-4001
Can	British Columbia, ITT	604-192-8866
Can	British Columbia, Space Elctrns.	604-294-1167
Can	Manitoba, ITT	204-786-8401
Can	New Brunswick, ITT	506-857-8011
Can	Ontario, ITT	613-226-7406
Can	Ontario, ITT	416-736-1148
Can	Ontario, Space Elctrns.	416-638-4771
Can	Ontario, Space Elctrns.	613-820-8313
Can	Prince Edward Island, ITT	902-465-2350
Can	Quebec, ITT	514-335-7697
Can	Quebec, Space Elctrns.	514-697-8676
Can	Saskatchewan, ITT	306-933-2888

HITACHI AMERICA, LTD., 220 White Plains Rd., Tarrytown, NY 10591, Tel: 914-631-0600, TELEX: 234553, FAX: 914-631-0672; *Sls. Mgr.:* William Porter; *Dist. Mgr.:* John McDonnell

HITACHI DENSHI AMERICA LTD., Test & Meas. Div., 150 Crossways Pk. Dr., Woodbury, NY 11797, Tel: 516-921-7200, FAX: 516-921-0993; Empl.: 110; *Sls. Mgr.:* John Gray

HITECH EQUIPMENT CORP., 9400 Activity Rd., San Diego, CA 92126, Tel: 619-566-1892, FAX: 619-530-1458; Empl.: 12

HI-TECH, INC., 3600 16th St., Zion, IL 60099, Tel: 708-746-2447, FAX: 708-746-4945; Empl.: 35; *Sls. Mgr.:* J. Gordon Johnson

HITEMP TECHNOLOGIES, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0740, FAX: 408-922-0534; Empl.: 15; *Sls. Mgr.:* Roger Meade

HITRAN

FAX: 908-782-9733

HITRAN CORPORATION, 362 Highway 31, Flemington, NJ 08822-9943, Tel: 908-782-5525; FSC No.: 27672; Empl.: 120; *Sls. Mgr.:* James Hindle ..... **A•2235; D•1795, 2202-2203**

	Local Sales Offices & Reps	
AL	Birmingham, Robertson Sls.	205-823-4187
AZ	Scottsdale, Electro Mktg.	602-991-0110,
CO	Denver, Calvert Controls	303-428-4852
CT	Guilford, Motion Controls Assocs.	203-457-1874,
CT	Ridgefield, Manning & Assocs., Inc.	203-438-5027
ID	Boise, Calvert Controls	208-343-3964
IL	Addison, Hedge Assocs., Inc.	312-543-0888
LA	Metairie, RAPCO Assocs., Inc.	504-887-9500,
MA	Hopedale, Motion Controls Assocs.	508-478-0736
NY	Syracuse, Lachut Elctrl. Sls.	315-458-6486,
NC	Charlotte, Servicon Sls. Corp.	704-588-1035
OR	Eugene, Calvert Controls	503-683-2018
OR	Portland, Calvert Controls	503-236-1358
PA	Fort Washington, Hostvedt-Pavoni, Inc.	215-643-5757
PA	Pittsburgh, Greye Glass Assocs.	412-366-6664
UT	Salt Lake City, Calvert Controls	801-531-8129
WA	Seattle, Calvert Controls	206-251-6135
WA	Spokane, Calvert Controls	509-244-3601
WA	Tacoma, Calvert Controls, Inc.	206-383-1130
WA	Tri-Cities, Calvert Controls	509-545-4506
WV	Sissonville, Interstate Ind. Sls. Corp.	304-988-3687
WI	Brookfield, Kirchmayer-Seidel	414-781-5469
	Local Distributors	
NY	Jamaica, Queens Indl. Elec. Corp.	718-526-7198
RI	Providence, WALCO Elec. Co.	401-467-6500,

HMW ENTERPRISES, INC., 604 Salem Road, Etters, PA 17319, Tel: 717-938-4691, FAX: 717-938-4095; FSC No.: 06A150; Empl.: 40; *Sls. Mgr.:* Gerhard Schmutz

HOBART TAFA TECHNOLOGIES, Hobart Bros. Co., 146 Pembroke Rd., Concord, NH 03301, Tel: 603-224-9585, TELEX: 94-3424, FAX: 603-225-4342; Empl.: 60; *Sls. Mgr.:* Daniel Tuszynski; *Dist. Mgr.:* Daniel Tuszynski

HOBSON BROS., 4940 W. Lawrence Ave., Chicago, IL 60630-3884, Tel: 312-283-3600, FAX: 312-283-3606; Empl.: 75; *Sls. Mgr.:* Betty Maager

HODGE MANUFACTURING CO., INC., 55 Fisk Ave., Springfield, MA 01107, Tel: 413-781-6800, FAX: 413-733-6573; *Sls. Mgr.:* Edwin L. Kossoy

HOFFMAN, P.R., CO., MATERIALS PROC, 321 Cherry St., Carlisle, PA 17013, Tel: 717-243-2011, FAX: 717-243-1672; Empl.: 125; *Sls. Mgr.:* Galen Martin

HOFFMAN ENGINEERING, 900 Ehlen Dr., Anoka, MN 55303, Tel: 612-421-2240, FAX: 612-421-1556; *Sls. Mgr.:* Brad Dunn; *Dist. Mgr.:* Paul Premo

HOFFMAN ENGINEERING CORP., 20 Acosta St., Stamford, CT 06902, Tel: 203-325-8933, FAX: 203-327-4812; FSC No.: 06097; Empl.: 49; *Sls. Mgr.:* Jack DeSoye

HOKE INCORPORATED, 1 Tenakill Pk., Cresskill, NJ 07626, Tel: 201-568-9100, TELEX: 135428, FAX: 1-201-568-5913; *Sls. Mgr.:* Ray Pohlke; *Dist. Mgr.:* Ray Pohlke

HOKURIKU USA LTD., 8145 River Dr., Morton Grove, IL 60053, Tel: 708-470-8440, FAX: 708-967-1188; Empl.: 12; *Sls. Mgr.:* Ira Uslander

HOLADAY INDUSTRIES, INC., 14825 Martin Drive, Eden Prairie, MN 55344, Tel: 612-934-4920, FAX: 612-934-3604; Empl.: 29; *Sls. Mgr.:* David Baron

HOLD-HEET PRODUCTS CORP., 5011 N. Ravenswood Ave., Chicago, IL 60640, Tel: 312-728-4454, 312-728-4455, FAX: 312-728-2016; Empl.: 15; *Sls. Mgr.:* Dan Mundt; *Dist. Mgr.:* Dan Mundt ..... **B•1501**

HOLLEX, INC., See Cabletest Products Co.

HOLLINGSEAD INTERNATIONAL, 13701 Excelsior Drive, Santa Fe Springs, CA 90670, Tel: 213-921-3438, TELEX: 691-462, FAX: 213-921-6313; *Sls. Mgr.:* Doug Wagner

HOLLIS AUTOMATION, Esterline Corporation, 15 Charron Ave., Nashua, NH 03063, Tel: 603-889-1121, TELEX: RCA 294005; Empl.: 130; *Sls. Mgr.:* John L. Chugg; *Dist. Mgr.:* Jerry Vermette

HOLT INC., 9351 Jeronimo Rd., Irvine, CA 92718, Tel: 714-859-8800, TELEX: 182704, FAX: 714-859-9643; FSC No.: 44270; Empl.: 110; *Sls. Mgr.:* Roger Smith

HOLT INSTRUMENT, C.P.D. Engineering, Inc., 126 Mott St., PO Box 230, Oconto, WI 54153, Tel: 414-834-2222, FAX: 414-834-3178; FSC No.: 09435; Empl.: 10; *Sls. Mgr.:* C. P. De Witt

	Local Sales Offices & Reps	
AZ	Phoenix, Barnhill Assocs.	602-955-2955
CA	Torrance, Cutlass Elctrns., Inc.	213-324-7360
CO	Denver, Barnhill Assocs.	303-792-9500
NM	Albuquerque, Barnhill Assocs.	505-299-7658
OK	Tulsa, Barnhill Assocs.	918-492-5036
TX	Houston, Barnhill Assocs.	713-266-2666
UT	Salt Lake City, Barnhill Assocs.	801-226-1239

HOLUB INDS., See Blackburn, Div. of F L Industries

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FAX: 302-652-4578

HOMALITE, Whitco, Inc., 11 Brookside Dr., Wilmington, DE 19804, Tel: 302-652-3686, TWX: 510-600-0874; Empl.: 35; *Sls. Mgr.:* Susan Stepchuck ..... **B•1085**

HONDA CONNECTORS, See Mhotronics, Inc.

HONEYWELL INC., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408, Tel: 612-870-5186, TWX: 910-576-2692; Empl.: 15,000

HONEYWELL INC., Commercial Bldgs. Grp., MN 27-4231, Honeywell Plaza, Minneapolis, MN 55408, Tel: 612-870-2294; Empl.: 6000; *Sls. Mgr.:* Mannie Jackson

HONEYWELL INFORMATION SYSTEMS, 200 Smith St., MS 440, Waltham, MA 02154, Tel: 617-895-6000

HONEYWELL MICROSWITCH DIV., 830 E. Arapaho Dr., Richardson, TX 75081, Tel: 214-470-4271, TELEX: 73-0890, FAX: 214-470-4417; Empl.: 300; *Sls. Mgr.:* Doug Rasmussen; *Dist. Mgr.:* Dave Kimbrough

HOOSIER MAGNETICS, INC., 6545 W. Central Ave. Rm.203, Toledo, OH 43617, Tel: 419-841-7173, FAX: 419-841-7359; FSC No.: 3160; Empl.: 90

HOPKINS ENGRG., 12900 Foothill Blvd., San Fernando, CA 91342, Tel: 818-361-8691, TELEX: 910380-5379, FAX: 818-361-7409; FSC No.: 02777; Empl.: 100

HOPPECKE BATTERY SYSTEMS, INC., 292 Main St., Bulter, NJ 07405, Tel: 201-492-0045, TELEX: 5106002498, FAX: 201-492-2714; *Sls. Mgr.:* Arthur M. Silverman; *Dist. Mgr.:* Arthur M. Silverman



HOPPER ELECTRONICS, 1943 West North Lane 9, Phoenix, AZ 85021, Tel: 602-870-3093; Empl.: 10 ..... **D•1175**

HOTPACK CORP., 10940 Dutton Rd., Philadelphia, PA 19154, Tel: 215-824-1700, 800-523-3608, TWX: 710-670-1694, FAX: 215-637-0519; FSC No.: 66; Empl.: 100; *Sls. Mgr.:* Hugh McKenna

Hotpack is a manufacturer and is sold direct. To contact the salesman in your area call 800-523-3608 or 215-824-1700.

HOUSE OF BATTERIES, 776 W. 19 St., Costa Mesa, CA 92627, Tel: 714-642-8222, 800-432-3385, FAX: 714-548-6598; Empl.: 15; *Sls. Mgr.:* Pat Hoscoe

HOUSTON ATLAS, a Baker Hughes Company, 9441 Baythorne Drive, Houston, TX 77041, Tel: 713-462-6116, TELEX: 75-0197, FAX: 713-462-1831; Empl.: 45; *Sls. Mgr.:* Judy Hood

HOUSTON INSTRUMENT, AMETEK, Inc., 8500 Cameron Rd., Austin, TX 78753, Tel: 512-835-0900, TWX: 910-874-2022; Empl.: 450; *Dist. Mgr.:* Rod Schaffner

HOWARD INDUSTRIES, INC., Box 287, One North Dixie Hwy., Milford, IL 60953, Tel: 815-889-4105, FAX: 815-889-4313; Empl.: 350; *Sls. Mgr.:* Dan Sutter; *Dist. Mgr.:* Barb Davis

HOWELL INSTRUMENTS, 3479 W. Vickery Blvd., Ft. Worth, TX 76107, Tel: 817-336-7411, TELEX: 75-8233; FSC No.: 98869; Empl.: 180; *Sls. Mgr.:* Mike Lathem

HP DIRECT, Hewlett-Packard, 1320 Kifer Rd., Sunnyvale, CA 94086, Tel: 800-538-8787; Empl.: 80,000

HUBBELL INDUSTRIAL CONTROLS INC., 50 Edwards St., Madison, OH 44057, Tel: 216-428-1161, ESYLNK: 980-439, FAX: 216-428-7635

HUDSON TOOL & DIE CO., 18 Malvern St., Newark, NJ 07105, Tel: 201-589-1800, TWX: 710-995-4445, FAX: 201-589-8570; FSC No.: 02875; Empl.: 300

HUGHES AIRCRAFT CO., Connecting Devices Div., 17150 Von Karman Ave., Irvine, CA 92714, Tel: 714-660-5701, FAX: 714-660-5825; FSC No.: 53669; *Sls. Mgr.:* Terry Jarnigan

HUGHES AIRCRAFT CO., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999, Tel: 213-517-6000, TELEX: 67-7064, TWX: 910-347-7321, FAX: 213-517-6714; Empl.: 1249; *Sls. Mgr.:* Jerry H. Herman

HUGHES AIRCRAFT CO., Industrial Products Division, 2051 Palomar Airport Rd., Carlsbad, CA 92009, Tel: 619-931-3000, FAX: 619-931-3334

HUGHES ELECTRONICS PRODUCTS CORP., 34467 Industrial Rd., Livonia, MI 48150, Tel: 313-427-8310, FAX: 313-427-2282; Empl.: 20; *Sls. Mgr.:* Richard L. Smith

HUGHES MICROELECTRONIC CIRCUITS DIVISION, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903, Tel: 714-759-2952, TWX: &, FAX: 714-759-2280

HUGHES SEMICONDUCTOR PRODUCTS CENTER, 500 Superior Ave., Newport Beach, CA 92663, Tel: 714-759-2665, FAX: 714-759-2913; FSC No.: 62458; *Sls. Mgr.:* Steven Rubin

HUGHEY & PHILLIPS, INC., 2162 Union Pl., Simi Valley, CA 93065, Tel: 805-581-5591, FAX: 805-581-5032; FSC No.: 94295; Empl.: 30; *Sls. Mgr.:* Peter H. Johnson; *Dist. Mgr.:* Peter H. Johnson

HUGIN INDUSTRIES INC., 745 Distel Dr., Los Altos, CA 94022, Tel: 415-961-2950, FAX: 415-961-6431; Empl.: 6; *Sls. Mgr.:* Peter Hugin

HULL CORP., 3535 Davisville Rd., Hatboro, PA 19040, Tel: 215-672-7800, FAX: 215-672-7807; Empl.: 200; *Sls. Mgr.:* C. T. Lind; *Dist. Mgr.:* J. T. MacInnes

HUMISEAL DIV., CHASE Corporation, 26-60 BQE West, Woodside, NY 11377, Tel: 718-932-0800, TWX: 710-582-2141, FAX: 718-932-4345; FSC No.: 99109;46058; Empl.: 150; *Sls. Mgr.:* William G. Lott

HUMPHREY, INC., 9212 Balboa Ave., San Diego, CA 92123, Tel: 619-565-6631, TWX: 910-335-2001, FAX: 619-565-6873; Empl.: 278

HUNTINGTON ELECTRIC INC., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, Tel: 219-356-0778, FAX: 219-356-7891; *Sls. Mgr.:* Michael Khorshid

HUNTSVILLE MICROSYSTEMS, INC., 3322 South Memorial Pkwy., Huntsville, AL 35801, Tel: 205-881-6005, TWX: 510-600-8258, FAX: 205-882-6701; Empl.: 30; *Sls. Mgr.:* Kay Keller

HURRICANE ELECTRONICS LAB, P.O. Box 1280, Hurricane, UT 84737, Tel: 801-635-2003, FAX: 801-635-2495; FSC No.: 64109; Empl.: 35; *Sls. Mgr.:* C. R. Reeve

HURST

FAX: 812-386-7504

HURST MANUFACTURING DIV., Box 326, Princeton, IN 47670, Tel: 812-385-2564; Empl.: 200; *Sls. Mgr.:* Don Morrow ..... **B•1272-1275**

Local Sales Offices & Reps

AZ	Phoenix, Sierra Ind. Eng.	602-272-0084
CA	Fullerton, Emerson Motor Div.	714-992-4330
CA	Los Angeles, Sierra Ind'l. Engrg. Co.	213-624-3123
IL	Chicago, Golten Assocs.	708-512-0093
IN	Indianapolis, Emerson Motor Div.	317-842-1342
MD	Glen Arm, Hodgins Assoc.	301-592-7047
MA	Lexington, Hathaway Elctrns.	617-861-7010
MI	Grand Rapids, Emerson Motor Div.	616-942-9500
MN	Wayzata, Cardinal Sls. Co.	612-475-0042
NJ	Sussex, Carbone Assocs.	201-875-1882
NM	Phoenix, Sierra Ind. Eng.	602-272-0084
NY	Rochester, Agma Sls. Assocs.	716-381-5840
NY	Syracuse, Agma Sls. Assocs.	716-381-5840
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
OH	Canton, Emerson Elec. Co.	216-492-4119
OK	Edmond, Emerson Motor Div.	405-340-8228
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
TX	Arlington, Emerson Motor Div.	213-380-2670
WA	Seattle, Northmar	206-524-5170
WI	Milwaukee, Badgerep Inc.	414-241-9200
EXP	NY, Freeport, Minthorne Int'l.	516-546-4700
Can	Burlington, Ont., White Radio Ltd.	416-632-6894

HUTRONIX, INC., 2400 S. 34th Place, Tucson, AZ 85726, Tel: 602-790-5348, FAX: 602-790-8836; FSC No.: 70206; Empl.: 119

HV COMPONENT ASSOCIATES INC., P O Box 2484, Farmingdale, NJ 07727, Tel: 908-938-4499, FAX: 908-938-4451; Empl.: 20; *Sls. Mgr.:* Dennis R. Dean

HYBRICON CORPORATION, 12 Willow Road, Ayer, MA 01432, Tel: 508-772-5422, TWX: 710-347-0654, FAX: 508-772-2963; Empl.: 74; *Sls. Mgr.:* Janis K. Parker

HYBRID DESIGNS, INC., 666 W. Baker, Costa Mesa, CA 92626, Tel: 714-557-9933, FAX: 714-557-0322; FSC No.: 16450; Empl.: 65; *Sls. Mgr.:* Bob Soberman

HYBRID ELECTRONICS CORP., 6 DeAngelo Dr., Bedford, MA 01730, Tel: 617-275-5350, FAX: 617-275-3470; Empl.: 12; *Sls. Mgr.:* John Pantazis

HYBRIDS INTERNATIONAL LTD., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-6400, FAX: 913-764-6409; Empl.: 45; *Sls. Mgr.:* Abdul Ghafoor; *Dist. Mgr.:* John Finley ..... **A•1372-1373, 1727**

Hybridyne Inc.

FAX: 602-791-3899

HYBRIDYNE, INC., 2155 N. Forbes Blvd., Tucson, AZ 85745, Tel: 602-629-0001; Empl.: 90; *Sls. Mgr.:* Richard Brady ..... **A•1729**

Local Sales Offices & Reps

AZ	Phoenix, Wadsworth/Pacific	602-994-4840
CA	Santa Ana, Silicon Coast Assocs., Inc.	714-544-1131
CO	Ft. Collins, Rep Sales	303-226-1504
IL	Downers Grove, Rockford Controls Co.	708-960-2046
MA	Needham Hgts., Vanguard Elctrns.	617-449-5578
MN	Burnsville, Xerotex Technlgs. Corp.	612-894-5007
NJ	Cherry Hill, Metz-Benham-Assocs., Inc.	603-424-0404
NY	Hartsdale, Spectrum Sls. Inc.	914-472-8600
PA	Wynnewood, Metz-Benham-Assocs., Inc.	215-896-7300
TX	Austin, Design Mktg. & Assoc.	512-263-9151
TX	Dallas, Design Mktg. & Assoc.	214-480-8151
TX	Houston, Design Mktg. & Assoc.	713-550-3318

HY-CAL ENGINEERING, 9650 Telstar Ave., El Monte, CA 91731, Tel: 818-444-4000, FAX: 818-444-1314; FSC No.: 12199; Empl.: 145; *Sls. Mgr.:* D. Z. Chapman

HYCOMP, INC., 165 Cedar Hill St., Marlborough, MA 01752, Tel: 508-485-6300, TWX: 710-347-0385, FAX: 508-481-1547; FSC No.: 34707; Empl.: 65; *Sls. Mgr.:* David Petros

HYDRO-GEN PRODUCTS INC., P.O. Box 1517, Fort Collins, CO 80522-1517, Tel: 800-779-0126, FAX: 303-498-0528; Empl.: 25; *Sls. Mgr.:* Derek Bobo; *Dist. Mgr.:* Derek Bobo

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HY MEG CORP., 854 Westgate, Addison, IL 60005, Tel: 708-543-9250, FAX: 708-543-9260; Empl.: 24; *Sls. Mgr.:* Vincent Cupidro ..... **A•1916-1918**

Local Sales Offices & Reps

CA	La Habra, Cygnus	213-691-2993
CA	Mountain View, Westech	415-961-1422
NY	Ronkonkoma, Koelber & Mack	516-585-9686
WI	Cedarburg, American Microelectronics	414-375-4339

HYPERLOGIC CORPORATION, 2411 E. Valley Pkwy. 294, Escondido, CA 92027, Tel: 619-746-2765, FAX: 619-746-4089; Empl.: 2

HYPERTRONICS CORP., 16 Brent Dr., Hudson, MA 01749, Tel: 508-568-0451, 800-225-9228, FAX: 508-568-0680; FSC No.: 50541; Empl.: 145; *Sls. Mgr.:* E. Dalrymple

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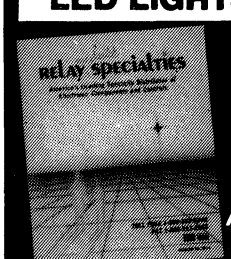

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HY-TEC INDUSTRIES, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786, Tel: 516-924-8686; *Sls. Mgr.:* Tom Poole

HYTEK MICROSYSTEMS, INC., 400 Hot Springs Rd, Carson City, NV 89706, Tel: 702-883-0820, FAX: 702-883-0827; FSC No.: 0ANM4; Empl.: 60; *Sls. Mgr.:* Jon Presnell

ICC, INC., 1144 W. Grove Ave., Orange, CA 92665, Tel: 714-998-8310, TELEX: 4992245ICCUSA, FAX: 714-998-5910; Empl.: 25

ICI ADVANCED MATERIALS, 475 Creamery Way, Exton, PA 19341, Tel: 215-363-4500, TELEX: 4973041, TWX: 510-668-6728, FAX: 215-363-4749; *Sls. Mgr.:* William Shaker

ICI INC., 1901 Petra La., Placentia, CA 92670, Tel: 714-579-7575, FAX: 714-579-3127; Empl.: 8

IC MASTER, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

ICO-RALLY CORPORATION, 2575 E. Bayshore Rd., Palo Alto, CA 94303, Tel: 415-856-9900, FAX: 415-856-8378; FSC No.: 51705; Empl.: 45; *Dist. Mgr.:* Barbara Enad/Doug Frait

ICS ELECTRONICS CORP., 744 S. Hillview Dr., Milpitas, CA 95035-5545, Tel: 408-263-5500, FAX: 408-263-5896; FSC No.: 58558; Empl.: 20; *Sls. Mgr.:* Thomas D. Curfman; *Dist. Mgr.:* Thomas D. Curfman

IC SENSORS, INC., 1701 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-432-1800, FAX: 408-434-6687; Empl.: 150; *Sls. Mgr.:* Greg Hayes

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FAX: 213-690-1352

IDEA, INC., 1300 Pioneer St, Ste. B, Brea, CA 92621, Tel: 213-697-4332; *Dist. Mgr.:* Margina D. Dennis ..... **B•1086-1087, 1164-1165**

Local Sales Offices & Reps

FL	Davie, America's Res. Co.	305-473-2550
FL	Jacksonville, America's Res. Co.	904-733-3822
FL	Orlando, America's Res. Co.	407-330-3155
IL	Chicago, MGA, Inc.	312-775-1151
IN	Indianapolis, MGA, Inc.	317-846-5788
IA	Cedar Rapids, Tech. Elect., Inc.	319-366-5443
MI	Flint, MGA, Inc.	313-732-3922
MI	Southfield, MGA, Inc.	313-358-4151
NH	Amherst, Bennetron	603-880-7008
TX	Dallas, Tycom Sls. Co.	214-960-7368
VA	Midlothian, Pacesetter Comp. Sls.	804-744-1337
WI	Milwaukee, MGA,Inc.	414-546-4466
WI	Oregon, MGA, Inc.	608-835-5540
Can	Kanata, Ont., Canadian Mktg. Technlgs.	613-591-9555
Can	Mississauga, Ont., Canadian Mktg. Technlgs.	416-612-0900
Can	Pt. Claire, Que., Canadian Mktg. Technlgs.	514-694-6088

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CA	Buena Park, Ford Elctrns., Inc.	714-521-8080
CA	Mission Viejo, Opto Plus ò	714-380-8654
CA	San Jose, Rose Elctrn. Distrbg.	408-943-0360
CT	Wallingford, GRS-Midan Elctrns., Inc.	203-265-2077
FL	Davie, Arco Dist., Inc.	305-473-2550
FL	Delray Beach, Fastbolt Florida Corp.	407-272-3100
FL	Melbourne, GRS-Rome Elctrns.	407-242-8151
IL	Addison, Belford Elctrns., Inc.	708-691-1100
IL	Chicago, Leeds Electro Comps.	312-625-3800
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620
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MN	Plymouth, Leeds Electro Comp.	612-557-1277
NJ	Camden, GRS Elctrns.	609-964-8500
NY	Farmingdale, Bulbtronics	516-249-2272
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Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-7705
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Can	St. Laurent, Que., ZEI Electronicsm Inc.	514-342-6211
Can	Surrey, B.C., Memco Corp.	604-590-1553

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FL	West Palm Beach, Boggs & Assocs.	407-478-8062
FL	Oldmar, Boggs & Assocs.	813-855-1812
IL	Schaumburg, Idec Corporation	312-882-7887
IL	South Barrington, Bu-Nell Engrg.	312-551-9000
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MA	Norwood, Hyland Assocs.	617-762-0345
MI	Farmington, Schiller- McBride Assoc.	313-553-0100
MN	Minnetonka, S. J. Collins & Assocs.	612-933-7661
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NM	Albuquerque, T.M.M.I.	505-298-6893
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NY	Syracuse, Lachut Elctrl. Sls. Inc.	315-458-6480
NC	Kernersville, Heritage Sls. Assocs.	919-996-4374
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OH	Cleveland, Matthew Haley Co.	216-892-1820
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OK	Tulsa, Don Plummer Sls. Co.	918-835-0979
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SC	Taylors, Heritage Sls. Assocs.	803-292-1723
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TX Lewisville, Rice Entprs. 214-436-6062
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CA Los Angeles, Masco Elctrns., Inc. 714-529-0866
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CA Santa Ana, Masco Elctrns., Inc. 714-836-7870, FAX:714-836-7870
CA Woodland Hills, Varigon, Inc. 818-594-5080
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FL Largo, TMA Technlg. Mktg. Assocs. 813-531-4405, FAX:813-545-8617
FL Orlando, TMA Tech. Mktg. Assocs. 407-857-3760, FAX:407-857-6412
GA Norcross, TMA Tech. Mktg. Assocs. 404-446-3565, FAX:404-446-0569
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KS Lenexa, Midtec 913-541-0505,FAX:913-541-1729
MA Burlington, Kitchen & Kutchin, Inc. 617-229-2660, FAX:617-273-5895
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MN Burnsville, 2M Sales, Inc. 612-890-7774, FAX:612-894-9342
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NY Endicott, Advanced Comps. Comp. Inc. 607-785-3191
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FAX: 516-567-7358

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CA San Jose, ILC Data Dvcs. Corp. 408-236-3260
CA Woodland Hills, ILC Data Dvcs. Corp. 818-992-1772
CO Englewood, Quorum 3 Sls. Grp. 303-799-8100
CT Canton Center, Dynamic Sls. of New Eng. 203-693-6567
FL Cassleberry, Perrott Assocs. 407-830-0094
FL Clearwater Beach, Perrott Assocs. 813-530-5779
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
IL Itasca, Janus, Inc. 708-250-9650
IN Carmel, Giesting & Assocs. 317-844-5222
KS Lenexa, Dytec/South 913-888-0215
KS Wichita, Dytec South, Inc. 316-263-7090
MD Frederick, ILC Data Dvc. Corp. 301-898-3121
MA Burlington, Dynamic Sls. of New Eng. 617-272-5676
MI Comstock Pk., Giesting & Assocs. 616-784-9437
MI Livonia, Giesting & Assocs. 313-478-8106
MN Eden Prairie, Comprehensive Tech. ... 612-941-7181
MO Maryland Hgts., Dytec/South 314-739-0665
NJ MtLaurel, Paragon Sls. & Mktg. 609-778-1190
NJ Totowa, ILC Data Dvcs. Corp. 201-785-1734
NM Albuquerque, Nelco Electronix 505-292-1399
NY E. Rochester, Tri Tech Elctrns., Inc. ... 716-385-6500
NY Endwell, Tri Tech Elctrns., Inc. 607-754-1094
NY Fayetteville, Tri-Tech Elctrns, Inc. 315-446-2881
NY Fishkill, Tri Tech Elctrns., Inc. 914-897-5611
MD Glen Burnie, Macrotech Assocs. 301-766-1111
NC Cary, Montgomery Mktg., Inc. 919-467-6319
NC Raleigh, Montgomery Mktg; Inc. 919-851-0010
OH Cincinnati, Giesting & Assocs. 513-385-1105
OH Dayton, Lionel Fedotin 513-275-9345
OH Euclid, Giesting & Assocs. 216-261-9705
OR Portland, Venture Elctrns. 503-624-0617
PA Harrisburg, Paragon Sls. & Mktg. 717-657-2063
PA Pittsburgh, Giesting & Assocs. 412-828-3553
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TX Houston, Bonser-Philhower Sls. 713-782-4144
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Salt Lake City, Quorum 3 Sls. Grp. 801-943-9227
VT Graniteville, Dynamic Sls. of New Eng. 802-476-4223
VA Sterling, ILC Data Dvcs. Corp. 703-450-7900
WA Bellevue, Venture Elctrns. 206-454-4594
WI Waukesha, Janus, Inc. 414-542-7575
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ILLINOIS LOCK CO., The Eastern Co., 301 W. Hintz Rd., Wheeling, IL 60090, Tel: 708-537-1800; Empl.: 120; *Sls. Mgr.:* Rick Brabeck ..... **B•1710-1711**

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VA Front Royal, Eltron Sls. Inc. 703-635-7201, FAX:703-635-1933
Can Pointe Claire, Que., Interep Technlgs. Ltd. 514-694-6544,FAX:514-694-2778

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IL Arlington Hgts., Infranor Inc. 312-870-0818
OH Columbiana, Infranor Inc. 216-482-9286

INFRARED INDUSTRIES, INC., 12151 Research Parkway, Orlando, FL 32826, Tel: 407-282-7700, FAX: 407-273-9046; Empl.: 50

ING. F. P. KOGL, Weissenwolffstr.14, 4221 Steyregg, Steyregg, Austria, Tel: 732-640-591-0, FAX: 732-640-592-5; Empl.: 8; *Sls. Mgr.:* Ing. Franz Peter Kogl; *Dist. Mgr.:* Mrs. Michaela Eibl

INJECTORALL ELECTRONICS (WOMAN OWNED), 110 Keyland Court, Bohemia, NY 11716, Tel: 516-563-3388, FAX: 516-563-3389 ..... **C•1147**

Local Distributors

AL Birmingham, ACK Radio Supp. 205-322-0588
AZ Tucson, Electronic City 602-622-1173
CA San Luis Obispo, Midstate Elctrns. Supp. 805-543-2770
CA San Rafael, Elctrns. Plus 415-457-0466
CA Sunnyvale, Halted Specialties 408-732-1573
IL Lombard, NyTron Elctrns. 312-691-8900
IN Evansville, Tri-State Supp. Co. 812-423-4257
IA Cedar Rapids, Iowa Radio Supp. Co. .. 800-332-5296
KY Louisville, P.I. Burkes 502-589-3960
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Needham, Y.D.I. 617-449-1005
MI Canton, The Elctrn. Connection 313-595-6655
NY Lindenhurst, RNJ Elctrns. 516-226-2700
NY Long Island City, Typeco 718-706-6666
NY Richmond Hill, Anchor 212-846-2420
NC Charlotte, Slayton Elctrns. 704-375-6600
OK Oklahoma City, Radio Supp., Inc. 405-332-6127
OR Beaverton, Norvac 503-644-1025
SC Charleston, Wholesale Indl. Elctrns. ... 803-722-2634
TX Fort Worth, Sweico 817-335-6521
VA Roanoke, H. C. Baker 703-344-9209

INLAND MOTOR
KOLLMORGEN CORPORATION

FAX: 602-458-2161

INLAND MOTOR, Kollmorgen Corp., 4020 E. Inland Rd., Sierra Vista, AZ 85635, Tel: 602-459-1150, TWX: 910-973-9869; FSC No.: 11384; Empl.: 580 ... **B•1280-1282**

Local Sales Offices & Reps

FL Deerfield Beach, Technlg. Mktg. Assocs. 305-427-1090
IA Grimes, Drives Plus 515-986-3991
PA Media, Homersmith, Inc. 215-543-2434
FL Orlando, Technlg. Mktg. Assocs. 407-857-3760
AZ Sierra Vista, Inland Motor 602-459-1150
MD Annapolis, Homersmith, Inc. 301-269-6493
MI Farmington Hills, Carter, McCormic & Peirce, Inc. 313-477-7700
FL Largo, Technlg. Mktg. Assocs. 813-531-4405
KS Kansas City, Drives Plus 913-268-5410
MN New Brighton, Motion Technlgs., Inc. .. 612-631-3069
NJ Williamstown, Homersmith, Inc. 609-629-0606
MO St. Charles, Drives Plus 313-441-7765
OH Medina, Cygnus Inc. 216-725-1663
PA Downingtown, Homersmith, Inc. 215-269-3637
TX Richardson, Barger Engrg., Inc. 214-349-6171

Specialty/Instrument/Industrial Drive Group

AL Huntsville, Technology Mktg. Assocs. 205-882-6162
AZ Tempe, Thor Engrg. 602-438-8494
CA Alhambra, Thorson Co. of Southern CA 818-281-2280
CA Goleta, Thorson Co. of Southern CA .. 805-964-8751
CA La Jolla, Thorson Co. of San Diego ... 619-292-8525
CA Mtn. View, Thorson West 415-964-9300
CA Signal Hill, Thorson Co. of Southern CA 213-595-0361
CO Englewood, Thorson Rocky Mt., Inc. .. 303-799-3435
GA Norcross, Technlg. Mktg. Assocs. 404-446-3565
IA Cedar Rapids, Carlson Elctrn. Sls. 319-378-1450
IL Elk Grove Vl, Carlson Elctrn. Sls. 708-956-8240
IN Indianapolis, Precision Elctrns. 317-842-3740
MA Needham Hgts., Vanguard Elctrns. Corp. 617-449-5578
NJ Wayne, SHL Assocs., Inc. 201-790-1714
NY E. Rochester, A & D Dvcs. 716-385-2778
NC Jamestown, Homersmith, Inc. 919-337-3370
OR Beaverton, Thorson Co. Northwest ... 503-644-5900
UT Salt Lake City, Thorson Rocky Mt., Inc. 801-973-7969
WA Bellevue, Thorson Co. Northwest 206-455-9180
WI Milwaukee, Carlson Elctrn. Sls. 414-476-2790

INMARK CORP., 4 Byington Pl, Norwalk, CT 06854, Tel: 203-866-8474, FAX: 203-866-0918; *Sls. Mgr.:* Roger Hibbert

INMOS CORP., P.O. Box 16000, Colorado Springs, CO 80935, Tel: 719-630-4000 (ext 4357), FAX: 719-630-4325; Empl.: 120; *Sls. Mgr.:* Richard Riker; *Dist. Mgr.:* David Bowers

INNOVATEK MICROSYSTEMS, INC., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720, Tel: 914-373-9003; Empl.: 8; *Sls. Mgr.:* Paul F. Fitts

INNOVATIVE ELECTRONICS, INC., Dynatech Corporation, 10110 USA Today Way, Miramar, FL 33025, Tel: 305-432-0300, FAX: 305-432-0705; Empl.: 40; *Sls. Mgr.:* Marshall Roper

INNOVUS, 1756 Junction Ave., Ste. E, San Jose, CA 95112, Tel: 408-436-7790, FAX: 408-436-8185; Empl.: 15

INRECO, See Ransco Industries

INRESCO, INC., 2411 Atlantic Avenue, Manasquan, NJ 08736, Tel: 908-223-6330, FAX: 908-223-2571; Empl.: 16

INSERVO, INC., 128 Commerce Drive, Box 110, LaGrange, OH 44050, Tel: 1-216-355-5102, FAX: 1-216-355-5342; Empl.: 70; *Sls. Mgr.:* Sandra Affolter

INSTANT BOARD CIRCUITS GRP., 20 A Pamaron Way, Novato, CA 94949, Tel: 415-883-1717, FAX: 415-883-2626; Empl.: 13

INSTRULAB, P.O. B. 98, Dayton, OH 45404, Tel: 513-223-2241; Empl.: 22; *Sls. Mgr.:* Fred Pummill

INSTRUM, MDH Industries, Inc., 426 W. Duarte Rd., Monrovia, CA 91016, Tel: 818-303-4210, TELEX: 182910, FAX: 818-357-8863; *Sls. Mgr.:* Craig Rahn

ICS

FAX: 708-543-6244

INSTRUMENTATION & CONTROL SYS., ICS.Inc., 520 Interstate Rd, Addison, IL 60101, Tel: 708-543-6200, TELEX: 271503 ICS UR; Empl.: 30; *Sls. Mgr.:* Harold Miller ..... **B•1504-1505; D•2208-2209**

Local Distributors

FL Largo, Allied Elctrns. 813-541-4660
IL Chicago, Leeds Electro Comps. 312-625-3800
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Allied Elctrns. 317-875-0448
MA Norwood, Allied Elctrns. 617-255-0361
MN Eden Prairie, Allied Elctrns. 612-829-7554
NJ Audubon, Universal Elctrn. Supp. ... 1-800-327-3529
NJ Mt. Laurel, Allied Elctrns. 609-234-7769
NY Fairport, Allied Elctrns. 716-425-3850
OH Solon, Allied Elctrns. 216-248-4200

PA Pittsburgh, Allied Elctrns. 412-367-4124
WI Green Bay, Power/Mation 414-496-0944

Local Sales Offices & Reps

Timer Representatives
CA Arcadia, HMC, Inc. 818-447-0958

UPS Representatives
TX Houston, Gettys-Eads-Adair 713-827-7155
AL Huntsville, Allied Elctrns. 205-721-3500
CA Canoga Park, C & A Elctrns. 818-340-6022
CA Fremont, Allied Elctrns. 415-770-0590
CA Tustin, Allied Elctrns. 213-860-0090
CO Englewood, Allied Elctrns. 303-790-1664
FL Pompano Bch., Allied Elctrns. 305-978-3008
GA Duluth, Allied Elctrns. 404-497-9544
GA Roswell, Henderson Ind. Equip. 404-552-0185
IL Berwyn, B-B & W, Inc. 312-749-1710
IL Rockford, Power/Mation 515-397-0510
IL Rosemont, Advent Elctrns. 312-297-6200
IA Cedar Rapids, Advent Elctrns. 319-363-0221
IL Wood Dale, Allied Elctrns. 708-860-0007
MD Columbia, Allied Elctrns. 301-381-1560
MI Farmington Hills, Advent Elctrns. 313-447-1650
MN St. Paul, Powermation 612-645-0781
NY Hauppauge, N & L Instrs. 516-234-9797
NY Mineola, Allied Elctrns. 516-248-2360
NC Raleigh, Allied Elctrns. 800-638-1381
OH Chagrin Falls, Comm-Omni 216-543-1328
OH Warren, REM Elctrn. Supp. Co., Inc. ... 216-373-1300
TX Brownsville, Garden Indl. Grp. 512-546-1612
TX Dallas, Wofford Elctrns. 214-320-0294
TX Ft. Worth, Allied Elctrns. 817-336-5401, 214-265-9341
TX Ft. Worth, Allied Export Svcs. 817-336-5401
WA Seattle, Allied Elctrns. 206-547-2827
WI Fond du Lac, Fedco Elctrns. 414-922-6490
WI Waukesha, Powermation 414-542-2868

INSTRUMENTATION MEAS. LAB., See Lockheed Electronics Co., Inc.

INSTRUMENTATION SERVICES, INC., 957 Winnetka Ave. N., Minneapolis, MN 55427, Tel: 612-544-8916, FAX: 612-544-4887; Empl.: 30; *Sls. Mgr.:* G. Ryan

INSTRUMENT DESIGN ENGINEERING ASSOCS., INC., See IDEA, Inc.

INSTRUMENTED SENSOR TECHNOLOGY, INC., 1305 S. Cedar St., Lansing, MI 48910, Tel: 517-371-1980, TELEX: 517-371-1244; Empl.: 10

INSTRUMENT ENCLOSURES, 9767 Glenoaks Blvd., Sun Valley, CA 91352, Tel: 818-768-4622, FAX: 818-767-4988; FSC No.: 62012; Empl.: 35; *Sls. Mgr.:* Guy Crutchfield

INSTRUMENT RESEARCH CO., Box 40207, Santa Barbara, CA 93103, Tel: 805-962-8336; Empl.: 6

INSTRUMENT RESISTOR CO., See INRESCO/Instr. Resistor

INSTRUMENTS, INC., 7263 Engineer Rd., Ste. G, San Diego, CA 92111, Tel: 619-571-1111, FAX: 619-571-0188; FSC No.: 34563; Empl.: 28; *Sls. Mgr.:* Ken Kalbfell

INSTRUMENTS & CONTROLS DIV., See Technology Systems Div., KRUG Intl.

FAX: 516-467-8558

INSTRUMENTS FOR INDUSTRY, INC., 731 Union Parkway, Ronkonkoma, NY 11779, Tel: 516-467-8400; Empl.: 25 ..... **D•1012**

Local Sales Offices & Reps
AL Eva, Barr Elctrn. Instrs. 205-796-7533
AZ Mesa, DJM Elctrns. 602-820-4030
CA Valencia, DJM Elctrns. 805-254-2677
CO Englewood, R.A. Mayes Co. 303-761-9447
FL Barr Elctrns. 407-723-4109
IA Hiawatha, EIR Co. 319-395-4500
KS Lenexa, KJS Mktg. 913-962-1795
MD Beltsville, Applied Engrg. 301-595-5393
MO Leasburg, KJS Mktg. 314-245-6579
NH Hudson, EMC Sls., Inc. 603-672-4455
NJ N. Plainfield, Brady Co. 201-755-7900
NM Albuquerque, Mesa Tech. Corp. 505-883-8833
NC Winston-Salem, Scientific Dvcs. S.E. .. 919-859-0868
PA Sewickley, Teplitz/Byrne Assocs. 412-741-3628
TX Richardson, Scientific Dvcs. 214-231-8106
WA Seattle, Del Black Assocs. 206-788-6131
Can Nepean, Ont., Multilek, Inc. 613-226-2365

INSTRUMENT SOCIETY OF AMERICA, P.O. Box 12277, Research Triangle Park, NC 27709, Tel: 919-549-8411, TELEX: 802-540, FAX: 919-549-8288; Empl.: 102

Instrument Specialties Co., Inc.

FAX: 717-424-6213

INSTRUMENT SPECIALTIES CO. HEADQUARTERS, P.O. Box A, Delaware Water Gap, PA 18327-0136, Tel: 717-424-8510, TWX: 510-671-4526; Empl.: 300; *Sls. Mgr.:* John Blazejewski ..... **B•1018; C•1691-1697**

Local Sales Offices & Reps
AZ Phoenix, O'Donnell Assocs. 602-944-9542
CA San Jose, O'Donnell Assocs. 408-456-2950
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Englewood, D. M. Harthun Assocs., Inc. 303-792-5050
FL Boca Raton, Kinetic Sls., Inc. 407-368-7373
ID Boise, Temco Northwest 208-345-2051
KS Wichita, Thunderbird Tech. Sls. 316-636-5018
MN St. Paul, Arkco Sls. 612-777-7454
MO Maryland Heights, Thunderbird Tech. Sls. 314-298-8940
NM Albuquerque, O'Donnell Assocs. S.W. 505-889-4522
OR Hillsboro, Temco Northwest 503-645-2030
TX Dallas, J. M. Spell 214-620-0040
WA Bothell, Temco Northwest 503-645-2030
WA Spokane, Temco Northwest 509-927-9392
Can Pickering, Ont., A. C. Simmonds & Sons, Ltd. 416-839-8041

INSTRUMENT SPECIALTIES CO., Western Div., 505 Porter Way, Placentia, CA 92670, Tel: 714-579-7100, FAX: 714-579-7105; Empl.: 25; *Sls. Mgr.:* William Oliver; *Dist. Mgr.:* Phil Strong

INSULATON COMPONENTS ASSOCIATES, INC., P.O. Box 4849, Downey, CA 90241, Tel: 213-861-7268, FAX: 213-861-7265

INSULCAST, Permagile Inds. Inc., 101 Commercial St., Plainview, NY 11803, Tel: 516-349-1100, TELEX: 221720 PERM UR, FAX: 516-349-1156; FSC No.: 13549; *Sls. Mgr.:* William P. Flaim, Natl. Sls. Mgr.

INTAQ®

FAX: 206-284-3705

INTAQ KEY PANELS, GM Nameplate, Inc., 2040 15th Ave. W., Seattle, WA 98119, Tel: 206-284-5475; FSC No.: 9905; Empl.: 350; *Sls. Mgr.:* Alan Burk ..... **B•1815**

Local Sales Offices & Reps
AZ Tempe, Elctrn. Dev./Sls. 602-438-1547
AL Huntsville, JWL Assocs. 205-883-1712
CA San Diego, Omni 619-268-9606
CA San Jose, G M California 408-435-1666
CA Irvine, Balzer-Wolf Assoc. 714-261-6877
CO Englewood, Delitron 303-741-2122
FL St. Petersburg, Gulfport & Tech. Sls. .. 813-573-3910
HI Honolulu, Menehune Unlimited 808-737-3472
ID Eagle, GM/West 208-939-7202
IL Elgin, BK/Custom Engrd. Pts. 708-741-8556
IN Zionsville, WK/Custom Engrd. Pts. 317-873-5626
MI Southfield, E&A Inds., Inc. 313-647-0330
MN Burnsville, Electromec Sls., Inc. 612-894-8200
MO St. Louis, Halpin D. Burke & Son 314-968-2727
NH Mt. Vernon, GM/Northeast 603-673-9737
NJ Pitman, Colrud Corp. 609-589-5866
NJ West Caldwell, Grimm, Siegel & Assoc. 201-575-9300
NC Charlotte, JWL Assocs. 704-541-5750
OH Akron, Augnat Assocs. 216-239-2499
OR Portland, GM-Portland 503-223-9879
PA Pittsburgh, Allied Entprs. 412-788-2992
TX Irving, EDS Southwest 214-929-8140
VA Reston, Colrud Corp. 703-904-0240
WA Seattle, GM Nameplate Seattle 206-284-2200
Can Richmond,B.C., Enerlev Sls. Ltd. 604-273-0882
Can Scarborough, Ont., Banks Elctrns. Ltd. 416-292-5152

INTEC CONTROLS CORP., 55 West St., Walpole, MA 02081, Tel: 508-660-1221, FAX: 508-660-2374; Empl.: 25; *Sls. Mgr.:* Bruce Manthey; *Dist. Mgr.:* Bruce Manthey

INTEGRATED CIRCUITS INC. (ICI), See Interpoint

INTEGRATED DEVICE TECHNOLOGY, INC., 3236 Scott Blvd., Santa Clara, CA 95054-3090, Tel: 408-727-6116, TWX: 910-338-2070, FAX: 408-492-8674; FSC No.: 61772; Empl.: 2090; *Sls. Mgr.:* Joe Zabkar (VP); *Dist. Mgr.:* Bill Franciscovich

INTEGRATED ENGINEERING SOFTWARE, 347-435 Ellice Ave., Winnipeg, Man., Canada R3B 1Y6, Tel: 204-942-5636, FAX: 204-944-8010; Empl.: 10; *Sls. Mgr.:* Bennetta Benson

INTEGRATED MICROWAVE

FAX: 619-755-8679

INTEGRATED MICROWAVE, 3422 Tripp Ct., San Diego, CA 92121-1009, Tel: 619-259-2600; FSC No.: 60656; Empl.: 75; *Sls. Mgr.:* Jeff Beard ... **A•1678-1679**

Local Sales Offices & Reps
AZ Tempe, Cain Technology 602-966-4322
CA Mountain View, Disman Bakner 415-969-3010
CA Orange, Cain Technology 714-997-7311
CA Van Nuys, Cain Technology 818-904-9392
FL Satellite Beach, BWS Microwave Mktg. 407-773-6170
MD Burtonsville, Mid-Atlantic Microwave Sales 301-725-3955
MA Chelmsford, Matrix Sales 508-459-4000
NJ Paramus, El-Tech Sales 916-463-2664
NY E. Syracuse, Em-Tech Assocs. 315-437-6410
PA Ft. Washington, Beta Sales 215-643-6650

INTEGRATED POWER DESIGNS, INC., 9c Princess Rd., Lawrenceville, NJ 08648, Tel: 609-896-2122, FAX: 609-895-1738; Empl.: 18; *Sls. Mgr.:* Steven Thompson

INTEGRATED TECHNOLOGIES SOLUTIONS INC., 402 Chestnut Lane, East Meadow, NY 11554, Tel: 516-481-0857, FAX: 516-292-3115; Empl.: 8; *Sls. Mgr.:* M. Lieber ..... **D•1267**

Local Sales Offices & Reps
CA Chino, Deltatec Intl. Inc. 714-551-8546

INTEGRITY TECHNOLOGY CORP., 1400 Coleman Ave., Ste. E15, Santa Clara, CA 95050, Tel: 408-262-8640, TELEX: 697-2396, ESYLNK: MCI Mail:209837, FAX: 408-262-1680; Empl.: 247; *Sls. Mgr.:* Larry Young

Local Sales Offices & Reps
CA Santa Clara, Integrity Techng. Co. 408-262-8640
CO Littleton, GLX, Inc. 303-771-3230
FL Clearwater, H.E. Johnson & Assocs. .. 813-447-7529
MA Agawam, Hi-Q Mktg. 413-789-4683
NY Wading River, Niktronics 516-929-4671

INTEK, INC., 751 Intek Way, Westerville, OH 43081, Tel: 614-895-0301, FAX: 614-895-0319; FSC No.: 6680; *Sls. Mgr.:* Robert Curry

INTELCO, 8 Craig Road, Acton, MA 01720, Tel: 508-264-4485, TELEX: 62923380, FAX: 508-264-9677; Empl.: 35

INTELLIGENCE POWER TECHNOLOGY, 829 Flynn Rd., Camarillo, CA 93012, Tel: 805-484-4441, FAX: 805-987-0271; Empl.: 22; *Sls. Mgr.:* K. Iwan

INTELLIGENT INSTRUMENTATION/BURR-BROWN, 1141 W. Grant Road,MS 131, Tucson, AZ 85705, Tel: 602-624-2434, FAX: 602-623-8965; *Sls. Mgr.:* Bill McGovern ..... **D•1637-1639**

INTELLIGENT INTERFACES, INC., P.O. Box 1486, Stone Mountain, GA 30086, Tel: 404-381-9891, 1-800-842-0888; FSC No.: OA4H9; Empl.: 3; *Sls. Mgr.:* Robert E. Jarvis

INTELLUTION, INC., 315 Norwood Park South, Norwood, MA 02062, Tel: 617-769-8878, TELEX: 940-103, FAX: 617-769-1990; *Sls. Mgr.:* Jeff Cassis; *Dist. Mgr.:* Jeff Cassis

INTEPRO SYSTEMS INC., Six Fortune Dr., Billerica, MA 01821, Tel: 508-663-7555, FAX: 508-663-7558; Empl.: 50; *Sls. Mgr.:* Mike O'Connor; *Dist. Mgr.:* Mike O'Connor

INTERACTION SYSTEMS INC., 86 Coolidge Ave., Watertown, MA 02172, Tel: 617-923-6001, FAX: 617-923-2112 ..... **D•1098**

INTERACTIVE CIRCUITS SYSTEMS LTD., 5430 Canotek Rd., Gloucester,Ont., Canada K1J 9G2, Tel: 613-749-9241, 1-800-267-9794, FAX: 613-749-9461; Empl.: 20

INTERACTIVE COMPUTER PRODUCTS, INC., 23482 Peralta, unit C, Laguna Hills, CA 92653, Tel: 714-770-5332; Empl.: 20; *Sls. Mgr.:* Pat Cooper

INTERCONNECT DEVICES, INC., 5101 Richland Ave., Kansas City, KS 66106, Tel: 913-342-5544, TELEX: 286767 IDIKC UR, FAX: 913-342-7043; Empl.: 150; *Sls. Mgr.:* Donna McKinney, Cathy Snead; *Dist. Mgr.:* Carol Narr

Distributor

FAX: 714-447-3976

INTERCONNECT SPECIALTIES, INC., Tel: 800-752-4777, 714-773-0411, TELEX: 910 321 0310

.....613, 620, 633, 714, 718, 724, 752, 791, 813, 816

INTERELECTRONICS CORP., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920, Tel: 914-EL8-8000; Empl.: 82; *Sls. Mgr.:* M. H. Pintell; *Dist. Mgr.:* G. Sherwood ..... **D•1797**

INTERFACE, INC., 7401 E. Butherus Dr., Scottsdale, AZ 85260, Tel: 602-948-5555, TELEX: 825-882, FAX: 602-948-1924; FSC No.: 32311; Empl.: 85; *Sls. Mgr.:* Irv Wilson

FAX: 617-986-8932

INTERFACE ENGINEERING INC., 300 Centre St., Holbrook, MA 02343, Tel: 617-986-2600, TELEX: 249-545; FSC No.: 14352; Empl.: 25; *Sls. Mgr.:* Thomas Scanlon ..... **D•1182-1183**

Local Sales Offices & Reps

NY	Great Neck, Industron Assoc.	516-487-2620
VA	Herndon, Gans & Pugh Assocs., Inc.	703-709-0305

Local Distributors

VA Arlington, Gans & Pugh Assocs, Inc.

INTERFACE PRODUCTS, INC., 4630 North Ave., Oceanside, CA 92056, Tel: 619-945-0230, FAX: 619-945-0239; FSC No.: 55300; Empl.: 75; *Sls. Mgr.:* William Lang

INTERFACE TECHNOLOGY, Dynatech Corp., 2100 E. Alosta Ave., Glendora, CA 91740, Tel: 818-914-2741, TELEX: 4945489, FAX: 818-335-8346

INTERFAN

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FAX: 415-340-1670

INTERFAN, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-1203; Empl.: 12; *Sls. Mgr.:* F. L. Nelson ..... **C•1626-1629**

Local Sales Offices & Reps

AZ	Glendale, Knight Co.	602-433-2166
CA	Anaheim, Impact Elctrns., Inc.	714-533-1351,
CA	Burbank, Darco	818-504-2425
CA	Burlingame, William J. Purdy Co.	415-347-7701
CO	Englewood, William J. Purdy Co., Assocs.	303-790-2211
FL	Lighthouse Pt., Jack Krutek & Assocs.	305-783-2501
IL	Mt. Prospect, The Dombrow Co.	708-253-3326
IN	Indianapolis, John Sukup, Inc.	317-253-5501
MD	Monkton, Imagitron Sls. Co.	301-374-5600
MI	Royal Oak, Hilltronics Inc.	313-435-0920
MN	St. Paul, Proud Inds., Inc.	612-646-9428
MO	Bridgeton, AEM, Inc.	314-298-9900
NY	Hempstead, Kahgan Brody Assocs.	516-538-2300
NY	E. Syracuse, R.M. Scanlon & Assocs.	315-463-7682
OH	Cleveland, Marlow Assocs. Inc.	216-831-8232
OR	Beaverton, Pacific Mktg. Specialists	503-641-9373
PA	Pittsburgh, Marlow Assocs. Inc.	412-343-5050
TX	Bedford, El-Tec Sls., Inc.	817-268-2896
WA	Redmond, Pacific Mktg. Specialists	206-882-3144
Can	Lachine, Que., Bytewide Mktg.	514-636-4121

INTERGRAPH CORP., Advanced Processor Division, 2400 Geng Rd., Palo Alto, CA 94303, Tel: 415-494-8800, FAX: 415-856-9224; *Sls. Mgr.:* James Pierce; *Dist. Mgr.:* James Pierce, Sls. Rep. Mgr.

INTERLOGIC INDUSTRIES, 85 Marcus Dr., Melville, NY 11747-4294, Tel: 516-420-8111, FAX: 516-420-8007; Empl.: 46; *Sls. Mgr.:* Bert Freifeld

INTERLOOP, 706 Charcot Ave., San Jose, CA 95131, Tel: 408-922-0520, FAX: 408-922-0545; Empl.: 3

INTER-MARKET, 1946 Lehigh Ave., Glenview, IL 60025, Tel: 708-729-5330, FAX: 708-729-4849; FSC No.: 34165; Empl.: 10; *Sls. Mgr.:* Phil Gardanier

INTERMATIC, Intermatic Plaza, Spring Grove, IL 60081, Tel: 815-675-2321, TELEX: 25-265, FAX: 815-675-2112; Empl.: 1000

INTERMETRICS MICROSYSTEMS SOFTWARE, INC., 733 Concord Ave., Cambridge, MA 02138, Tel: 617-661-1840, 800-356-3594, FAX: 617-661-0072; Empl.: 600ò; *Sls. Mgr.:* Burr Tupper

INTER METRO INDUSTRIES CORP., North Washington St., Wilkes-Barre, PA 18705, Tel: 717-825-2741, TELEX: 831-833, FAX: 717-823-0250

INTERNATIONAL COMPONENTS CORP., 105 Maxess Rd., Melville, NY 11747, Tel: 516-293-1500, TELEX: 221576, FAX: 516-293-4983; Empl.: 100; *Sls. Mgr.:* Ken Reed ..... **D•1037-1039**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AR	Mabelville, Erickson Sls.	501-455-0618
CA	Burbank, Darco	818-504-2425
CO	Littleton, Romulus Elctrns.	303-770-4888
FL	Tamarac, Hughes Assocs.	305-720-1674
GA	Atlanta, Hughes Assocs.	404-662-1587
IL	Arlington Heights, MJ Petersen	708-577-8200
IA	Cedar Rapids, Delltron Co.	319-393-0075
LA	Chalmette, Erickson Sls. Inc.	504-271-1976
MA	Framingham, Stone Comp. Sls.	508-875-3226
MA	Long Meadow, Stone Comp. Sls.	413-567-1019
MS	Corinth, Hughes Assocs.	601-287-2915
MO	Florissant, Delltron Co.	314-839-0033
MO	Kansas City, Delltron Co.	816-436-6445
NJ	Pennsuakem, ArJay Tech.	609-662-0285
NY	Melville, ICC	516-293-1500
NC	Charlotte, Hughes Assocs.	919-467-7029
OH	Cincinnati, Bob Gilbert Assocs.	513-574-1932
OR	Portland, Adapt E2	503-297-2151
TN	Knoxville, Hughes Assocs.	615-558-0283
TX	Dallas, Erickson Sls. Inc.	214-739-5833
WA	Bellevue, Adapt E2	206-637-0302
PR	Hato Rey, Casanova Indl. Sls. Corp.	809-753-8674

Local Distributors

CA	Canoga Park, Myco Vickers	213-340-2025
CA	Redwood City, Hi-Cor	415-365-5087
CA	San Diego, Tauber Elctrns. Corp.	619-274-7242
CA	Sunnyvale, Penstock Microwave Dist.	408-727-1200
CT	Bridgeport, Park Distr.	203-366-7200
CT	East Haven, JV Elctrns.	203-469-2321
FL	Ft. Lauderdale, Bros. Elctrns.	305-561-6700
FL	Ft. Lauderdale, National Resistor Co.	305-772-4500
GA	Norcross, Applied Power, Inc.	404-263-0421
IL	Bensenville, Voyager Elctrns. Corp.	312-860-1300
IL	Wheeling, Hawk Elctrns., Inc.	708-459-4030
IN	Indianapolis, RM Elctrns.	317-291-7110
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Chelmsford, Shelly Ragon	508-250-9666
MA	Sharon, Adcour Passive Comps.	617-784-8123
MI	Grand Rapids, R M Elctrns.	616-531-9300
MI	Southfield, R M Elctrns.	313-262-1582
MN	Eden Prarie, Cassidy Elctrns.	612-944-0100
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
MN	Minneapolis, Cassidy Elctrns.	612-835-7746
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	St. Louis, Beckwith Elctrns.	314-343-6463
NJ	Bellmaur, Mid-Atlantic Elctrns.	609-931-5303
NJ	Clifton, Vantage Comps.	201-667-1840
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	Sparta, Instruments & Equip.	201-729-4293
NY	Commack, Vantage Comps. Corp.	516-543-2000
PA	Philadelphia, MurTronics	215-632-4330
TN	Hixson, Techni-Tronics	615-842-0514
TX	Dallas, Wholesale Elctrns.	214-969-9400
TX	Fort Worth, Allied Elctrns.	817-336-7414
TX	Ft. Worth, C & W Supp. Co.	817-831-0395
WA	Seattle, Vesco	206-575-3607

INTERNATIONAL CONFIGURATIONS, INC., P. O. Box 3374, Enfield, CT 06082, Tel: 203-749-6380, TELEX: 643067, FAX: 203-749-2985; FSC No.: 62484; Empl.: 4; *Sls. Mgr.:* Ov. L. Baldwin

INTERNATIONAL CONVERTER CORP., 770-101 Wooten Road, Colorado Springs, CO 80915, Tel: 719-570-6900, FAX: 719-570-6180; Empl.: 9; *Sls. Mgr.:* Matt Breneman

INTERNATIONAL CRYSTAL MFG., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126, Tel: 504-236-3741, 1-800-426-9825, FAX: 405-235-1904,1-800-322-9426; Empl.: 120; *Sls. Mgr.:* Sheri Smith; *Dist. Mgr.:* Sheri Smith, Sls. Mgr.

INTERNATIONAL DATA AQUISTION & CONTROL, INC., Box 397, Rte. 101 The Meeting Place, Amherst, NH 03031, Tel: 603-673-0765, FAX: 603-673-0767; Empl.: 7; *Sls. Mgr.:* Gene Calvano; *Dist. Mgr.:* Gerry Klein

INTERNATIONAL DIGITAL ELECTRONICS, 160 W. Santa Clara St., Ste. 800, San Jose, CA 95113, Tel: 408-283-1010 (ext 107), FAX: 408-283-0344; Empl.: 2; *Sls. Mgr.:* Masanori Kotani

INTERNATIONAL DIODE, 229 Cleveland Ave., Harrison, NJ 07029, Tel: 201-482-6518, FAX: 201-482-4958; Empl.: 9; *Sls. Mgr.:* Lee Toong

INTERNATIONAL ELECTRO MAGNETICS, INC., 350 N. Eric Dr., Palatine, IL 60067, Tel: 708-358-4622, TELEX: 4932869 IEM UI; Empl.: 6; *Sls. Mgr.:* T. Pretto ..... **D•1036**

INTERNATIONAL EYELETS, INC., 5674 El Camino Real No. L, Carlsbad, CA 92008-9812, Tel: 619-931-1446, 1-800-333-9353, FAX: 619-931-8667; FSC No.: 5325; Empl.: 5; *Sls. Mgr.:* Sally Dalrymple

INTERNATIONAL INSTRUMENTATION, INC., 2282 Townsgate Rd., Westlake Vlg., CA 91361, Tel: 805-495-7673, FAX: 805-379-0701; Empl.: 32; *Dist. Mgr.:* John Mesenbring

INTERNATIONAL INSTRUMENTS, A PRIME TECHNOLOGY COMPANY, Twin Lakes Rd, P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; Empl.: 150; *Dist. Mgr.:* Keith MacDowall ..... **D•1350-1351**

Local Sales Offices & Reps

CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	N. Branford, II Consult Factory	203-481-5721
FL	Lakeland, Munday Sls., Co.	813-858-5606
KS	Olathe, Tech. Sls. Assoc.	913-829-2800
MO	Ferguson, Tech. Sls. Assocs.	314-725-5361
OH	Westlake, Advanced Tech. Assocs.	216-835-5050
PA	Malvern, Stitzer Assocs.	215-644-5500

Local Distributors

CA	Los Angeles, E.I.L. Instrs., Inc.	213-685-7020
CA	Palo Alto, Metermaster	415-960-8500
CA	San Diego, Metermaster	619-560-4841
CA	Sunnyvale, E.I.L. Instrs.	408-245-4320
CO	Denver, E.I.L. Instrs., Inc.	303-534-4160
CO	Denver, Metermaster Instr. Corp.	303-722-5766
CT	Middletown, E.I.L. Instrs., Inc.	203-346-6646
FL	Palm Bay, E.I.L. Instrs., Inc.	407-725-8300
GA	Kennesaw, CMI Metermaster	404-425-8902
IL	Bridgeview, E.I.L. Instrs., Inc.	312-430-2292
IL	Glendale Heights, CMI Metermaster	312-351-4554
IN	Indianapolis, E.I.L. Instrs., Inc.	317-545-1373
KY	Louisville, E.I.L. Instrs., Inc.	502-454-3420
LA	New Orleans, Industrial Instr. Works	504-733-8355
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	Southbridge, CMI-Metermaster	508-765-1676
MI	Ferndale, Ram Meter Inc.	313-398-6767
MN	Minneapolis, Process Meas. Co.	612-544-4035
NJ	Pensauken, E.I.L. Instrs., Inc.	609-488-0474
NY	Clarence, E.I.L. Instrs.	716-634-8500
NY	Hauppauge, E.I.L. Instrs., Inc.	516-231-6333
NY	Long Island City, Metermod Instr. Corp.	718-726-4850

NY Rochester, E.I.L. Instrs. 716-586-8251
NC Charlotte, E.I.L. Instrs. 704-376-2237
OH Cleveland, Process Measurement Corp. 216-587-3600
OH Dayton, E.I.L. Instrs., Inc. 513-435-2134
PA Pittsburgh, E.I.L. Instrs. 412-823-2255
TX Dallas, E.I.L. Instrs., Inc. 214-357-0297
TX Garland, CMI Metermaster 214-271-5671
TX Houston, CMI Metermaster 713-644-1631
TX Houston, E.I.L. Instrs., Inc. 713-271-3100
VA Norfolk, E.I.L. Instrs., Inc. 804-855-9553
VA Springfield, E.I.L. Instrs., Inc. 703-569-2611
WA Redmond, E.I.L. Instrs., Inc. 206-882-3222
Can Longueuil, Que., E.I.L. Instrs. 514-651-4844
Can Mississauga, Toronto, E.I.L. Instrs. 416-624-6660
Can Toronto, Ont., Versatile Measuring Instrs. 416-239-8161
AZ Tempe, CMI Metermaster 603-431-0880

INTERNATIONAL LIGHT, 17 Graf Rd., Newburyport, MA 01950-4092, Tel: 508-465-5923, TELEX: 94-7135, FAX: 508-462-0759; Empl.: 19; *Sls. Mgr.:* Bob Angelo; *Dist. Mgr.:* Bob Angelo

INTERNATIONAL MACHINE & TOOL CORP., 115 Maple St., Warwick, RI 02888, Tel: 401-467-6905, FAX: 401-467-5885; Empl.: 35; *Sls. Mgr.:* Peter S. Piscopio

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Local Sales Offices & Reps
MA Attleboro, Antex-Overseas Sls. 617-222-5221
PA Downingtown, Grasso Tech. Sls. 215-458-8967

INTERNATIONAL MICROELECTRONICS, P.O. Box 170415, Arlington, TX 76003, Tel: 817-561-2244, FAX: 817-561-5824

INTERNATIONAL MICROSYSTEMS, 521 Valley Way, Milpitas, CA 95035, Tel: 408-942-1001, FAX: 408-942-1051; Empl.: 10; *Sls. Mgr.:* Peter Schade

INTERNATIONAL MICROTRONICS, 4016 E. Tennessee St., Tucson, AZ 85714, Tel: 602-748-7900, FAX: 602-790-2808; Empl.: 16; *Sls. Mgr.:* Otto H. Fest, Jr. ..... **D•1352-1357**

Local Distributors
CA Santa Ana, Tech-Ser, Inc. 408-496-1004
CA Torrance, Tech-Ser, Inc. 213-370-7200
CO Aurora, R&R Instrmn. 303-340-8728
IL Chicago, Data Elctrns. 312-283-0300
MA Waltham, Calibron/Burton Instr. 617-894-6440
MO Manchester, Universal Precision Instr. 314-394-4693
NY Rochester, Masline Elctrns. 716-546-5373
OR Portland, Hydraulic Instrmn. Svcs. 503-643-5648
TX Dallas, Textrol Inc. 214-637-6262
WA Redmond, Hydraulic Instrmn. Svcs. 206-867-5437

INTERNATIONAL POLARIZER, INC., 320 Elm Street, Marlborough, MA 01752, Tel: 508-481-7495, TELEX: 601 6454, FAX: 508-481-0222; Empl.: 8; *Sls. Mgr.:* Donald Rickert

INTERNATIONAL POWER DC POWER SUPPLIES, INC., 355 N. Lantana, Ste. 710, Camarillo, CA 93010, Tel: 805-987-7900, FAX: 805-388-2686; Empl.: 25; *Sls. Mgr.:* Jose M. Covarrubias; *Dist. Mgr.:* Jose M. Covarrubias ..... **D•1779-1781**

Local Sales Offices & Reps
AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA El Cajon, Atronix/Marble 619-444-1501
CA Gilroy, Mouser Elctrns. 800-346-6873
CA Mission Viejo, Atronix/Marble 714-858-9009
CA San Diego, Zerimar Sales 619-436-3379
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
CA So. CA, Elkins & Assocs. 818-597-1075
CA Solvang, Atronix/Marble 805-686-4366
FL Land O Lakes, A.J. Power Source 813-996-2583
GA Atlanta, AJ's Power Source 404-441-7927
IL Wheeling, Ed Joyner & Co. 708-520-1200
IN Evansville, Evansville Supply 812-424-7541
IA Cedar Rapids, Advanced Tech. Sls. 319-393-8280
KS Olathe, Advanced Tech. Sls. 913-782-8702
ME Portland, The MacInnis Co. 800-544-1014
MD Randallstown, Beacon North, Inc. 703-478-2480
MA Boston, The MacInnis Co. 617-762-8090
MI Livonia, Electro-Mktg. 313-421-7590
MI Muskegon, Electro-Mktg. 616-798-1912
MN Minneapolis, Clay Rep Co. 612-861-2191
MO Bridgeton, Advanced Tech. Sls. 314-291-5003
MO St. Louis, Advanced Tech. Sls. 314-878-2921
NV Las Vegas, Sandy's Elctrn. Supp. 702-383-8353
NH Manchester, The MacInnis Co. 800-544-1014
NH Windham, The MacInnis Co. 800-544-1014
NJ E. Rutherford, A-A Elec., Inc. 201-777-5477
NJ Ft. Lee, Neptune Elctrns. Co. 201-461-2789
NJ Randolph, Mouser Elctrns. 800-346-6873
NM Mouser Elctrns. 800-346-6873
NY E. Syracuse, Advanced Comps. Corp. 315-437-6700
NY Glen Head, Livera-Polk Assocs. 516-759-9300
NY Penn Yan, Advacom Technlg., Inc. 315-536-2221
NY Plainview, Neptune Elctrns. Co. 516-349-1600
NY Troy, Trojan Elctrn. Supp. 518-274-4481
NC Raleigh, Overton Assocs. 919-781-7004
OH Cleveland, Major Elctrns. Corp. 216-461-2100
OH Dayton, Electro-Mktg. 513-890-8322
OH N. Royalton, Electro-Mktg. 216-582-0075
OK AID Elctrns., Inc. 800-669-4761
OK Oklahoma City, RSC Elctrns. 405-631-7729
OR Clackamas, Platt Elec. Supp. 503-655-3504
OR Hillsboro, Turn-A-Round Sls. 503-640-4641
OR Medford, Platt Elec. Supp. 503-772-1414
OR Portland, 04 Controls 503-659-7891
OR Portland Metro, Platt Elec. Supp. 503-224-1919
OR Tualatin, Platt Elec. Supp. 503-684-2087
PA McKean, Advacom, Inc. 814-476-7774
PA N. Versailles, CMD Elctrns. 412-678-6020
PA Pittsburgh, Electro-Mktg. 412-823-5400
RI Mouser Elctrns. 800-346-6873
RI Providence, The MacInnis Co. 800-544-1014
SC Mouser Elctrns. 800-346-6873
SC Seneca, Overton Assocs. 803-638-7101
SD Mouser Elctrns. 800-346-6873
TN Mouser Elctrns. 800-346-6873
TN New Tazewell, Overton Assocs. 615-626-6009
TX Austin, AID Elctrns., Inc. 800-669-4761
TX Austin, RSC Elctrns. 512-834-1415
TX Austin, Wofford Elctrns. 512-339-1131
TX Dallas, Wofford Elctrns. 214-320-0294
TX Houston, AID Elctrns., Inc. 800-669-4761
TX Houston, Wofford Elctrns. 713-847-3583
TX Irving, AID Elctrns., Inc. 800-669-4761
TX Mansfield, Mouser Elctrns. 800-346-6873
TX Richardson, RSC Elctrns. 214-644-3444
UT Ogden, Taylor Mktg. 801-546-9570
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VT Mouser Elctrns. 800-346-6873
VT Burlington, The MacInnis Co. 800-544-1014
VA Sterling, Beacon North, Inc. 703-478-2480
VA Sterling, ICE Comps. 703-478-2677
WA Longview, Platt Elec. Supp. 206-423-4800
WA Seattle, H.D. Campbell 206-433-1900
WA Seattle, PLatt Elec. Supp. 206-624-4083
WA Vancouver, Platt Elec. Supp. 206-699-4833
WV Mouser Elctrns. 800-346-6873
WI Cedarburg, A-A Elec., Inc. 414-377-8000
WI Green Bay, A-A Elec., Inc. 414-499-6000
WI N. Wisconsin, Clay Rep Co. 612-861-2191
WI S. Wisconsin, Ed Joyner and Co. 708-520-1200
WY Mouser Elctrns. 800-346-6873
Can Surrey, B.C., Enerlec Sls. 604-273-0882
Can Surrey, B.C., Enerlec Sls., Ltd. 604-888-1667

Local Distributors
CA Canoga Pk., Sandy's Elctrn. Supp. 818-346-0510
CA Costa Mesa, Marvac Dow Elctrns. 714-650-2001
CA Fullerton, Orvac Elctrns. 714-871-1020
CA Gilroy, Mouser Elctrns. 800-346-6873
CA Long Beach, Mag-Trol 213-435-3451
CA N. Hollywood, Sandy's Elctrn. Supp. 818-765-8585
CA Pasadena, Marvac Dow Elctrns. 818-793-1195
CA San Jose, Sierra West 408-945-1050
CA San Jose, Spectra Elctrns. 408-452-1590
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CA Santee, Mouser Elctrns. 800-346-6873
CA Simi Valley, Pace Elctrns., Inc. 805-522-7394
CA Thousand Oaks, Pace Elctrns. 805-497-7515
CA Vista, Pacific Phoinix, Inc. 619-598-3955
CO Mouser Elctrns. 800-346-6873
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
DE Mouser Elctrns. 800-346-6873
FL Lakeland, A-A Electric, Inc. 813-665-6941
FL Oldsmar, Applied Power, Inc. 813-854-4004
GA Atlanta, A-A Electric, Inc. 404-449-8670
GA Norcross, A-A Elec., Inc. 404-449-8670
GA Norcross, Applied Power, Inc. 404-263-0421
HI Mouser Elctrns. 800-346-6873
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ID Boise, Platt Elec. Supp. 208-376-5643
ID Idaho Falls, Platt Elec. Supp. 208-524-6171
ID Pocatello, Platt Elec. Supp. 208-233-2002
ID Twin Falls, Platt Elec. Supp. 208-734-5413
IL Champaign, Klaus Radio 217-356-1896
IL Geneva, Melvin Elctrns. 708-232-7300
IL Mt. Prospect, Feed Control 708-253-3898
IL Peoria, Klaus Radio 309-691-4840
IN Evansville, Evansville Supp. Co. 812-424-7541
IA Mouser Elctrns. 800-346-6873
KS Olathe, Tradewise 913-782-8702
KS Wichita, RSC Elctrns. 316-267-5213
KY Mouser Elctrns. 800-346-6873
LA Mouser Elctrns. 800-346-6873
ME Mouser Elctrns. 800-346-6873
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MA Wilmington, North Star Elctrns. 508-657-5155
MI Brighton, Applied Power, Inc. 313-227-3604
MN Eden Praire, Braas Co. 612-937-8902
MN N. St. Paul, Edison Controls 612-770-5122
MS Mouser Elctrns. 800-346-6873
MO Kansas City, Richland Automation 816-241-2000
MT Mouser Elctrns. 800-346-6873
NE Omaha, Automation Elec. 402-331-2255
NV Elko, Platt Elec. Supp. 702-753-7553
NV Las Vegas, Sandy's Elctrn. Supp. 702-383-8353
NH Manchester, Cronin Elctrns., Inc. 603-624-0105
NH Windham, Orion Inds., Inc. 603-437-4446
NJ E. Rutherford, A-A Electric, Inc. 201-777-5477
NJ Randolph, Mouser Elctrns. 800-346-6873
NY Canandaigua, Advacom Technlgy., Inc. 716-396-9050
NY Glen Head, Livera Polk Assocs. 516-759-9300
NY Penn Yan, Advacom Technlg., Inc. 315-536-2221
NY Troy, Trojan Elctrn. Supp. 518-274-4481
NC Mouser Elctrns. 800-346-6873
ND Mouser Elctrns. 800-346-6873
OH Cleveland, Major Elctrns. Corp. 216-461-2100
OR Beaverton, Platt Elec. Supp. 503-641-6121
OR Clackamas, Platt Elec. Supp. 503-655-3504
OR Eugene, Platt Elec. Supp. 503-485-7528
OR Medford, Platt Elec. Supp. 503-772-1414
OR Portland, 04 Controls 503-659-7891
OR Portland Metro, Platt Elec. Supp. 503-224-1919
OR Salem, Platt Elec. Supp. 503-581-7012
OR Tualatin, Platt Elec. Supp. 503-684-2087
PA McKean, Advacom, Inc. 814-476-7774
PA N. Versailles, CMD Elctrns. 412-678-6020
TX Mansfield, Mouser Elctrns. 800-346-6873
UT Salt Lake City, Platt Elec. Supp. 801-974-5733
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VA Sterling, ICE Comps., Inc. 703-478-2677
WA Bellevue, Platt Elec. Supp. 206-885-4124
WA Longview, Platt Elec. Supp. 206-423-4800
WA Seattle, H.D. Campbell 206-433-1900
WA Seattle, Platt Elec. Supp. 206-624-4083
WA Vancouver, Platt Elec. Supp. 206-699-4833
WA Yakima, Platt Elec. Supp. 509-452-6444
WI Cedarburg, A-A Electric, Inc. 414-377-8000
WI Green Bay, A-A Electric, Inc. 414-499-6000

IPD

FAX: 617-782-7416

INTERNATIONAL POWER DEVICES INC., 155 N. Beacon St., Brighton, MA 02135, Tel: 617-782-3331; Empl.: 96; *Sls. Mgr.:* Aileen Liu, G/M; *Dist. Mgr.:* Russell Mitnik ..... **D•1799-1805**

Local Sales Offices & Reps
AL Huntsville, Macro Mktg. 205-883-9630
AZ Chandler, ELEC-COM 602-893-2930
CA Los Angeles, Power Partners 213-215-0800
CA San Diego, Power Partners 619-560-0099
CA San Ramon, Tech. Conslts. 415-830-0829
CA Santa Barbara, Power Partners 805-966-3309
CO Franktown, MRC 303-660-8750
CO Littleton, MRC 303-794-4684
FL Maitland, Hawkins Fredrickson Assocs. 407-831-2474
FL Pompano Beach, Hawkins Frederickson Assoc. 305-979-0330
FL Tampa, Hawkins Frederickson Assoc. 813-651-1063
GA Norcross, Macro Mktg. 404-662-5580
IL Chicago, M. Gottlieb Assocs. 312-775-8620
IA Cedar Rapids, Lorenz Sls. 319-377-4666
MA Arlington, Interstate Sls. Assoc. 617-646-3914
MA Bolton, Future Electronics, Corp. 508-366-2400
MA Chelmsford, Interstate Sls. Assoc. 508-256-2287
MI Ann Arbor, Augnat Assocs. 313-668-3134
MN Minneapolis, Robert W. Marshall Corp. 612-929-0457

MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
NJ Glen Gardner, Daner-Hayes 800-225-8760
NJ Haddonfield, Sunday O'Brien 609-429-4013
NY Massapequa, Daner-Hayes 800-225-8760
NY Rochester, Indl. Tech. Sls. 716-872-1628
NY Smithtown, T & K Sls. 516-724-3456
NC Raleigh, C-Tech Sls. 919-782-8100
OH Akron, Augnat Assocs. 216-273-1211
OH Dayton, Augnat Assocs. 513-298-1507
OR Beaverton, Future Elctrns., Corp. 503-645-9545
OR Beaverton, Pacific Mktg. Specialists Inc. 503-641-9373
TX Dallas, Seaton Corp. 214-980-9860
TX Houston, Seaton Corp. 713-731-2649
VA Richmond, Glasscock Assocs. 804-798-2125
Can Kanata, Ont., Canadian Mktg. Techlgs. 613-591-9555
Can Mississauga, Ont., Canadian Mktg. Technlgs. 416-612-0900
Can Pointe Claire, Que., Canadian Mktg. Technlgs. 514-694-6088

Local Distributors

AL Huntsville, Future Elctrns., Corp. 205-830-2322
AZ Phoenix, Bell Inds. 602-966-7800
AZ Phoenix, Future Elctrns., Corp. 602-968-7140
CA Agoura Hills, Bell Industries 818-879-6501
CA Anaheim, Computech Elctrns. 714-939-9113
CA Chatsworth, Future Elctrns., Corp. 818-772-6240
CA Huntsville, Future Elctrns. 205-830-2322
CA Irvine, Future Elctrns., Corp. 714-250-4141
CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, Computech Elctrns. 408-945-9100
CA Sacramento, Bell Inds. 916-652-0414
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Future Elctrns., Corp. 619-278-5020
CA San Jose, Future Elctrns., Corp. 408-434-1122
CA Sunnyvale, Bell Inds. 408-734-8570
CO Denver, Bell Inds. 303-424-1985
CO Denver, Future Elctrns., Corp. 303-421-0123
CT Bethel, Future Elctrns., Corp. 203-743-9594
FL Altamonte Springs, Bell Inds. 407-339-0078
FL Altamonte Springs, Future Elctrns., Corp. 407-767-8414
FL Clearwater, Future Elctrncs. 813-530-1222
FL Clearwater, Future Elctrns., Corp. 813-530-1222
FL Oldsmar, Applied Power 813-854-4004
GA Atlanta, Future Elctrns., Corp. 404-441-7676
GA Norcross, Applied Power, Inc. 404-263-0421
GA Norcross, Bell Inds. 404-662-0923
IL Chicago, Future Electronics 708-882-1255
IL Elk Grove Village, Bell Inds. 708-640-1910
IN Fort Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Bell Inds. 317-875-8200
IA Cedar Rapids, Bell Inds. 319-365-4877
MD Columbia, Future Elctrns., Corp. 301-290-0600
MD Gaithersburg, Axis Elctrns. 301-840-9640
MD Jessup, Bell Inds. 301-953-2566
MA Andover, Bell Inds. 508-474-8880
MA Bolton, Future Electronics 508-779-3000
MI Brighton, Applied Power, Inc. 313-227-3604
MI Detroit, Future Elctrns., Corp. 313-261-5270
MI Livonia, L.W.C. Distributors 313-464-7700
MI Wixom, Bell Inds. 313-347-6633
MN Eden Prairie, Future Elctrns., Corp. 612-944-2200
MO St. Louis, Future Elctrns., Corp. 314-469-6805
NH Londonderry, Orion Inds. 603-437-3260
NJ Fairfield, Future Elctrns., Corp. 201-227-4346
NJ Lodi, TRC Elctrns. 201-779-8282
NM Albuquerque, Bell Inds. 505-292-2700
NY Long Island, Future Elctrns., Corp. 516-234-4000
NY Rochester, Future Elctrns., Corp. 716-272-1120
NY Syracuse, Future Elctrns., Corp. 315-451-2371
NC Charlotte, Future Elctrns., Corp. 704-529-5500
NC Raleigh, Future Elctrns., Corp. 919-790-7111
OH Dayton, Bell Inds. 513-435-8660
OR Beaverton, Future Elctrns., Corp. 503-645-9454
OR Lake Oswego, Bell Inds. 503-635-6500
PA Allentown, TRC Elctrns. 215-391-8977
PA Philadelphia, Future Elctrns., Corp. 609-778-7600
TX Dallas, Bell Inds. 214-690-0466
TX Dallas, Future Elctrns., Corp. 214-437-2437
TX Dallas, Seaton Elctrns. 214-980-9860
TX Houston, Future Elctrns., Corp. 713-556-8696
TX Houston, Seaton Elctrns. 713-731-2649
UT Midvale, Bell Inds. 801-255-9611
UT Salt Lake City, Future Elctrns., Corp. 801-972-8489
WA Redmond, Future Elctrns., Corp. 206-881-8199
WI Waukesha, Bell Inds. 414-547-8879
WI Waukesha, Future Elctrns., Corp. 414-786-1884
Can Calgary, Alb., Future Elctrns., Corp. 403-250-5550
Can Edmonton, Alb., Future Elctrns., Corp. 403-438-2858
Can Mississauga, Future Electronics 416-612-9200
Can Montreal, Que., Future Elctrns. Corp. 514-694-7710
Can Ottawa, Ont., Future Elctrns., Corp. 613-820-8313
Can Quebec City, Que., Future Elctrns., Corp. 418-682-8092
Can Vancouver, B.C., Future Elctrns., Corp. 604-294-1166
OR Beaverton, Future Elctrns., Corp. 503-645-9545

INTERNATIONAL POWER MACHINES, 2975 Miller Park North, Garland, TX 75042, Tel: 800-527-1208, TELEX: 163592 IPM POWER DAL, FAX: 214-494-2690; *Sls. Mgr.:* Barry Papermaster, VP Mktg. & Sls.

International Power Sources, Inc.

FAX: 508-879-8669

INTERNATIONAL POWER SOURCES, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7434 ..... **D•1807-1809**

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
AZ Scottsdale, Power Up Elctrns. 602-955-1105
CA Laguna Hills, Electro Venture South 714-581-9244
CA Los Altos Hills, H B Mktg. 415-941-4080
FL Palm Beach Gardens, Graham Assocs., Inc. 407-622-4049
IL Arlington Hgts., Phoenix Elctrn. Sls. 708-394-4422
KS Olathe, Tech. Sls. Assocs. 913-829-2800
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MA Franklin, OEM Mktg. & Sls. 508-528-4983
MN Edina, Engineering Prods. Assoc., Inc. 612-835-9022
MO St. Louis, Tech. Sls. Assocs. 314-521-2044
NH Salem, OEM Mktg. & Sls. 603-893-0009
NY Jericho, J-Square Mktg. 516-935-3200
NC Winston-Salem, Murcota 919-722-9445
OH Cincinnati, KCH Co. 513-931-1686
PA Montgomeryville, Eastern Sci. Mktg. 215-368-4570
TX Richardson, Jim D. Gray & Assocs. 214-699-9976
UT Ogden, Taylor Mktg. 801-456-9570
WI Brookfield, McMahon Sls., Inc. 414-782-3335

Local Distributors

CA Redwood City, HdB Elctrns. 415-368-1388
GA Norcross, Applied Power, Inc. 404-263-0421
MI Brighton, Applied Power, Inc. 313-227-3604
NH Londonderry, Orion Inds., Inc. 603-437-4446
TX Stafford, Southwest Elctrns. 713-240-4000

International IOR Rectifier

FAX: 213-772-9028

INTERNATIONAL RECTIFIER CORP., 233 Kansas St., El Segundo, CA 90245, Tel: 213-772-2000; Empl.: 2400; *Sls. Mgr.:* Don Prescott; *Dist. Mgr.:* Shawn Fogarty ..... **B•1507**

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Phoenix, Sun State Tech. Sls. 602-220-0595
CA Chatsworth, First Rep 818-718-6155
CA Mtn. View, Brooks Tech. Grp. 415-960-3880
CA San Diego, Harvey King, Inc. 619-587-9300
CA Tarzana, Power Comp. Sls. 818-881-9111
CO Englewood, Thorson Rocky Mountain, Inc. 303-799-3435
CT Fairfield, N.R.G. Ltd., Inc. 203-384-1112
FL Altamonte Springs, Lawrence Assocs., Inc. 407-339-3855
FL Kissimmee, Intl. Rectifier 407-933-2383
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
IL Palatine, International Rectifier 312-397-0002
IL Rolling Meadows, Phase II Mktg., Inc. 708-806-1330
KY Carmel, Tech. Mktg. Corp. 317-844-8462
IN Ft. Wayne, Tech. Mktg. Corp. 219-432-5553
IA Cedar Rapids, Hitec Central, Inc. 319-396-3228
KY Louisville, Technlg. Mktg. Corp. 502-893-1377
MO Independence, Hitec Central, Inc. 816-796-6684
MA Burlington, AD/Nova Sls., Inc. 617-270-9600
MI Farmington Hills, Luebbe Sls. 313-489-8828
MN Edina, Mel Foster Tech. Sls. 612-941-9790
MO Bridgeton, Hitec Central, Inc. 314-291-5920
NJ Pallisades Park, International Rectifier 201-943-4554
NJ W. Caldwell, Tech. Mktg. Grp. 201-226-3300
NM Albuquerque, Reptronix Ltd. 505-292-1718
NY E. Syracuse, Nycorn, Inc. 315-437-8343
NY Fishkill, Intl. Rectifier 914-896-4262
NY Melville, Tech. Mktg. Grp. 516-351-8833
NC Cary, Montgomery Mktg., Inc. 919-467-6319
NC Greensboro, Intl. Rectifier 919-299-4762
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Dayton, Luebbe Sls. Co. 513-294-0426
OH Northfield, Intl. Rectifier 216-467-0852
OH Westlake, Luebbe Sls. Co. 216-899-0071
OR Beaverton, Electra Tech. Sls., Inc. 503-643-5074
PA Broomal, L. D. Lowery, Inc. 215-356-5300
PA Pittsburgh, Luebbe Sls. Co. 412-364-0490
TX Austin, BP Sls. 512-346-9186
TX Houston, BP Sls. 713-782-4144
TX Richardson, BP Sls. 214-234-8438
UT Salt Lake City, Thorson Rocky Mtn., Inc. 801-973-7679
WA Kirkland, Electra Tech. Sls., Inc. 206-821-7442
WI Brookfield, International Rectifier 414-784-2480
WI Wauwatosa, Phase II Mktg., Inc. 414-771-9986

INTERNATIONAL RESISTIVE COMPANY, P.O. Box 1860, Boone, NC 28607, Tel: 704-264-8861, TELEX: 46-9902, FAX: 704-264-8865; Empl.: 1700; *Dist. Mgr.:* Larry J. Johnston

INTERNATIONAL RESOURCE SVCS., 7792 N.W. 72nd Ave., Miami, FL 33166, Tel: 305-884-2924, FAX: 305-885-3127; Empl.: 5; *Sls. Mgr.:* Richard L. Winn



FAX: 402-694-6180

INTERNATIONAL SENSOR SYSTEMS, INC., Aurora Industrial Pk., Box 345, Aurora, NE 68818, Tel: 402-694-6111; Empl.: 45; *Sls. Mgr.:* Wayne Roblee ..... **A•1730-1731**

Local Sales Offices & Reps

CA Mission Viejo, EAB Assocs. Inc 714-859-7701
MD Baldwin, Quarterback Sls. Inc. 301-764-9400
MA Scituate, Olsen Tech Sls. Inc. 617-545-5101
MN Minneapolis, Stoss Assocs., Inc. 612-925-2757
MO Jefferson City, Williams Assocs. Co. 314-893-2459
NE Omaha, IONEB 402-895-4431
NJ Collingswood, Resource Partnerships, Inc. 609-869-3170
NY Liverpool, Syronics, Inc. 315-451-0968
NC Raleigh, Raycom, Inc. 912-266-9827
OH Cincinnati, Applied Data Mgt. 513-579-8108
TN McMinnville, B & D Mktg. 615-473-7155
WA Bothell, Evergreen Mktg. Grp. 206-485-8063

INTERNATIONAL SENSOR TECHNOLOGY, 17771 Fitch St., Irvine, CA 92714, Tel: 714-863-9999, FAX: 714-474-7417; *Sls. Mgr.:* Jack McCann

INTERNATIONAL TECHNOLOGIES, INC., 68 Albany Rd., Warwick, RI 02888, Tel: 401-781-5595, FAX: 401-467-5885; Empl.: 15; *Sls. Mgr.:* R.W. Elsdoerfer

INTERNATIONAL TELECOMMUNICATIONS COMPONENTS, INC., 94 B East Jefryn Blvd., Deer Park, NY 11729, Tel: 516-243-1444, FAX: 516-595-9160; FSC No.: 0E6J8; Empl.: 15; *Sls. Mgr.:* Rick Walter

INTERNATIONAL TRANSDUCER CORP., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111, Tel: 805-683-2575, TELEX: 658 495, FAX: 805-967-8199; FSC No.: ID 532; Empl.: 65; *Sls. Mgr.:* Christine M. Bashforth

INTEROPTICS

FAX: 415-340-1670

INTEROPTICS, Purdy Group, 770 Airport Blvd, Burlingame, CA 94010, Tel: 415-347-7727, TELEX: 677-1439 (PURDY UW); Empl.: 35 ..... **B•1217**

Local Sales Offices & Reps

AZ Mesa, McDonald-Kerr Tech. Assoc. 602-833-7734
CA Poway, William Steffens Assoc. 619-487-1115
CA Sunnyvale, Pass Assocs. 408-735-9040
FL Boca Raton, Beacon Elctrns. 407-997-5740
FL Clearwater, Beacon Elctrns 813-796-2378

FL Longwood, Beacon Elctrns. 407-332-1940
MA Mendon, DMA Mktg. 508-473-9456
MN Edina, Dytec Instrs., Inc. 612-831-7169
NJ Passaic, Lightcomm Sls. Assocs. 201-778-6540
NY New York, Lightcomm Sls. Assocs. ... 212-254-3211
NC Fayetteville, Zim-Tek 919-488-4101
OH Cleveland, Marlow Assocs. 216-831-8232
TX Dallas, Allied Comps., Inc. 214-238-0408
OR Beaverton, Pacific Mktg. Specialists ... 503-641-9373
TX Austin, Allied Comps., Inc. 512-331-4494
TX Hurst, Allied Comps., Inc. 817-589-0456
VA Richmond, EME IV, Inc. 804-360-5049
VA Williamsburg, EME IV, Inc. 804-253-0171
WA Redmond, Pacific Mktg. Specialists ... 206-882-3144

interpoint

FAX: 206-882-1990

INTERPOINT CORPORATION, 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98073-9705, Tel: 206-882-3100; FSC No.: 50821; Empl.: 450; *Sls. Mgr.:* D.T. Baughman, VP of Sls. .... **A•1732-1733; D•1810-1820**

Local Sales Offices & Reps

AL Huntsville, Novus Grp. 205-534-0044
AZ Tempe, Gassner & Clark 602-968-9037
TX Irving, Kite Elctrn. Sls. 214-986-0321
CA San Diego, Varigon San Diego 619-576-0100
CA Woodland Hills, Varigon Inc. 818-594-5080
CO Parker, Tech. Mktg. Assocs. 303-841-3435
FL Lighthouse Point, Krutek & Assocs. ... 305-783-2501
GA Norcross, Novus Grp. 404-263-0320
IN Ft. Wayne, Corrao Marsh Inc. 219-482-2725
IN Greenfield, Corrao Marsh Inc. 317-462-6568
CA Mountain View, Weseloh-Swanson ... 415-961-0565
FL Maitland, Jack Krutek & Assoc. 407-628-4837
MD Owings Mills, Neal Deoul Assocs. 301-363-4311
MA Wakefield, Howard C. Jappe Co. 617-245-9359
MN Minneapolis, Intertec 612-921-8443
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MD Marriotsville, Neal Deoul Assoc. 301-795-5775
NJ Flanders, K & R Engrg. Sls. 201-584-5235, 800-631-9362
NY E. Syracuse, Advanced Comps. Corp. 315-699-2671
NC Cary, Novus Grp. 919-460-7771
OH Mayfield Village, Arthur H. Baier Co. ... 216-461-6161
PA Pipersville, Yax Assocs. 215-766-2100
TX Houston, Kite Electrn. Sls. 713-738-5258
Can Calgary, Alb., Cana Rep. Grp. Inc. 403-243-5148
Can Montreal, Que., Cana Rep Grp. Inc. 514-276-4477
Can Surrey, BC, Cana Rep Grp. Inc. 604-589-8595
Can Willowdale, Ont., Cana Rep. Grp. Inc. .. 416-250-6683

Local Distributors

IA Cedar Rapids, Midwest Tech. Sls. 319-393-5115
KS Goddard, Midwest Tech. Sls. 316-794-8565
MO Earth City, Midwest Tech. Sls. 314-298-8787
UT Salt Lake City, Technology Mktg. Assoc. 801-943-5609

INTERSWITCH, Wm. J. Purdy Co., 770 Airport Blvd, Burlingame, CA 94010, Tel: 415-347-8217, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (Purdy UW); Empl.: 32; *Sls. Mgr.:* Clarence Bruce ..... **B•1817**

Local Sales Offices & Reps

CA Burlingame, Interswitch 415-347-8217
CA Burbank, Darco 818-504-2425
CA Burlingame, William J. Purdy Co. 415-347-7701
CO Englewood, William J. Purdy Co. 303-790-2211
IL Addison, Hedge Assocs., Inc. 708-543-0888
IN Indianapolis, John Sukup Inc. 317-253-5501
MA Framingham, Gallagher Assocs., Inc. .. 508-626-2346
MI Royal Oak, Hilltronics, Inc. 313-435-0920
MN Minneapolis, Hei-Lite Sls., Inc. 612-550-0506
NY Victor, Net Sls., Inc. 716-924-1844
OH Cleveland, Marlow Assocs. 216-861-8232
OH Dayton, Marlow Assocs. 513-274-9666
OR Beaverton, Pacific Mktg. 503-641-9373
PA Ambler, W.R. Hartmaier Assocs. 215-643-6691
TX Dallas, Elcom Mktg. 214-241-2166
TX Houston, Elcom Mktg. 713-350-8064
WA Redmond, Pacific Mktg. 206-882-3144
NJ Leonia, Peter E. Schmitt Co., Inc. 201-944-2806

Local Distributors

AL Huntsville, Powell Elctrns. 205-539-2731
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA Fremont, Allied Elctrns. 415-770-0590
CA San Jose, Powell Elctrns. 408-943-9020
CA Sunnyvale, Penstock 408-730-0300
CA Tustin, Allied Elctrns. 714-669-4190
CO Denver, Integrated Elctrns. 303-292-6121
FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
GA Norcross, Allied Elctrns. 404-446-8595
IL Chicago, Federal Screw Prods. 312-478-5744
IL Elgin, Allied Elctrns. 312-697-8200
MD Columbia, Powell Elctrns. 301-621-8080
MA Lynn, Land Elctrn. Co. 617-592-2220
MA Westborough, Powell Elctrns. 617-366-6100
MA Wilmington, Allied Elctrns. 617-942-0150
MN Minneapolis, Bergquist 612-835-2322
NJ Englewood, Powell Elctrns. 201-894-0800
NJ Mt. Laurel, Allied Elctrns. 609-234-7769
NY Buffalo, Summit Distrs. 716-887-2800
NY Rochester, Allied Elctrns. 716-244-9440
NY Rochester, Summit Elctrns. 716-334-8110
NC Raleigh, Allied Elctrns. 919-876-5845
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, Allied Elctrns. 412-367-4124
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Irving, Powell 214-550-0547
UT Salt Lake City, Standard Supp. Co. 801-486-3371
WA Seattle, Allied Elctrns. 206-547-2827
WI Milwaukee, Taylor Elec. Co. 414-241-4321
Can Don Mills, Ont., Saynor Varah 416-445-0723

INTER-TECHNICAL GROUP INC., WIMA Div., 2269 Saw Mill River Rd., Ste. 400, P.O. Box 217, Elmsford, NY 10523, Tel: 914-347-2474, FAX: 914-347-7230; Empl.: 17; *Sls. Mgr.:* Gary M. Fey; *Dist. Mgr.:* Andrew E. Dvorscak ..... **A•1071-1073**

Local Sales Offices & Reps

AL Huntsville, J. R. Assocs. 205-830-2130
AZ Phoenix, Saguaro Sls. 602-861-1856
CA Campbell, Shur Sls. 408-374-5577
CO Arvada, ArrowHead/CSI Sls. Corp. 303-423-5556
FL Clearwater, Electrocraft, Inc. 813-573-2277
GA Conyers, J.R. Assocs. 404-760-1815
MA Millis, Selmark Assocs., Inc. 508-376-2914
MI Detroit, Qualitron 313-534-1511
MN Minneapolis, Holmgren Assocs. 612-786-7641
NY Rochester, BKT Assocs., Inc. 716-461-9880
NY Smithtown, T & K Sls. 516-724-3456
NC Greensboro, Arthur, Harris and Assoc., Inc. 919-275-3030
OR Beaverton, Harry Levinson Co. 503-690-1312
OH Columbus, Tom Mulligan Co. 614-457-2242
TN Chattanooga, J. R. Assocs. 615-977-0711
TX Houston, Barry Sls., Inc. 713-784-5860
TX Richardson, Barry Sls, Inc. 214-234-0255
UT Midvale, Arrowhead/CSI Sls. Corp. ... 303-423-5556
VA Richmond, Glasscock Assocs. 804-740-0063
WA Seattle, Harry Levinson Co. 206-382-1300

Local Distributors

CA San Jose, Shelly-Ragon, Inc. 408-432-0600
CA Sunnyvale, Capsco Sls., Inc. 408-734-3020
CT Bridgeport, Park Distrs. Inc. 203-366-7200
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Melbourne, Pridmore Corp. 407-727-2491
CO Englewood, Indelco, Inc. 303-694-9444
IL Rosemont, Advent Elctrns., Inc. 312-297-6200
IN Indianapolis, Advent Elctrns., Inc. 317-872-4910
IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
MA Ashland, March Elctrns. 508-881-6715
MN New Brighton, Chris Elctrns. Distr. 612-631-2647
NJ East Brunswick, Brothers Elctrns., Inc. 201-238-2200
NM Albuquerque, Betatron Elctrns. 505-821-1122
NY Bohemia, March Elctrns. 516-563-6000
NY Penn Yan, Advacom Technlg., Inc. 315-536-2221
OH Englewood, Argent Inds., Inc. 513-836-8633
PA Exton, VSH Elctrns. 215-363-2250
PA North Versailles, CMD Elctrns., Inc. 412-678-6020
TX McKinney, Prime Distrbg. Co. 214-231-0170
WA Seattle, Kam Elctrns. Div. 206-382-1300

INTRA-COMPUTER, 87-46 Van Wyck Expwy., Jamacia, NY 11418, Tel: 718-297-5500, FAX: 718-297-5518; Empl.: 9; *Sls. Mgr.:* Art Yaglian

INTRONICS, INC., 150 Dan Rd., Canton, MA 02021, Tel: 617-828-4992, FAX: 617-828-5050; Empl.: 75

ION PHYSICS CO., 11 Industrial Way, Atkinson, NH 03811, Tel: 603-893-6687, FAX: 603-893-6729

IPAC GRP., 3047 Indl. Blvd., Bethel Pk., PA 15102, Tel: 412-831-9200, TWX: 510-697-3935, FAX: 412-831-9580; Empl.: 50; *Sls. Mgr.:* Joseph Gill

IPM, INC., Elnik Systems, 3 Edison Place, Fairfield, NJ 07004, Tel: 201-882-8033, FAX: 201-882-8037; Empl.: 8; *Sls. Mgr.:* Claus J. Joens

IRONICS INCORPORATED, 798 Cascadilla St., Ithaca, NY 14850, Tel: 607-277-4060, TELEX: 705-742; *Sls. Mgr.:* R. Chris Martens

IR SCIENTIFIC, Box 110, Carlisle, MA 01741, Tel: 508-667-7110; Empl.: 10

ISC CARDION ELECTRONICS, INC., Long Island Expwy., Woodbury, NY 11797, Tel: 516-921-7300, TELEX: 221683 CARD, TWX: 510-221-2179, FAX: 516-921-7330; FSC No.: 12909; Empl.: 450; *Sls. Mgr.:* F. J. Gareffa

ISC DATACOM, ISC Defense & Space, 1288 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-747-0300, FAX: 408-747-1873; FSC No.: 74444; Empl.: 35; *Sls. Mgr.:* C. Frank

ISC MAGNETICS DIV., See Aeroflex Labs., Inc., Magnetic Prods. Div.

ISKRA ELECTRONICS, INC., 155 Dupont St., Plainview, NY 11803, Tel: 516-349-0222, TELEX: 221527, FAX: 516-349-7642; *Sls. Mgr.:* Debbie Gremito ..... **A•1075, 1923, 2095**

Local Sales Offices & Reps

IL Cary, Bob Burns & Assocs. 708-516-3322
NM Albuquerque, FP Sls. 505-345-5553
IN Indianapolis, Insul Reps. 317-251-1994
LA Hammond, Design Mktg. of LA, Inc. ... 504-542-1115
AZ Tempe, F P Sls. 602-894-5303
NJ Medford, CEF Assocs. 609-953-8945
GA Alpharetta, R A Sls. 404-442-6749
NY North Port, R. P. Luce & Co. 516-754-5064
NC New Bern, R A Sls. 919-244-2672
OH Mentor, Sales Plus 216-942-7811
SC Easley, R A Sls. 803-859-1859
TN Knoxville, Insul Reps 615-691-7586
UT Salt Lake City, Sage Assoc. 801-467-5451

Local Distributors

MA Billerica, Baldwin Comps. Ctr. 508-667-6710
NJ Westwood, Seacor 201-666-5600
NY Ronkonkoma, Baldwin Comps. 516-588-5700



FAX: 516-937-3840

ISL PRODUCTS INT'L, LTD., 235 Robbins La., Ste. 270, Syosset, NY 11791-6093, Tel: 516-937-3475, TELEX: 503242; Empl.: 10; *Sls. Mgr.:* Ken Kawaller ..... **A•1734, 2042, 2237; C•1399, 1759**

Local Sales Offices & Reps

IN Indianapolis, C.C. Electro Sales 317-255-1508
MN St. Paul, Countryman Assoc. 612-645-9151

ISOCOM INC., 274 E. Hamilton Ave., Ste.E, Campbell, CA 95008, Tel: 408-370-2212, FAX: 408-370-2309; *Sls. Mgr.:* Stephen Parry; *Dist. Mgr.:* Glenda Rees

ISOLATION PRODUCTS, INC., 157 San Lazaro Ave., Sunnyvale, CA 94086, Tel: 408-730-4672; Empl.: 5

ISOREG CORP., 410 Great Rd., P.O. Box 486, Littleton, MA 01460, Tel: 508-486-9483, FAX: 508-486-3539; FSC No.: 7Y052; Empl.: 75; *Sls. Mgr.:* Paul Foss; *Dist. Mgr.:* Paul Foss



FAX: 508-676-0885

ISOTEK CORPORATION, 566 Wilbur Ave., Swansea, MA 02777, Tel: 508-673-2900; Empl.: 3; *Sls. Mgr.:* Steve Mathewson ..... **A•1925-1927**



FAX: 804-977-1849

ISOTEMP RESEARCH, INC., P.O. Box 3389, Charlottesville, VA 22903, Tel: 804-295-3101; FSC No.: 031785; Empl.: 58 ..... **A•1376-1377**

Local Sales Offices & Reps

CA	Fremont, Wm. Parks & Assocs.	415-796-0875
CA	San Diego, Qualtronics	619-695-0118
IL	Woodridge, Trend-Tronics	312-985-0626
NC	Raleigh, Godwin Assocs.	919-847-3006

ISOTRONICS, INC., Industrial Park, New Bedford, MA 02745, Tel: 508-998-2000, TWX: 710-344-1961; *Sls. Mgr.:* Jeffrey Lang

ITEK ENCODER, See BEI Motion System/ITEK Encoder Div.

ITHACO, INC., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437, Tel: 607-272-7640, TWX: 510-255-9307, FAX: 607-272-4550; Empl.: 100; *Sls. Mgr.:* E. W. Seymour

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ITT CANNON, 666 E. Dyer Road, Santa Ana, CA 92705-5684, Tel: 714-557-4700, TELEX: 75-3917, TWX: 910-997-0523; FSC No.: 71468;Multiple; Empl.: 1500; *Sls. Mgr.:* Richard Torson; *Dist. Mgr.:* Richard Torson

ITT

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ITT COMPONENTS, ITT Corporation, 5 Jenner St., Irvine, CA 92718, Tel: 714-727-3001, TELEX: 681-389, TWX: 910-595-1744; FSC No.: 61725; Empl.: 20; *Dist. Mgr.:* M. Pommier ..... **A•2096-2097; B•1508-1515**

Local Sales Offices & Reps

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CO	Englewood, Romulus Elctrns.	303-770-4888
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Pompano Bch., Bolton Assocs.	305-975-7245
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IL	Inverness, Heartland Tech. Sls.	708-358-6622
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IN	Indianapolis, M/S	317-881-0110
KS	Wichita, Thunderbird Tech. Sls.	316-684-3941
MD	Lutherville, DGR	301-583-1360
MA	Sudbury, KSA of New England	508-443-5881
MI	Brighton, Elctrn. Sources Inc.	313-227-3598
MN	Minnetonka, Neotech	612-935-7930
MO	Maryland Hgts., Thunderbird Tech. Sls.	314-298-8940
NJ	Mt. Laurel, Wyck Mktg.	609-727-1070
NM	Albuquerque, Syntech	505-266-7951
NY	Manhasset, Win Cor Elctrns.	516-627-9474
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TX	Plano, Milco Mktg.	214-578-1996
WA	Redmond, EMG	206-882-0962
WA	Vancouver, EMG	206-254-4572
WI	Brookfield, Heartland	414-792-0920

Local Distributors

AL	Huntsville, Time	205-721-1133
AL	Mobile, Control Design Supp.	205-666-6693
AZ	Tempe, Control Design Supp.	602-829-7981
AZ	Tempe, Richey Impact Elctrns.	800-421-7258
AZ	Tempe, Time	602-967-2000
AR	Maumelle, Control Design Supp.	501-851-3137
CA	Anaheim, Control Design Supp.	714-821-1516
CA	Chatsworth, Time	818-998-7200
CA	Garden Grove, Richey Impact Elctrns.	714-895-0060
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Irvine, ITT Multi Comps.	714-727-4001
CA	Oakland, Brill	415-834-5888
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CA	San Diego, Richey Impact Elctrns.	619-271-4511
CA	San Diego, Time	619-586-0129
CA	San Jose, Integrated Elctrns.	408-263-1100
CA	San Jose, ITT Multicomps.	408-279-0685
CA	San Jose, Richey Impact Elctrns.	408-432-7100
CA	Santa Monica, Master Distrs.	213-452-1229
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CA	Sunnyvale, Time	408-734-9888
CA	Torrance, Time	213-320-0880
CA	Tustin, Time	714-669-0100
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CO	Denver, Integrated Elctrns.	303-292-6121
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CO	Englewood, Time	303-721-8882
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CT	New Haven, Greene Shaw Co.	203-397-0710
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FL	Ft. Lauderdale, Time	305-484-1778
FL	Melbourne, Greene Shaw	407-951-3636
FL	Orlando, Time	407-841-6565
FL	Pompano Bch., Control Design Supp.	305-782-1311
GA	Norcross, Time	404-368-0969
GA	Stone Mountain, Control Design Supp.	404-979-3500
IL	Chicago, Leeds Electro Comps.	312-825-3800
IL	Chicago, NEP Elctrns.	708-595-8500
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
IL	Schaumberg, Time	708-303-3000
IL	Schaumburg, Control Design Supp.	708-307-8900
IN	Indianapolis, Control Design Supp.	317-788-4559
IN	Indianapolis, CSE	317-879-9119
IN	Indianapolis, Mar Elctrns.	317-633-6699
IA	Marion, Control Design Supp.	319-373-2923
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MD	Beltsville, RESCO-Washington	301-937-9100
MD	Columbia, Time	301-964-3090
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MA	Canton, Richey Impact Elctrns.	617-821-1500
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Peabody, Time	508-532-9900
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MI	Livonia, Key Elctrns.	313-489-5455
MN	Edina, Time	612-943-2433
MN	Minneapolis, Control Design Supp.	612-721-1628
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MO	Kansas City, Control Design Supp.	913-362-4248
MO	Manchester, Time	314-391-6444
MO	St. Louis, Control Design Supp.	314-426-3150
NV	Las Vegas, Kiesub Elctrns.	702-733-3888
NJ	Marlton, Time	609-596-6700
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	W. Berlin, GCI	609-768-6767
NJ	Wayne, Time	201-785-8250
NM	Albuquerque, Betatron Elctrns.	505-344-2381
NM	Albuquerque, Harrison/Intl.	505-291-9951
NY	E. Syracuse, Time	315-432-0355
NY	Hauppauge, Time	516-273-0100
NY	Rochester, Masline	716-546-5373
NC	Charlotte, Control Design Supp.	704-588-4410
NC	Raleigh, Greene-Shaw	919-954-7138
NC	Raleigh, Resco	919-781-5700
NC	Raleigh, Time	919-847-9650
OH	Cincinnati, Schuster	513-489-1400
OH	Cleveland, Schuster	216-425-8134
OH	Columbus, Time	614-794-3301
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Integrated Elctrns.	503-641-1690
OR	Portland, Time	503-684-3780
PA	Malverne, Control Design Supp.	215-296-0150
TX	Austin, Time	512-346-7346
TX	Carrollton, LCD	214-245-0600
TX	El Paso, Harrison/Intl.	915-598-3406
TX	Houston, Control Design Supp.	713-868-4018
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TX	Richardson, Time	214-644-4644
UT	Nephi, Control Design Supp.	801-623-2908
UT	W. Salt Lake, Integrated	801-298-1869
UT	W. Valley, Time	801-973-8494
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WA	Redmond, Time	206-882-1600
WA	Seattle, Radar	206-282-2511
WA	Seattle, Richey Impact Elctrns.	206-575-1910
WI	New Berlin, Control Design Supp.	414-784-1015
WI	New Berlin, NEP Elctrns.	414-785-9100

ITT CONOFLOW, ITT Fluid Technology Corp., Route 78, St. George, SC 29477, Tel: 803-563-9281, TELEX: 4945706, FAX: 803-563-2131; *Sls. Mgr.:* Thomas Floro

ITT GILFILLAN, ITT Defense Inc., 7821 Orion Ave., P.O. Box 7713, Van Nuys, CA 91409, Tel: 818-988-2600, TELEX: 651421, TWX: 910-495-1787; FSC No.: 24930; Empl.: 1250; *Sls. Mgr.:* Nick Riley, VP

ITT HIGBIE BAYLOCK, 3000 University Drive, Auburn Hills, MI 48321-7016, Tel: 313-340-3000, FAX: 313-340-3707; Empl.: 1500; *Sls. Mgr.:* R.M. Davie VP Sls.

ITT POWERSYSTEMS CORP., Box 688, Galion, OH 44833-0688, Tel: 419-468-5200, TELEX: 4972923, FAX: 419-468-3235; Empl.: 450; *Sls. Mgr.:* C. Searles; *Dist. Mgr.:* G. Ardolino

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ITW PAKTRON, Div. of Illinois Tool Works, P.O. Box 4539, 1205 McConville Rd., Lynchburg, VA 24502, Tel: 804-239-6941; FSC No.: 19396; *Sls. Mgr.:* Richard Slocum ..... **A•1076-1077**

Local Sales Offices & Reps

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FL	Cassel Berry, Dyne-A-Mark	407-831-2822
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
GA	Norcross, ACM, Inc.	404-448-7025
IL	Rolling Meadows, Weisser Assoc.	312-392-5556
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TX	Dallas, Electra Reps, Inc.	214-248-3852
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WI Hartland, Selective Sls. Inc. 414-367-1133
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FL Clearwater, Future Elctrns., Inc. 813-578-2770
FL Ft. Lauderdale, N R C Elctrns. 305-772-4500
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GA Norcross, Future Elctrns., Inc. 404-441-7676
IL Elk Grove Village, Bell Inds. 312-640-1910
IL Schaumburg, Future Elctrns. 312-882-1255
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OR Beaverton, Future Elctrns. 503-646-9454
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SC Greenville, Dixie Elctrns., Inc. 803-297-1435
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TN Knoxville, Dixie Elctrns., Inc. 615-938-4131
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TX Richardson, Future Elctrns., Inc. 214-437-2437
UT Salt Lake City, Future Elctrns. Inc. 801-972-8489
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WI Mequon, Taylor Elec. 414-241-4321
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Can Ottawa, Ont., Future Elctrns. 613-820-8313
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Can St. Foy, Que., Future Elctrns. 418-682-8092
Can Vancouver, B.C., Future Elctrns. 604-294-1166
Can Winnipeg, Manitoba, Future Elctrns. 204-786-7711

ITW Switches

FAX: 312-545-4450

ITW SWITCHES, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040, TELEX: 275226; Empl.: 500; *Dist. Mgr.:* P. Smentek ..... **B•1712-1721**

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AL Huntsville, Electro Mech 205-880-0592
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CA Los Angeles, The Knight Co. 213-670-2833
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CT Clinton, Selmark Assoc. 203-573-9088
FL Altamonte Springs, Semtronics 407-831-8233
GA Atlanta, Electro Mech. 404-447-6478
IL Downer's Cove, Golten Assoc. 708-512-0093
IA Cedar Rapids, R. F. Welch Co. 319-362-6824
KS Kansas City, BC Elctrns. 913-342-1211
MD Baltimore, MicroComp 301-644-5700
MA Millis, Selmark Assoc. 508-376-2914
MI Grand Rapids, Urban & Assoc. 616-245-0511
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MO St. Louis, BC Elctrns. 314-521-6683
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NY E. Syracuse, Fountain, Young & Co. 315-437-7733
NC Raleigh, Electro Mech 919-790-9300
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TX Dallas, Electra Reps. 214-248-3852

IVEK CORP., Fairbanks Rd., N. Springfield, VT 05150, Tel: 802-886-2238, FAX: 802-886-8274; Empl.: 15; *Sls. Mgr.:* Mark Tanny; *Dist. Mgr.:* Frank Nobile

IVO

FAX: 908-542-2938

IVO INDUSTRIES, INC., 201 Industrial Way W., Eatontown, NJ 07724, Tel: 908-542-5151, 800-932-0489; Empl.: 10; *Sls. Mgr.:* Daniel Vannote ..... **B•1091, 1722-1723, 1906-1907**

IXYS CORP., 2355 Zanker Rd., San Jose, CA 95131-1109, Tel: 408-435-1900, TELEX: 384928IXYSSNJ UD, FAX: 408-435-0670; FSC No.: 408-435-1033; Empl.: 100; *Sls. Mgr.:* Kent Paris

JAE
JAE Electronics, Inc.

FAX: 714-753-2699

JAE ELECTRONICS INC., 142 Technology Drive, Irvine, CA 92718, Tel: 714-753-2600; Empl.: 3400 (Worldwide); *Sls. Mgr.:* David Shaff, Dir. Field Sls.; *Dist. Mgr.:* Paul Parkinson ..... **B•1724-1725; C•1400-1403**

Local Sales Offices & Reps

AL Huntsville, Glen White Assocs. 205-882-6751
CA Newport Beach, Camda, Inc. 714-553-9228
CA San Diego, Camda, Inc. 619-726-9844
CA Santa Clara, Pinnacle Sls. 408-249-7400
CA Studio City, Camda, Inc. 818-762-9261
CO Littleton, Con-Tek Mktg. 303-973-8490
FL Clearwater, Glen White Assocs. 813-938-7557
FL Deerfield Beach, Glen White Assocs. 305-570-8545
FL Ft. Lauderdale, JAE Elctrns. 305-563-3484, 800-248-0737
FL Satellite Bch., Glen White Assocs. 407-773-3514
GA Norcross, Glen White Assocs. 404-441-1447
IN Ft. Wayne, Frank J. Campisano Co. 219-486-6443
IN Indianapolis, Campisano Co. 319-577-0319
MD Baltimore, Glen White Assocs. 301-321-7235
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NJ Matawan, Shepard & Assocs. 908- 254-5757
NY Pittsford, Franklin Sls. Corp. 716-248-8251
NC Charlotte, Glen White Assocs. 704-875-3777
NC Raleigh, Glen White Assocs. 919-848-1931
OH Cincinnati, Frank J. Campisano Co. 513-574-7111
OH Columbus, Frank J. Campisano Co. 614-876-5404
OH Mentor, Frank J. Campisano 216-975-9300
TX Plano, Jae Elctrns. 214-881-1183
TX Plano, RAM 214-424-4455
OR Portland, Venture Elctrns. 503-624-0617
PA Coraopolis, Frank J. Campisano Co. 412-264-5151
RI Cranston, Jae Elctrns. 401-946-0210
PA West Chester, TCA Inc. 215-692-6853
TX Austin, RAM 512-250-5082
TN Gray, Glen White Assocs. 615-477-8850
TX Houston, RAM 713-580-7394
TX Houston, RAM 713-955-0768
VA Lynchburg, Glen White Assocs. 804-385-6110
WA Bellevue, Venture Elctrns. 206-454-4594

Local Distributors

AZ Scottsdale, Cypress Elctrns. 602-949-0802
CA Buena Pk, Cypress Elctrns. 213-404-0445, 714-521-5230
CA San Diego, Cypress Elctrns. 619-535-0011
CA Santa Clara, Compass Elctrns. 408-432-7575
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Englewood, Cypress Elctrns. 303-792-5829
GA Atlanta, Satori 404-242-0606
MA Middleboro, Glynn Elctrns. 508-947-4262
MN Eden Prairie, Cypress Elctrns. 612-934-2104
NH Manchester, Glynn Elctrns. 603-622-8131
NY Deer Pk., Ramtronix Inc. 516-242-4700
OH Akron, Aesco Elctrns. 216-762-8818
OH Columbus, Aesco Elctrns. 614-882-6762
OR Beaverton, Cypress Elctrns. 503-223-8900
PA Bristol, AIM Elctrns. 215-785-3500
TX Dallas, Satori 214-518-1946
TX Dallas, Cypress Elctrns. 214-225-0065
WA Bothell, Cypress Elctrns. 206-483-1144

JAICO PRODUCTS, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622, Tel: 312-421-1090, FAX: 312-421-1165; Empl.: 35; *Sls. Mgr.:* John S. Jaidinger

JAMES ELECTRONICS, 4050 N. Rockwell, Chicago, IL 60618, Tel: 312-463-6500, FAX: 312-465-1504; Empl.: 220; *Sls. Mgr.:* Vincent Kennedy

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FAX: 818-842-3396

JANCO CORP., Box 3038-Glenoaks Sta., Burbank, CA 91508, Tel: 818-846-1800, TWX: 910-498-2701; FSC No.: 91812; Empl.: 185; *Sls. Mgr.:* Maurice Goldwater ..... **B•1726-1727**

Local Sales Offices & Reps

AZ Mesa, Sys. Sls. of AZ. Inc. 602-464-9989
CA San Diego & So. California, Gabriel & Assoc. 714-666-0660
CA San Jose, Ruppert Sls. & Engrg. 408-998-8717
CO Aurora, Key Specs. 303-690-6106
FL Orlando, MacKay, Smith & Assocs. 305-423-4353
GA Atlanta, MacKay, Smith & Assocs. 404-449-7444
IL Addison, Vikeland Sls. 708-832-8425
IN Greenwood, Aktron Corp. 317-888-2260
KS Wichita, Dy-Tronix Inc. 316-838-2645
MD Ellicott, Tech. Sls. Inc. 800-225-4335
MA Swansea, Eastrep Co. 617-672-0788
MN St. Paul, Cahill, Schmitz & Cahill 612-646-7217
MO Bridgeton, Dy-Tronix Inc. 314-291-4777
NJ Cherry Hill, Quality Comps. 609-428-6266
NY Fairport, TAC Sls. Inc. 716-377-2250
NC Charlotte, MacKay, Smith & Assocs. 704-372-1188
OH Columbus, Tom Mulligan Company 614-457-2242
TX Irving, Trice Mktg. Corp. 214-255-1877
WA Seattle, Norwest 206-827-9562

Local Distributors

CA Burbank, Merit Comp. Supp. 818-842-7607
CA Westlake Village, Tech-Cable Prods. 818-991-4697

JAN

FAX: 718-784-0796

JAN HARDWARE MFG. CO., P.O. Box 1199, Melville, NY 11747, Tel: 718-361-0800; FSC No.: 99813; Empl.: 35; *Sls. Mgr.:* Irwin E. Wasserman ..... **C•1585-1590**

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Local Sales Offices & Reps

CA San Diego, James E. Fitch & Assocs. 213-946-8062
CA Santa Fe Springs, James E. Fitch & Assoc. 213-945-2624
MD Gaithersburg, Naudain Assocs. South. 301-258-5040
MA Brookline, Harman Assoc., Inc. 617-232-6687
MA Lee, Harman Assoc., Inc. 413-243-1158
NJ Marlton, Naudain Assoc. 609-983-5300
TX Richardson, AGM Sls. Co. 214-644-1475

JEMA

FAX: 708-251-3738

JAPAN ELECTRONIC MANUFACTURERS AGENCY, INC., 1000 Skokie Blvd., Wilmette, IL 60091, Tel: 708-251-3600; Empl.: 10; *Sls. Mgr.:* James Schafen; *Dist. Mgr.:* Chris Gantz ..... **D•1022-1023, 1040-1041, 1268-1269**

JAPANESE PRODUCTS CORP., 7 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-8880, TELEX: 516929 ANS BACK ENFD, FAX: 914-592-7001; Empl.: 8; *Sls. Mgr.:* Don Cassalia

JARO COMPONENTS, INC., 1225 Broken Sound Pkwy., Boca Raton, FL 33431, Tel: 305-771-7000, FAX: 305-772-8899; Empl.: 30; *Sls. Mgr.:* Floyd Burwell; *Dist. Mgr.:* Floyd Burwell

J.A.W. INDUSTRIES, INC., 1750-A Costner Dr., Warrington, PA 18976, Tel: 215-343-8990, FAX: 215-343-8942; Empl.: 20; *Sls. Mgr.:* J. McLaughlin; *Dist. Mgr.:* J. McLaughlin

JAYCO PLASTICS OF CALIFORNIA, INC., 507 W. Blueridge Ave., Orange, CA 92665, Tel: 714-974-1701, TELEX: 678401, FAX: 714-998-4954; Empl.: 33 ..... **B•1818-1819**

Local Sales Offices & Reps

AZ Tempe, ETS 602-921-7122
CA Los Angeles, Satori Elec. 213-214-1791
CA San Diego, Coastal Elctrn. Sls. 619-459-4148
CA Sunnyvale, Pass Assocs. 408-735-9040
CO Boulder, Stratford Grp. 303-530-3194
GA Atlanta, Satori Elec. 404-242-0606
IL Berkeley, ESA 708-544-0120
NM Albuquerque, ETS 800-424-2540
NY New York, Breen Assocs. 201-696-8683
NC Raleigh, Pinnacle Mktg. 919-878-4658
OR Portland, D.A. Sullivan Co. 503-292-2448
TX Dallas, Satori Elec. 214-518-1946

JAYCOR, P.O. Box 85154, San Diego, CA 92186, Tel: 619-453-6580, FAX: 619-535-9763; FSC No.: 3M687; Empl.: 800; *Sls. Mgr.:* Steven Lutjens

JB ELECTRONIC TRANSFORMERS, 2300 W. Armitage Ave., Chicago, IL 60647, Tel: 312-342-0080, FAX: 312-342-9098; FSC No.: 11700; Empl.: 150

jbm

FAX: 603-623-0446

JBM ELECTRONICS, INC., 1 Commerce Drive, Bedford, NH 03110-6802, Tel: 603-623-0222; FSC No.: 62694; Empl.: Approx. 50; *Sls. Mgr.:* Susan Bennett ..... **A•1572-1577, 2238-2239**

Local Sales Offices & Reps

AL Huntsville, BCI, Inc. 205-539-4411
AZ Tucson, Clemick & Assocs. 602-749-4003
CA San Diego, Quattro Sls. 619-581-3093
CA Santa Clara, Westrep 408-988-8833, FAX:408-988-3186
FL Miramar, Dan-Tech Sls. 305-963-6142
GA Chamblee, BCI, Inc. 404-455-0405
IL Arlington Hgts., Davix Intl. Ltd. 414-255-1600, FAX:414-255-1863
MD Kensington, Koebert Assocs. 301-493-8924
MA Needham Hgts., Kanan Technlgs. 617-449-7400
MN St. Paul, Proud Assocs. 612-646-9428
NY Pittsford, Franklin Sls. Corp. 716-248-8251
NY Roslyn Hgts., November Elctrn. Sls. ... 516-621-6378
NC Charlotte, Quantum Mktg. 704-523-8822
NC Raleigh, Quantum Mktg. 919-846-5728
PA Glenside, Koebert Assocs. 215-887-2310
TX Austin, Texoma Sls. 512-441-1771
TX Freeport, Texoma Sls. 409-233-3192
TX Houston, Texoma Sls. 713-462-1432
TX Richardson, Texoma Sls. 214-238-8127
WV Inwood, Koebert Assocs. 304-229-8401
Can Mississauga, Ont., Indigo Electronics .. 416-670-0284

J-B-T INSTRUMENTS, INC., Box 1818, New Haven, CT 06508-1818, Tel: 203-776-1111, FAX: 203-624-8142; Empl.: 25; *Sls. Mgr.:* Lillian Sharron

JC SYSTEMS, INC., 11175 Flintkote Ave., San Diego, CA 92121, Tel: 619-453-9980, FAX: 619-453-2115; Empl.: 20; *Sls. Mgr.:* Ralph Aniunas

JDK CONTROLS, INC., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, Tel: 805-499-7779, FAX: 805-499-0990; Empl.: 40; *Sls. Mgr.:* Reece Kendall ..... **A•2043**

Local Sales Offices & Reps

NJ Matawan, Tim Reilly Assocs. 908-566-4555

JEFFERS ELECTRONICS, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621, Tel: 602-281-4925, TELEX: 165036, FAX: 602-281-2930; FSC No.: 59474; Empl.: 400; *Sls. Mgr.:* Ken Shobert; *Dist. Mgr.:* Steve Morris

W. S. JENKS & SON, 1933 Montana Ave. NE, Washington, DC 20002, Tel: 202-529-6020, 800-673-8199, FAX: 202-832-3411

JENNINGS
HIGH VOLTAGE COMPONENTS

FAX: 408-286-1789

JENNINGS, 970 McLaughlin Ave., San Jose, CA 95122-2696, Tel: 408-292-4025, TELEX: 34-6311, TWX: 910-338-0159; FSC No.: 73905; Empl.: 350; *Sls. Mgr.:* E. V. Valehrach ..... **A•1079; B•1516-1519; D•1274**

Local Sales Offices & Reps

AL Huntsville, Brandel-Stephens 205-883-0445
AZ Phoenix, Crown Systems 602-274-3180
CA Encino, King-Way Assocs. 818-788-4124
CA San Jose, H. W. Assocs. 408-996-9940
CO Denver, Lindberg Co. 303-758-9033
FL Deerfield Beach, Brandel-Stephens ... 305-427-8558
FL Orlando, Brandel-Stephens 305-425-3202
GA Atlanta, Brandel-Stephens 404-261-7579
IL Arlington Hgts., Berndt Assocs. 312-632-0900
IN Carmel, Berndt Assocs. 317-844-0114
KS Shawnee Mission, Lowell-Kangas & Assoc. 913-631-3515
MD Hunt Valley, Marktron 301-628-1111
MD Rockville, Marktron 301-251-8990
MA Haverhill, L.K. Assocs. 617-373-1313
MN Minneapolis, Berndt Assocs. 612-546-2021
MO St. Louis, Lowell-Kangas & Assoc. 314-821-4050
NJ Flanders, K&R Engrg. Sls. 201-584-5235
NM Albuquerque, Lindberg Co. 505-881-1006
NY Kingston, Leonard D. Allen, Inc. 914-338-7588
NY Syracuse, Leonard D. Allen, Inc. 315-437-8387
NC Greensboro, Brandel-Stephens 919-274-6952
OH Centerville, Bear Mktg., Inc. 513-436-2061
OH Richfield, Bear Mktg., Inc. 216-659-3131
PA Huntingdon Valley, Omega Elctrns. ... 215-947-4135
PA Pittsburgh, Bear Mktg., Inc. 412-531-2002
TX Houston, Barry Sales 713-784-5860
TX Richardson, Barry Sales 214-234-0255
UT Salt Lake City, Lindberg Co. 801-277-2643
WI Milwaukee, Berndt Assocs. 414-545-8400

Local Distributors

CA Carlsbad, Surcom Assocs. 619-438-4420
IL La Fox, Richardson Elctrns., Ltd. 312-456-0600
TN Bristol, Kintronics 615-878-3141

JENSEN TOOLS, INC., Axia, Inc., 7815 S. 46th St., Phoenix, AZ 85044, Tel: 602-968-6241, FAX: 800-366-9662; Empl.: 250; *Sls. Mgr.:* Bill Frost

JEROME INDUSTRIES CORP., 730 E. Division St., Elizabeth, NJ 07201, Tel: 908-353-5700, FAX: 908-353-1021; Empl.: 150; *Sls. Mgr.:* Anthony Di Girolamo ..... **A•2241; D•1822-1825**

JERSEY SPECIALTY CO., See JSC Wire & Cable

JETA
POWER SYSTEMS, INC

FAX: 213-426-2417

JETA POWER SYSTEMS, INC., 2675 Junipero, Signal Hill, CA 90806, Tel: 213-427-0095; Empl.: 110; *Sls. Mgr.:* Derek Steel ..... **D•1826-1827**

Local Sales Offices & Reps

AL Huntsville, R.O. Whitesell & Assoc. 205-883-5110
AZ Phoenix, ISBS 602-971-6250
CA Los Alamitos, Power Specialists, Inc. .. 213-594-9418
CO Arvada, Arrowhead/CSI Sls., Inc. 303-423-5597
CT Vernon, George Urban & Assocs. 203-647-3991
FL Boca Raton, S. Atlantic Comp. Sls. 407-391-1034
FL Orlando, S. Atlantic Comp. Sls. 407-857-3650
FL Winterhaven, S. Atlantic Comp. Sls. 813-324-0953
GA Atlanta, R. O. Whitesell & Assocs. 404-449-9190
IL Elmhurst, UTRONIX 708-834-1100
IN Indianapolis, R. O. Whitesell 317-359-9283
MD Wheaton, Brimberg Sls. 301-946-2670
MA Dover, George Urban & Assocs. 617-329-4068
MN Edina, Engrg. Prods. Assocs. 612-835-9022
NH Londonderry, George Urban Assoc. 603-437-3622
NY Fairport, Hi-Tec Sls. 716-223-5922
NY Yonkers, Sonkin Assocs. 914-968-8282
NC Fuguay-Varina, R.O. Whitesell & Assoc. 919-552-1122
NC Greensboro, R.O. Whitesell & Assocs. 919-273-1945
OH Cincinnati, R.O. Whitesell & Assocs. 513-521-2290
OH Cleveland, R.O. Whitesell & Assocs. .. 216-447-9020
OH Columbus, R.O. Whitesell & Assocs. .. 614-888-9396
OH Dayton, R.O. Whitesell & Assocs. 513-298-9546
PA Allentown, TRC Elctrns. 215-391-8977
PA Pittsburgh, R. O. Whitesell 412-963-6161
TN Knoxville, R.O. Whitesell & Assocs. 205-883-5150
TX Dallas, Sunbelt Comps. 214-248-8000
UT Midvale, Arrowhead/CSI Sls. 801-561-5688
WA Vancouver, Northwest Comp. Sls. 206-695-1331
WA Kirkland, N.W. Comp. Sls. 206-828-2104
Can Montreal, Empro Sls. 514-341-6420

JETTRON PRODUCTS INC., P.O. Box 337, E. Hanover, NJ 07936, Tel: 201-887-0571, FAX: 201-887-4182; FSC No.: 04435; Empl.: 30; *Sls. Mgr.:* Ben Latawiec ..... **C•1404-1405**

Local Sales Offices & Reps

CA El Cajon, A-Tronics 619-444-1501
NY New York, Eltron Export Co. 212-944-7635

JEWELL ELECTRICAL INSTRUMENTS, 850 Perimeter Rd., Manchester, NH 03103, Tel: 603-669-6400, FAX: 603-669-5962; Empl.: 175; *Sls. Mgr.:* Andrew Roeper; *Dist. Mgr.:* Andrew Roeper

JFD ELCTRNS., See Murata Erie No. Amer., Inc.

JF MICROSYSTEMS, 3641 Frontier Road, Pasco, WA 99301-9619, Tel: 509-297-4294, 800-532-2737; Empl.: 2; *Sls. Mgr.:* Jim Follansbee

JFW INDUSTRIES, INC., 5134 Commerce Sq. Dr., Indianapolis, IN 46237, Tel: 317-887-1340, FAX: 317-881-6790; FSC No.: 61162; Empl.: 87; *Sls. Mgr.:* Carrie Glover

JH

FAX: 213-328-0057

JH AMERICA, INC., JI-HAW Group, 20809 Higgins Court, Torrance, CA 90501, Tel: 213-328-0051 ..... **C•1406-1407, 1760-1763**

Local Sales Offices & Reps

CA Sunnyvale, Logan Sls. 408-732-6020
CA Ventura, R D Sls. 805-650-0112
MN St. Paul, Johnson Co. 612-641-1878
NC Kernersville, Wallace Elctrn. Sls. 919-996-2742

Local Distributors

AZ Tempe, Comtel Corp. 602-829-9471
CA Anaheim, Deco Elctrns. 714-630-8252
CA San Diego, Deco Elctrns. 619-693-1595
FL Orlando, Computel 407-682-3957
NJ Kennilworth, Computel 201-241-5400
NC Charlotte, Computel 704-376-4414

JKL COMPONENTS CORPORATION

FAX: 818-897-3056

JKL COMPONENTS CORPORATION, 13343 Paxton St, Pacoima, CA 91331-2376, Tel: 818-896-0019; FSC No.: 55335; Empl.: 35; *Sls. Mgr.:* Ernie Soares; *Dist. Mgr.:* Bob Brandt ..... **B•1169**

Local Sales Offices & Reps

AL	Huntsville, Taylor-Stone Inc.	205-830-9322
CA	San Diego, Lawsco	619-755-0200
IL	Cary, Bob Burns & Assocs.	708-516-3322
NY	Henrietta, CMJ, Inc.	716-334-3277
IN	Indianapolis, Apex-Tec, Inc.	317-842-5559
MI	Farmington Hills, Clark Sls.	313-553-0610
MN	Bloomington, Murnco	612-854-4161
OH	Cincinnati, Clark Sls. Co.	513-922-7555
OH	Painsville, Clark Sls. Co.	216-247-7848
PA	Philadelphia, Check Assoc.	215-487-3007
TX	Irving, Kite Elec. Sls.	214-986-0321

Local Distributors

AL	Huntsville, Powell Elec.	205-539-2731
CA	San Diego, Richie/Impact Sls.	619-271-4511
AZ	Phoenix, Capital Elctrns.	602-252-5897
CA	Garden Grove, Richey Western	714-895-0060
CA	Gardena, Cal. Switch & Signal	213-770-2330
CA	San Diego, Richie/Impact Sls.	619-271-4511
CA	Santa Clara, Richey/Western Elec.	408-727-7411
CA	Sunnyvale, Target Elec.	415-961-1170
CT	Wallingford, Sager Elec.	203-265-4600
FL	Ft. Lauderdale, Powell Elec.	305-484-8377
GA	Norcross, Specialty Distrbg. Co.	404-446-3190
IL	Wheeling, Hawk Elec.	312-459-4030
IN	Indianapolis, Meunier Elctrns.	317-635-3511
KS	Lenexa, Amer. Elec. & Cable	913-469-0099
MD	Kensington, Marine Air Supp.	301-949-1353
MD	Rockville, M S Elctrns.	301-340-6400
MA	Hingham, Sager Elec.	617-749-6700
MA	Westborough, Powell Elec.	617-366-6100
MI	Livonia, LWC Distrs.	313-464-7700
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Richland, ATR Ent.	314-765-5219
MN	Fridley, Voyager Elec.	612-571-7766
NJ	Clifton, Vantage Comps.	201-777-4100
NM	Albuquerque, Walker Elec. Supply	505-883-2992
NY	Apalachin, Rogan Elec.	607-625-2949
NY	Bohemia, Genelco	516-589-0909
NH	Salem, Sager Elec.	603-898-1348
NC	Greensboro, Hammond	919-275-6391
OH	Cincinnati, Schuster Elec.	216-425-8134
OK	Oklahoma City, Radio Supp. Inc.	405-232-6127
PA	Bristol, Aim Elec.	215-785-3500
PA	Philadelphia, Powell Elec.	215-365-1900
TN	Chattanooga, Specialty Distr. Co.	615-624-1040
OH	Yellow Springs, Electro-Shield	513-767-1054
TX	Ft. Worth, T & S. Supp.	817-248-4781
WA	Greenacres, Mica Co.	509-928-1720
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Oshkosh, Electronic Inds.	414-235-8930
Can	Quebec, Future Elec.	514-694-7710

JMJ TECHNICAL PRODS., 50 Wheeler Point Rd., Newark, NJ 07105, Tel: 201-589-4257, FAX: 201-762-9334; Empl.: 8; *Sls. Mgr.:* Kevin Kolenut ..... **C•1591**

JMK INCORPORATED

FAX: 603-886-4115

JMK, INC., 15 Caldwell Dr., Amherst, NH 03031, Tel: 603-886-4100; Empl.: 200; *Sls. Mgr.:* J. Kennedy ..... **A•1626-1627**

Local Sales Offices & Reps

CA	Santa Clara, Cummings & Assocs.	408-247-8656
MN	St. Paul, Arkco Sls.	612-777-7454

JMR ELECTRONICS, 1525 Blondell Ave., Bronx, NY 10461, Tel: 212-597-6050, FAX: 212-597-6137; Empl.: 50

JM TRANSFORMER CO., INC., 112 Florida St, Farmingdale, NY 11735, Tel: 516-293-0475, FAX: 516-293-3923; Empl.: 18; *Sls. Mgr.:* J. Millman ..... **A•2242-2247**

JOBMASTER CORP., 9010 Liberty Rd., Randallstown, MD 21133-0207, Tel: 410-655-1400, FAX: 410-521-5461; Empl.: 16 ..... **A•1285**

JOHANSON DIELECTRICS, INC., 2220 Screenland Dr., Burbank, CA 91505, Tel: 818-848-4465, TWX: 910-498-2735, FAX: 818-841-7261; Empl.: 300 ..... **A•1081**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Tempe, Reptronix, Inc.	602-345-4580
AZ	Tucson, Compass Mktg. & Sls.	602-293-1220
CA	Costa Mesa, Richland Tech. Sls.	714-722-9881
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890
CT	Waterbury, Compak Inc.	203-753-6431
FL	Ft. Lauderdale, VG Sales Co.	305-938-4333
FL	Altamonte Springs, VG Sales Co.	407-831-8688
FL	Largo, VG Sales Co.	813-536-7787
IL	Lisle, WG Controls	708-963-5954
IN	Indianapolis, M & L Elctrns.	317-359-4742
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Columbia, PSA South	301-730-0359
MA	Hudson, Compak Inc.	508-568-0331
CT	Wethersfield, Compac Sls.	203-563-4784
MI	Ypsilanti, Techrep, Inc.	313-572-1950
MN	St. Paul, Cahill, Schmitz & Cahill, Inc.	612-646-7217
MO	St. Louis, Midtec Assocs.	314-275-8666
NM	Albuquerque, Reptronix, Inc.	505-292-1718
NY	East Rochester, L-Mar Assocs.	716-381-9100
NY	Huntington, Compar New York Inc.	516-423-5660
NC	Winston-Salem, Murcota	919-722-9445
OH	Westlake, Baehr Greenleaf Assocs.	216-892-1770
PA	Trevose, PSA, Inc.	215-245-0513
PA	Warrendale, Baehr-Greenleaf Assocs.	412-934-3088
TX	Dallas, C & J Assocs.	214-539-0140
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Oakton, PSA South	703-281-1806
WA	Seattle, Northmar, Inc.	206-524-5170

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
CA	Los Alamitos, SEMI DICE	213-594-4631
CA	San Diego, Bell Industries	619-268-1277
CA	Santa Clara, SEMI DICE	408-980-9777
CA	Yorba Linda, Corona Elctrns.	714-283-8185
CO	Denver, Newark Elctrns.	303-757-8531
CT	Bloomfield, Newark Elctrns.	203-243-1731
FL	Orlando, Newark Elctrns.	407-896-8350
IL	Chicago, Newark	312-784-5100
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Columbia, Jaco Elctrns.	301-995-6620
MA	South Easton, Semi Dice	508-238-8344
MA	Tewksbury, Jaco Elctrns.	508-640-0010
MI	Jackson, Newark Elctrns.	601-956-8300
MN	Minneapolis, Newark Elctrns.	612-331-6350
NJ	Fairfield, Micross Comps.	201-227-8007
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
OR	Lake Oswego, Bell Industries	503-635-6500
TX	Allen, Prime Distribution	214-542-7915
WI	Waukesha, Bell Industries	414-547-8879

JOHANSON MANUFACTURING CORPORATION, 400 Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-334-2676, FAX: 201-334-2954; FSC No.: 91293; Empl.: 200 ..... **A•1080**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Tempe, Reptronix, Ltd.	602-345-4580
CA	Escondido, Knight Co.	619-743-5136
CA	Los Angeles, Knight Co.	213-670-2833
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assoc., Mt. States	303-426-0890
CT	Wetherfield, Compak, Inc.	203-563-4784
FL	Ft. Lauderdale, Vg Sls.	305-938-4333
FL	Largo, Vg Sls.	813-536-7787
FL	Pompano Beach, Vg Sls.	305-971-0900
IL	Lisle, W.G. Controls	708-963-5954
IN	Kokomo, Schillinger Assocs.	317-455-2708
IA	Hiawatha, ARD Sales Co.	319-393-6392
MA	Hudson, Compak, Inc.	617-568-0331
MN	St. Paul, Cahill, Schmirz & Cahill, Inc.	612-646-7217
MO	St. Louis, Midtec Assocs.	314-275-8666
NM	Albuquerque, Reptronix Inc.	505-292-1718
NY	Boonton, Johanson Mfg. Corp.	201-334-2676
NY	Mount Vernon, Friedman-Smith Elctrn. Sls.	914-664-4866
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Columbus, Baehr, Greenleaf & Assocs.	614-847-0220
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assoc.	216-842-1770
PA	Evans City, Baehr, Greenleaf & Assocs.	412-776-2151
PA	Trevose, P.S.A.	215-245-0513
TX	Austin, W. Pat Fralia & Assocs.	512-835-7911
TX	Euless, W. Pat Fralia & Assocs.	817-267-3577
TX	Houston, W. Pat Fralia & Assocs.	713-772-1572
UT	Salt Lake City, Straube Assocs., Mt. States	801-263-2640
VA	Oakton, PSA South	703-281-1806
WA	Seattle, Northmar	206-524-5170

Local Distributors

AZ	Tempe, Penstock	800-255-6788
CA	Beverly Hills, Penstock	818-841-8881
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Gardena, Bell Inds.	213-515-1800
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Penstock	619-225-8600
CA	San Jose, All American Semiconductor	408-287-0190
CA	San Pedro, ASAP Elctrns./West	213-519-8377
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Penstock	408-730-0300
CA	Thousand Oaks, Bell Inds.	213-826-6778
CA	Westlake VL, JACO/Distel, Inc.	805-495-9998
CO	Denver, Penstock	303-973-3010
CO	Wheatridge, Bell Inds.	303-424-1985
FL	Deerfield Bch., Bell Inds.	305-421-1997
FL	Ft. Lauderdale, All American	305-572-7999
FL	Tampa, JACO	813-628-4665
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove VL, Bell Inds.	312-640-1910
IL	Palatine, Penstock	708-934-3700
IN	Indianapolis, Bell Inds.	317-634-8202
IN	Indianapolis, Penstock	317-784-3870
MD	Baltimore, Radio Elec. Svc.	301-529-0500
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MA	Seekonk, M-Squared	617-761-5490
MA	Wakefield, All American	617-246-2300
MA	Wilmington, RC/Jaco Elctrns.	617-273-1860
NJ	Fairfield, Penstock	201-808-1414
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
NY	Syracuse, Newark Elctrns.	315-437-6611
OH	Dayton, Bell Inds.	513-435-8660
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Ft. Worth, PATCO Supplies	817-429-8596
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Bell Inds.	206-747-1515

JOHNSON, E. F., CO., P.O. Box 59089, Minneapolis, MN 55459-0089, Tel: 612-943-5500, FAX: 507-835-6485; Empl.: 1400; *Sls. Mgr.:* Arnie Nicklin

JOHNSON CONTROLS BATTERY GROUP, INC., 900 East Keefe Ave., Milwaukee, WI 53212, Tel: 414-961-6500, FAX: 414-961-6506; Empl.: 250; *Sls. Mgr.:* Daniel E. Ellis, Dir. Sls. & Mktg.

JOHNSON YOKOGAWA CORP., 4 Dart Road, Newnan, GA 30265, Tel: 404-254-0400, FAX: 404-254-0928; Empl.: 700; *Sls. Mgr.:* Chuck Micallef

JOLO INDUSTRIES, INC., 13921 Nautilus Dr., Garden Grove, CA 92643, Tel: 714-554-6840, FAX: 714-554-0306; FSC No.: 30035; Empl.: 20; *Sls. Mgr.:* J.S. Giampiccolo, Jr. ..... **C•1408-1409**

Local Sales Offices & Reps

AZ	Scottsdale, JK & Assocs.	602-990-8804
CA	Los Angeles, Quattro Sls. Assocs.	213-372-4221
CA	Mountain View, Leddy Assocs.	415-969-6313
CA	Orange County, Quattro Sls. Assocs.	800-735-4510
CA	San Diego, Quattro Sls. Assocs.	619-581-3093
CA	San Fernando Valley, Quattro Sls. Assocs.	805-523-2978
FL	Longwood, Mathias Assocs., Inc.	407-682-1700
IL	Chicago, McNulty & Assocs.	312-980-9868
MA	Reading, Lincoln Tech. Sls.	617-944-9594
MI	Sterling Heights, Geotronix, Inc.	313-254-0520
OH	Cleveland, Geotronix Mktg. Assocs.	216-659-6100
OH	Trotwood, Geotronix, Inc.	513-854-5939
OR	Beaverton, Evergreen Mktg. Grp.	503-643-8020
PA	Allison Park, Geotronix, Inc.	412-487-1770
TX	Austin, Barry Sls., Inc.	512-837-3616
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls., Inc.	214-234-0255
WA	Seattle, Evergreen Mktg. Grp. Inc.	206-485-8063
Can	Nepean, Ont., Tech-Trad, Inc.	613-727-1272

Local Distributors

FL	Miami, Elec. Equip.	305-526-6060
OH	Richfield, Alpha Distr. Corp.	216-659-7100

JONARD INDUSTRIES CORP., 134 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-0700, TELEX: 996570, TWX: 710-562-0107, FAX: 914-793-4527; Empl.: 65; *Sls. Mgr.:* C. McClory

JONATHAN MANUFACTURING CORP., 1101 So. Acacia Ave., Fullerton, CA 92631, Tel: 714-526-4651, FAX: 714-879-1212; Empl.: 375; *Sls. Mgr.:* Todd Leverich

JONES, HIRAM, ELCTRNS. INC., See Hiram Jones Elctrns. Inc.

JORI RESOURCES, 2128 Knoll Dr., Ventura, CA 93003, Tel: 805-642-2266, FAX: 805-642-5978; Empl.: 4

JOSLYN ELECTRONIC SYSTEMS, P.O. Box 817, Goleta, CA 93116, Tel: 800-752-8068, 805-968-3551, TELEX: 181824, FAX: 805-968-2335; FSC No.: 23663; Empl.: 240; *Sls. Mgr.:* M. Young

JOULE POWER, INC., Joyce Industrial Pk., Summer Rd., Boxborough, MA 01719, Tel: 508-263-9712, FAX: 508-263-9071 ..... **D•1829**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Scottsdale, Sun Tech Mktg. 602-483-1082
CA San Jose, Silicon Valley Sls. 408-432-1967
FL Altamonte Springs, Over & Over 407-332-1222
GA Norcross, Over & Over 404-449-6205
IL Schaumberg, Victory Sls. 708-490-0300
MA Burlington, Tech Rep. Inc. 617-272-5965
NJ Fairfield, Metrologic Corp. 201-575-5585
NC Raleigh, Over & Over 919-876-7338
OH Chargin Falls, Larry Bennett & Assocs. 216-247-2174
PA Wayne, John Lyons Mktg. 215-687-2277
TX Plano, Aticus 214-964-0663
UT Ogden, Doug Taylor & Assocs. 801-546-9570
VA Alexandria, Tech Reps. Inc. 703-370-2600
WA Edmonds, Power Sources Unlimited .. 206-743-6641
Can Montreal, Que., Solid State Engrg. 514-481-3313

JOVIL MANUFACTURING CO., INC., Precision Rd., Danbury, CT 06810, Tel: 203-792-6700, TELEX: 969634, FAX: 203-790-8645; Empl.: 25; *Sls. Mgr.:* Keith Fredlund

JRW INDUSTRIES, INC., 2312 N Second St., Harrisburg, PA 17110, Tel: 717-236-1418, FAX: 717-236-1895; Empl.: 4; *Sls. Mgr.:* Kevin J. Williams, Sls. Mgr.

JSC WIRE & CABLE, Box 248, Burgess Pl., Wayne, NJ 07474, Tel: 201-694-6200, 1-800-572-9473, FAX: 201-694-8297; Empl.: 40; *Sls. Mgr.:* Richard Wojtovitz

J.S.T. CORP., 1200 Business Ctr. Dr., Ste. 400, Mt. Prospect, IL 60056, Tel: 1-800-292-4243, FAX: 708-803-4918; *Sls. Mgr.:* Ron Lesky; *Dist. Mgr.:* Ron Lesky ..... **C•1411-1421**

Local Sales Offices & Reps

AL Huntsville, Over & Over, Inc. 205-837-7105, FAX:205-837-7305
AZ Scottsdale, Whyle & Assocs. 602-391-0226, FAX:602-391-9498
CA Arcadia, Van Gott & Assocs. 818-445-9728, FAX:818-445-5019
CA Auburn, Ad. Tech. Mktg. 916-888-0788, FAX:916-888-0787
CA Escondido, Van Gott & Assocs. 619-489-0893, FAX:619-489-8167
CA Santa Clara, GMB Tech Sls. 408-496-6181, FAX:408-496-0634
CO Arvada, Arrowhead Sls. Corp. 303-423-5556, FAX:303-423-5598
FL Altamonte Spgs., Over & Over, Inc. 407-322-1222, FAX:407-332-4433
FL Coral Springs, Over & Over, Inc. 305-753-7050, FAX:305-753-0337

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IN Ft. Wayne, Corrao/Marsh 219-482-2725, FAX:219-484-7491
IN Greenfield, Corrao/Marsh, Inc. 317-462-4446, FAX:317-462-6568
MD Ellicott, AM-Tech Assocs. 301-461-5599, FAX:301-461-5659
MA Norwell, M.J. Sls., Inc. 617-982-8776, FAX:617-878-6707
MA Randolph, The T.M.R. Grp. 617-961-4486, FAX:617-986-4640
MI St. Joseph, Six Sigma 616-429-7788, FAX:616-429-7788
MI Sylvan Lake, Six Sigma 313-332-4900, FAX:313-332-4903
MN St. Paul, Countryman Assoc. Co. 612-645-9151, FAX:612-641-6153
MS Horn Lake, Edward Alan Co. 601-342-4989
MO Florissant, Palatine Engrg. & Sls. Inc. 314-839-0800,FAX:314-839-6023
MO Kansas City, Palatine Engrg. & Sls; Inc. 816-531-7221,FAX:816-531-7443
NJ Madsion, Venture Quest, Inc. 201-377-4922, FAX:201-377-0453
NY Clay, MJ Sls., Inc. 315-699-9596, FAX:315-699-7851
NY W. Babylon, Venture Quest, Inc. 516-491-3120, FAX:516-491-0907
NC Charlotte, Over & Over, Inc. 704-542-9111, FAX:704-542-9937
NC Raleigh, Over & Over 919-876-7338, FAX:919-876-8098
OH Highland Hgts., KT/DEPCO 216-442-6200, FAX:216-461-2101
OH Mentor, Qualtek Elctrns. Corp. 216-951-3300, FAX:216-951-7252
OR Hillsboro, Turn-A-Round Sls. 503-640-4641, FAX:503-640-4640
PA Fort Washington, SMC Inc. 215-628-3394, FAX:215-628-3395
PA Pittsburg, KT/Depco 412-367-1011, FAX:412-367-2153
TX Arlington, T-Tec Sls. 817-429-9151, FAX:817-457-6704
TX Arlington, T-Tec Sls. 817-461-0522, FAX:817-277-8502
TX El Paso, T-Tec Sls. 915-598-1898, FAX:915-598-2485
TX Gilmer, T-Tec Sls. 918-747-8316, FAX:903-734-5316
TX Katy, T-Tec Sales 713-347-2926, FAX:713-347-2088
WA Kirkland, Turn-A-Round Sls. 206-822-4634, FAX:206-828-0633
WI Brookfield, Circuit Sls. 414-784-7773, FAX:414-784-4528
Can Markham, Ont., Avotronics, Ltd. 416-475-2024, FAX:416-475-2019
Can Vancouver, BC, Fairwest Sls. 604-685-1473, FAX:604-681-7712

Local Distributors

AL Birmingham, KSM Elctrns. 205-879-8377, FAX:205-879-8406
AZ Tempe, Elctrn. Hardware 602-967-1691, FAX:602-967-1694
AZ Tucson, SWS Elctrns; Inc. 602-628-1613, FAX:602-628-1921
CA Fremont, Vic/Tal Sls. 415-651-6420, FAX:415-651-8795
CA Fullerton, I.S.I. 714-773-0411,FAX:714-447-3976
CA Huntington Bch., On-Line Elctrns. 714-847-5111, FAX:714-847-4485
CA Irvine, Kensington Elctrns. 714-588-0575, FAX:714-588-0176
CA N. Hollywood, Elctrn. Hardware 818-982-6100, FAX:818-764-1889
CA Norwalk, Myco Elctrns. Supp. 213-404-2053, FAX:213-926-8536
CA San Carlos, Logan Elctrns. 415-594-0700, FAX:415-594-1687
CA San Diego, Mock III 619-693-8230, FAX:619-693-3355
CA San Jose, Spectra Elctrns. 408-452-1590, FAX:408-452-1683
CA Santa Clara, Elctrn. Hardware 408-988-1000, FAX:408-988-4189
CA Santa Clara, Trinty Elctrns. 408-980-9011, FAX:408-980-9014
CA Vista, Elctrn. Hardware 619-231-1307, FAX:619-598-6958
CO Englewood, Indelco 303-795-3431, FAX:303-795-8298
CT Wallingford, Midstate Elctrns. 203-265-9900, FAX:203-269-2374
FL Ft. Lauderdale, KSM Elctrns. 305-971-5900, FAX:305-977-0489
GA Athens, Dixie Elctrns. 404-613-7755, FAX:404-613-7856
GA Atlanta, KSM Elctrns. 404-458-2013, FAX:404-451-0891
GA Augusta, Dixie Elctrns. 404-722-2055, FAX:404-722-0388
IL Addison, Belford Elctrns. 708-691-1100, FAX:708-691-1118
IL Bensenville, Voyager I 708-860-1300, FAX:708-860-1573
IL Glendale Hgts., KSM Elctrns. 708-529-1700, FAX:708-529-3668
IL Palatine, OHM Elctrns. 708-359-5500, FAX:708-359-9686
IN Carmel, Altex Elctrns. 317-848-1323, FAX:317-844-6593
IN Elkhart, Babsco, Inc. 219-293-0631, FAX:219-293-7207
IN Indianapolis, Mar Elctrns. 317-633-6699, FAX:317-633-6687
MD Gaithersburg, Axis Elctrns., Inc. 301-840-9640, FAX:301-840-9299
MA Burlington, QPL Elctrns. Distrs. 617-229-2424, FAX:617-273-5075
MA Franklin, JEM Elctrns. 508-520-3105, FAX:508-520-3109
MI Grand Rapids, S.F. Elctrns. 616-459-0216, FAX:616-459-5601
MI Southfield, Michigan Lectrols Corp. 313-353-1350, FAX:313-353-1433
MI Wyoming, E.C. Elctrns. 616-530-0576, FAX:616-530-8598
MN Fridley, Voyager II 612-571-7766, FAX:612-571-9519
MN New Brighton, Chris Elctrns. 612-631-2647, FAX:612-631-3071
MN Roseville, TLC Distbn. 612-483-2226, FAX:612-481-0287
NE Lincoln, Scott Elctrns. 402-466-8221, FAX:402-466-4187
NE Omaha, Scott Elctrns. 402-734-6750, FAX:402-734-1442
NJ Cherry Hill, Jeta Corp. 609-663-7272, FAX:609-663-1698
NJ Moorestown, Marlac Elctrns. 609-234-4200, FAX:609-234-0672
NJ Woodbridge, Calmm Elctrns. 201-750-4497, FAX:201-750-4212
NM Albuquerque, TMA, Inc. 505-345-8921, FAX:505-344-1113
NY Bohemia, Key Comps., Inc. 516-567-7500, FAX:516-567-2920
NY Hauppauge, Addem Distbg. Div. 516-273-6777, FAX:516-273-7086
NC Charlotte, Dixie Elctrns. 704-377-5413, FAX:704-377-2561
NC Winston-Salem, Dixie Elctrns. 919-724-5961, FAX:919-723-7024
OH South Euclid, Circuit Elec. 216-382-0330, FAX:216-382-4411
OR Aloha, Elctrn. Concepts 503-642-9715, FAX:503-591-8383
OR Beaverton, Micro Power Elctrns. 503-626-7086, FAX:503-643-1556
PA Bristol, Aim Elctrns. 215-785-3500, FAX:215-785-3510
SC Columbia, Dixie Elctrns. 803-779-5332, FAX:803-765-9276
SC Greenville, Dixie Elctrns. 803-297-1430, FAX:803-297-1439
SC N. Charleston, Dixie Elctrns. 803-552-2671, FAX:803-552-2676
TN Gray, Dixie Elctrns. 615-477-2131, FAX:615-477-4407
TN Oak Ridge, Dixie Elctrns. 615-481-3393, FAX:615-481-3397
TN Soddy Daisy, Techni-Tronics 615-332-2119, FAX:615-332-1061
TX Austin, Wofford Elctrns. 512-339-1131, FAX:512-835-7351
TX Dallas, Wofford Elctrns. 214-320-0294:FAX:214-320-2017
TX El Paso, Schick Entprs. 915-772-3283:FAX:915-772-3034
TX Friendswood, Schick Enterprises 713-388-1714
TX Houston, Wofford Elctrns. 713-847-3583, FAX:713-847-4035
TX N. Richland Hills, Swieco Elctrns (Dixie) 817-281-1811,FAX:817-281-1783
WA Redmond, Priebe Elctrns. 206-881-2363, FAX:206-881-0508
Can Burlington. Ont., Alternate Source Comps., Ltd. 416-335-6385,FAX:416-332-1385
Can Concord, Ont., Zierick Canada Corp. ... 416-669-1429, FAX:416-669-5626

Can Markham, Ont., ARMA Elctrns. Sls., Inc. 416-475-1858,FAX:416-475-2019
Can Vancouver, B.C., Brockton Elctrns. Ltd. 604-291-6665,FAX:604-291-6664

JUDCO MFG. INC., P.O. Box 487-E84, 1429 240th St, Harbor City, CA 90710, Tel: 213-534-0959; *Sls. Mgr.:* Kevin Johnson

JUDD WIRE INC., 57 Turnpike Rd., Turners Falls, MA 01376, Tel: 413-863-4357, FAX: 413-863-2305; FSC No.: 3357; Empl.: 148; *Sls. Mgr.:* Jim Paradise ..... **B•1020-1021; C•1764**

Local Sales Offices & Reps

AL	Huntsville, R & G Assocs.	205-880-8020
AZ	Phoenix, O'Donnell Associates	602-944-9542
CA	Los Altos, Ewing Foley	415-941-4525
CA	Torrance, O'Donnell Assocs.	213-539-9664
CO	Boulder, Stratford Grp.	303-530-3194
FL	Coral Springs, J.P. Jasco & Assocs.	813-371-3814
IL	Arlington Heights, Rozner Sls. Co.	312-577-0067
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MA	Marlborough, O.K. Engrg.	617-481-6400
MN	Bloomington, EMT Engineering	612-888-1020
MO	Hazelwood, Spectrum Sls.	314-731-5151
NJ	Haddonfield, M & S Mesa Inc.	609-429-9531
NM	Albuquerque, O'Donnell Assocs.	505-883-1030
NY	Fairport, Senntec Sls.	716-425-3954
OH	Worthington, Simcox Assocs.	614-885-8776
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
TX	Dallas, Stevens Sls. Co.	214-702-0132
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Madison, Sea Wire & Cable	205-772-9616
CA	Concord, Control Master	415-939-3600
CA	Fountain Valley, Innovative Sys.	714-968-6383
CA	Irvine, Republic Elctrns.	714-855-2222
CA	Menlo Park, Bay Associates	415-321-2990
CA	San Leandro, Anixter	415-352-3100
CA	Torrance, Blake Wire & Cable	213-533-8141
CA	Valencia, Wirenetics Co.	805-257-2400
CO	Colorado Springs, SCI	303-598-6888
CT	East Hartford, E. J. Stephens Co.	203-282-9400
CT	Manchester, I.M.S.	203-649-4415
FL	Altamonte Springs, Royce Elctrns.	305-869-4700
FL	Ft. Lauderdale, Anixter	305-485-4455
FL	Ft. Lauderdale, Pacer Elctrns.	305-462-0902
IL	Brookfield, Conductors Unltd.	312-485-7855
MA	Woburn, Pacer Elctrns.	617-935-8330
MN	Bloomington, K. L. Tannehill	612-881-6700
NH	Amherst, North Country Wire & Cable	603-889-0063
NJ	Dover, Electro Spec.	201-361-6300
NY	Farmingdale, Weico Elctrns.	516-293-0050
MA	Lowell, Anixter	508-459-6400
NY	Rochester, Simcona Elctrn.	716-328-3230
FL	Tampa, Conductors Unlimited	813-248-1620
NC	Raleigh, Wholesale Electric	919-878-9400
OH	Dayton, Astro Inds.	513-429-5900
PA	Montgomeryville, Pyttronic Ind.	215-242-6700
TX	Dallas, Interstate Wire	214-553-1311
WA	Tukwila, Carlyle Inc.	206-251-0700
WI	New Berlin, Indl. Elec. Wire & Cable	414-782-2323

JUDD WIRE INC., 870 Los Vallecitos Blvd., San Marcos, CA 92069, Tel: 619-744-7720, FAX: 619-744-6089; FSC No.: 3357 ..... **B•1020-1021; C•1764**

Refer to Judd Wire, Turners Falls, MA for sales office and distributor information.

JULIE RESEARCH

FAX: 212-691-3320

JULIE RESEARCH LABS., 508 West 26 Street, New York, NY 10001, Tel: 212-633-6625, TWX: 710-581-5138; FSC No.: 07062; Empl.: 35; *Sls. Mgr.:* Pamela Spencer; *Dist. Mgr.:* Pamela Spencer ..... **A•1929; D•1270-1273**

Local Sales Offices & Reps

CA	Fresno, Lion Elctrn. Labs	209-233-9096

JUMO PROCESS CONTROL, INC., 735 Fox Chase, Coatsville, PA 19320, Tel: 215-380-8002, FAX: 215-380-8009; *Sls. Mgr.:* Gunnar Oberg

KAHLE ENGINEERING, 50 S. Center St. Bldg. No. 1, Orange, NJ 07050, Tel: 201-678-2020, FAX: 201-678-0326; Empl.: 50; *Sls. Mgr.:* Daniel Fowler

KSI

FAX: 508-922-8374

KAISER SYSTEMS, INC., 126 Sohier Road, Beverly, MA 01915, Tel: 508-922-9300; FSC No.: IFD78; Empl.: 100; *Sls. Mgr.:* Steve Swech ..... **D•1830-1835**

KALAMAZOO TECHNICAL FURNITURE, See TECLAB

KALGLO ELCTRNS. CO., INC., 6584 Ruch Rd, E. Allen Twp., Bethlehem, PA 18017-9359, Tel: 215-837-0700, TWX: 510-651-2101, FAX: 215-837-7978; FSC No.: 64521; *Sls. Mgr.:* James H. Beidelman

KALMUS & ASSOCS., INC., 2424 S. 25th Ave., Broadview, IL 60153, Tel: 708-343-7004, FAX: 708-343-7016; Empl.: 250; *Sls. Mgr.:* Kent Prather

KAMAN INSTRUMENTATION, 1500 Garden of the Gods, P.O. Box 7463, Colo Springs, CO 80907, Tel: 1-719-599-1892, FAX: 719-599-1823; FSC No.: 21732; Empl.: 200

KAM COMPONENTS, INC., P. O. Box 192-EEM, Nesconset, NY 11767, Tel: 516-585-0666, FAX: 516-585-1580; Empl.: 29; *Sls. Mgr.:* Cheryl Day

K&L MICROWAVE, INC., 408 Coles Circle, Salisbury, MD 21801, Tel: 301-749-2424, FAX: 301-749-5725; FSC No.: 50140; Empl.: 550; *Sls. Mgr.:* Jim Price

K & L OSCILLATEK, A DOVER TECHNOLOGY CO., See Oscillatek, A Dover Technology Co.

K & M ELECTRONICS, 11 Interstate Dr., W. Springfield, MA 01089, Tel: 413-781-1350, FAX: 413-737-0608; FSC No.: 66613; Empl.: 700; *Sls. Mgr.:* James Chase

KAPPA® TECHNOLOGIES INC.

FAX: 908-388-4786

KAPPA TECHNOLOGIES, INC., 1443 Pinewood St, Rahway, NJ 07065, Tel: 908-396-9400, 1-800-223-0603; FSC No.: 20933; Empl.: 175; *Sls. Mgr.:* M. Pearl ..... **A•1578-1588, 1680-1681, 2248-2249; D•1836**

Local Sales Offices & Reps

AZ	Scottsdale, Interstate Marketing	602-244-9050
CA	Woodland Hills, Interstate Marketing	818-883-7606
CO	Wheatridge, Wescom Mktg. Inc.	303-422-8957
MD	Middletown, S.T./Woolard Co., Inc.	301-371-4500
MN	Osseo, Gaffney Sls. Co.	612-425-5484
NJ	Ft. Lee, Neptune Elctrns. Co.	201-461-2789
NY	Cazenovia, S.T./Woolard Co., Inc.	315-655-8145
NY	Plainview, Neptune Elctrns. Co.	516-349-1600
PA	Ft. Washington, SMC, Inc.	215-628-3394
TX	Austin, Gardin-Moore Sls.	512-794-2900
TX	Dallas, Gardin-Moore Sls.	214-985-1193
TX	Houston, Gardin-Moores Sls.	713-496-7651
UT	Salt Lake City, Wescom Mktg. Inc.	801-269-0419
SC	Pickens, S.T./Woolard Co., Inc.	803-878-3830

Local Distributors

CA	Laguna Hills, Jaco/Distel, Inc.	714-837-8966
CA	San Jose, Jaco/Distel, Inc.	408-432-9290
CA	Sherman Oaks, Delay Line Distrs. Inc.	213-283-2058
CA	Westlake, Jaco/Distel, Inc.	805-495-9998
CT	Meriden, Jaco Elctrns., Inc.	203-235-1422
FL	Boca Raton, Jaco/QC	407-241-7950
GA	Norcross, Jaco/QC	404-449-9508
MD	Columbia, Jaco Elctrns., Inc.	301-995-6620
MA	Tewksbury, Jaco Elctrns., Inc.	508-640-0010
NY	Hauppauge, Jaco/Elctrns., Inc.	516-273-5500
NC	Raleigh, Jaco/QC	919-876-7767
OK	Tulsa, Jaco/QC	918-664-8812
TX	Addison, Jaco/QC	214-733-4300
TX	Austin, Jaco/QC	512-835-0220
TX	Sugar Land, Jaco/QC	713-240-2255
WA	Redmond, Jaco/Distel, Inc.	206-881-9700

KATRONIC ELEKTRONIC GES.M.B.H., OrtenburgerstraBe 28, Austria, Tel: 04762-5340, FAX: 534075; Empl.: 74; *Sls. Mgr.:* Herbert Sandner

KAUT & BUX MANUFACTURING CO., 675 Tower Rd, P.O. Box 867, Mundelein, IL 60060, Tel: 708-949-8505, TELEX: 6871289 KBM UN/, FAX: 1-708-949-4250; *Sls. Mgr.:* Heinz Kutschera

KAVLICO CORP., 14501 Los Angeles Ave., Moorpark, CA 93021, Tel: 805-523-2000, TELEX: 65-1481, FAX: 805-523-7125; Empl.: 500; *Dist. Mgr.:* Drew Distin

KAYCEE INDUSTRIES LTD., 32 Ramjibhai Kamani Rd, B.E. Bombay-38, INDIA, Tel: 2615567-68, 2613521-22-23, FAX: (91-22) 2616106; Empl.: 400

KAY ELEMETRICS CORP., 12 Maple Ave., P.O. Box 2025, Pine Brook, NJ 07058-2025, Tel: 201-227-2000, TWX: 710-734-4347; FSC No.: 80138; Empl.: 50; *Sls. Mgr.:* Stephen P. Crump ..... **A•1750**

KAY-RAY/SENSALL, INC., 1400 Business Center Drive, Mt. Prospect, IL 60056, Tel: 708-803-5100; Empl.: 170

KAY-TOWNES, Div. of Alco Industries, Inc., P.O. Box 593, Rome, GA 30161, Tel: 404-291-9871, FAX: 404-235-6851; Empl.: 60; *Sls. Mgr.:* James Joiner; *Dist. Mgr.:* Pauline Petty

KB ELECTRONICS, 73 Wortman Ave., Brooklyn, NY 11207, Tel: 718-257-3300, TWX: 710-584-2308, FAX: 718-257-4740; Empl.: 140; *Sls. Mgr.:* A Bueller

KCK AMERICA INC., Mitsubishi Materials Corporation, 930 Remington Rd., Schaumburg, IL 60173-4516, Tel: 708-884-8688, FAX: 708-884-9327; Empl.: 500; *Sls. Mgr.:* K. G. Such, V.P.

KD COMPONENTS, INC., 2710 S. Main St, Santa Ana, CA 92707, Tel: 714-545-7108, TWX: 910-595-2678, FAX: 714-549-7966; FSC No.: 58421; Empl.: 32; *Sls. Mgr.:* Wayne Devine

KDI/TRIANGLE ELECTRONICS, 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-5700, TWX: 710-986-8220; FSC No.: 64537; Empl.: 385

KDS AMERICA, Daishinku Corp., 10901 Granada Ln., Overland Pk., KS 66211, Tel: 913-491-6825, FAX: 913-491-6812; Empl.: 12; *Sls. Mgr.:* Tom Lawrence-East. Reg.; *Dist. Mgr.:* Sara Peterson ..... **A•1379**

Local Sales Offices & Reps

AL	Huntsville, ACM	205-881-5493
AZ	Carefree, Integrated Rep Co., Inc.	602-488-1740
CA	Fountain Valley, Dyna Rep.	619-693-1111
CA	San Diego, Bestronics	714-545-3255
CA	San Jose, QCI Assocs.	408-432-1070
CA	Simi Valley, Dyna Rep.	805-527-0072
CO	Wheatridge, Wescom Mktg., Inc.	303-422-8957
FL	Boynton, D-Assocs.	305-492-8634
FL	Sanford, D-Assocs.	407-321-9594
FL	Tampa, D-Assocs.	407-321-9594
GA	Norcross, ACM	404-448-7025
IL	Itasca, Circuit Sls.	708-773-0200
IN	Fishers, Rathsburg Assoc.	317-577-4500
IA	Cedar Rapids, Barnes Wes Tech. Assoc.	319-393-9790
MA	Scituate, CTC Assocs.	617-848-2077
MI	Farmington Hills, Rathsburg Assocs.	313-489-1500
MN	Chanhassen, Barnes Sls. Assocs.	612-934-2907
NY	Buffalo, Quality Comps.	716-837-5430
NY	Manlius, Quality Comps.	315-682-8885
NY	Smithtown, PAF Assocs.	516-360-0940
NC	Charlotte, Prime Comps., Inc.	704-522-1150
NC	Raleigh, Prime Comps. Inc.	919-850-9866
OH	North Royalton, Rathsburg Assocs.	216-582-9550
OH	Reynoldsburg, Rathsburg Assocs.	614-866-2490
OR	Beaverton, Western Tech. Sls.	503-644-8860
PA	Norristown, DER, Inc.	215-272-4502
TX	Austin, SW Mktg. Assoc., Inc.	512-255-8010
TX	Dallas, SW Mktg. Assoc., Inc.	214-341-8631
TX	Houston, SW Mktg. Assoc.,Inc.	713-537-8166
UT	Salt Lake City, Wescom Mktg., Inc.	801-269-0419
WA	Bellevue, Western Tech. Sls.	206-641-3900
WA	Spokane, Western Tech. Sls.	509-922-7600
WI	Brookfield, Circuit Sls.	414-784-7773
Can	Burnaby, B.C., Vitel Elctrns.	514-636-5951
Can	Kanata, Ont., Vitel Elctrns.	613-592-0090
Can	Lachine, Que., Vitel Elctrns.	514-636-5951
Can	Mississauga, Ont., Vitel Elctrns.	416-676-9720

Local Distributors

AL	Huntsville, Future Electronics	205-830-2322
AL	Huntsville, Reptron	205-722-9500
AZ	Phoenix, Future Electronics	602-968-2140
CA	Chatsworth, Future Elctrns.	818-772-6240
CA	Garden Grove, Natl Elctrns.	714-892-7749
CA	Irvine, Future Elctrns.	714-250-4141
CA	Irvine, ITT Multicomps.	714-727-3001
CA	San Diego, Future Elctrns.	619-278-5020

CA San Jose, Compass Comps. 408-432-7575
CA San Jose, Eric Elctrns. 408-432-1111
CA San Jose, Future Elctrns. 408-434-1122
CA San Jose, PSC Elctrns. 408-737-1333
CA Saratoga, Western Micro 408-725-1660
CO Englewood, NEP Elctrns. 303-799-9898
CO Westminster, Future Electrns. 303-650-0123
CO Westminster, ITT Multicomponents ... 303-451-8740
CT Bethel, Future Elctrns. 203-743-9594
FL Altamonte Springs, Future Elctrns. 305-767-8414
FL Clearwater, Future Elctrns. 813-578-2770
FL Ft. Lauderdale, Reptron 305-735-1112
FL Tampa, Reptron 813-854-2351
GA Norcross, Future Elctrns. 404-441-7676
GA Norcross, Reptron 404-446-1300
IL Schaumburg, Future Elctrns. 312-882-1255
IL Schaumburg, Reptron 708-882-1700
IL Wood Dale, NEP Elctrns. 708-595-8500
MD Columbia, Future Elctrns. 301-995-1222
MA Burlington, Western Micro Technology 617-273-2800
MA Hopkinton, Interface Electronics 508-436-6858
MA Westboro, Future Elctronics 617-366-7400
MI Livonia, Future Elctrns. 313-261-5270
MI Livonia, Reptron 313-525-2700
MN Eden Prairie, Future Elctrns. 612-944-2200
MN Minnetonka, Reptron 612-938-0000
MO St. Louis, Future Elctrns. 314-469-6805
NJ Fairfield, Future Elctrns. 201-227-4346
NJ Mount Laurel Future Elctrns. 609-778-7600
NY Liverpool, Future Elctrns. 315-451-2371
NY Long Island, Future Elctrns. 516-234-4000
NY Rochester, Future Electrns. 716-272-1120
NC Charlotte, Future Elctrns. 704-529-5500
NC Raleigh, Reptron 919-870-5189
OH Solon, Reptron 216-349-1415
OH Worthington, Reptron 813-436-6675
OR Beaverton, Future Electrns. 503-645-9454
OR Beaverton, Western Microtechnology 503-629-2082
TX Austin, Omni Pro 512-794-9200
TX Dallas, Omni Pro 214-233-0500
TX Richardson, Future Elctrns. 214-437-2437
UT Salt Lake City, Future Elctrns. 801-972-8489
UT Salt Lake City, Western Microtechnology 801-575-7150
WA Redmond, Future Elctrns. 206-881-8199
WA Redmond, Western Microtechnology .. 206-881-6737
WI Waukesha, Future Elctrns. 414-786-1884
Can Pointe Claire, Future Elctrns. 514-694-7710

KEDMAN CO., Box 25667, Salt Lake City, UT 84125, Tel: 801-973-9112, FAX: 801-972-2756; Empl.: 100

KEITHLEY INSTRUMENTS

FAX: 216-248-6168

KEITHLEY INSTRS., 28775 Aurora Rd., Cleveland, OH 44139, Tel: 800-552-1115; Empl.: 750; *Sls. Mgr.:* Mike Sciulli ..... **D•1275-1277**

Local Sales Offices & Reps

AL Huntsville, W. A. Brown Instrs. 205-830-9224
AZ Tempe, Aztec Entprs. 602-431-8401
CA Carson, Tritek Solutions, Inc. 213-515-1590
PA Huntington Valley, Scientific Reps. 215-322-6500
CO Denver, Aztec Entrprs. 303-779-5285
FL Orlando, W. A. Brown Instrs. 407-648-9660
IL Buffalo Grove, Torkelson 708-520-0710
IN Indianapolis, Torkelson 317-244-7867
IA Cedar Rapids, Torkelson 319-373-0200
MA Reading, Keithley 800-552-1115
MI Detroit, EQS Sys. 313-455-7920
MN Minneapolis, Torkelson 612-835-2414
MO Florissant, Keithley 800-552-1115
NJ Paramus, Keithley 800-552-1115
NM Albuquerque, Aztec Entrprs. 505-262-1688
NY Melville, Keithley 800-552-1115
NY Syracuse, Labtronics 315-455-7314
NC Cary, W.A. Brown Instrs., Inc. 919-460-1120
OH Chesterland, EQS Sys. 216-729-2222
OR Wilsonville, Syntek 503-682-2750
TX Austin, Testech 512-338-9246
TX Houston, Testech 713-893-9661
TX Richardson, Testech 214-644-5010
VA Fairfax, Scientific Assocs. 703-385-0600
WA Bellevue, Syntek 206-462-7700
WI Waukesha, Torkelson Assocs., Inc. 414-784-7736

KEITHLEY METRABYTE, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3000, TELEX: 503989, FAX: 508-880-0179; FSC No.: 1 FG 11; Empl.: 140; *Sls. Mgr.:* Gary Gross; *Dist. Mgr.:* Gary Gross ..... **D•1184**

Local Sales Offices & Reps

AL Huntsville, Magaro Assocs. 205-882-0827
AZ Tempe, Aztec Entprs. 602-431-8401
CA Orange, X. B. X. Sls. 714-998-8200
CA San Jose, Nelson Elctrn. 408-437-9300
CO Denver, Aztec Entprs. 303-779-5285
FL Orlando, Magaro & Assocs. 407-859-6546
GA Atlanta, Magaro Assocs. 404-451-8862
IL Arlington Hts., Berndt Assocs. 708-632-0900
IN Carmel, Berndt Assocs. 317-844-0114
MN Minneapolis, Berndt Assocs. 612-546-2021
MO Manchester, Vertec Assoc., Inc. 314-394-6242
NJ Elmwood Park, L & M Assocs. 201-797-0441
NM Albuquerque, Aztec Entprs. 505-262-1688
NY Canandaigua, West Technlgs., Inc. 716-394-6355
NC Greensboro, Magaro Assocs. 919-282-4424
OH Chesterland, EQS Sys. 216-729-2222
OR Beaverton, Northwest Test & Meas. ... 503-645-9000
PA Huntington Valley, Sci-Rep, Inc. 215-322-6500
RI Narragansett, Pat Assocs. 401-783-9598
TX Richardson, Testech, Inc. 214-644-5010
UT Salt Lake City, Aztec Entprs. 801-467-4675
VA Fairfax, Sci-Rep, Inc. 703-385-0600
WA Bellevue, Northwest Test & Meas. 206-881-8857
WI Milwaukee, Berndt Assocs. 414-545-8400

KEL AM, See Teltec, Inc.

KELLER-PSI, 503 No. 15A Vista Bella, Oceanside, CA 92056, Tel: 619-967-6066, TELEX: 380-948, ESYLNK: 62744770, FAX: 619-967-0563; Empl.: 8; *Sls. Mgr.:* Dick Grove; *Dist. Mgr.:* Dick Grove

KEL CONNECTORS, INC., KEL Corp., 1250 Oakmead Pkwy., No. 105, Sunnyvale, CA 94086, Tel: 408-720-9044, FAX: 408-720-1989; *Sls. Mgr.:* Jim Eilers

Local Distributors

CA San Carlos, LoDan West 415-592-4600
FL Largo, LoDan Elctrns. 813-586-2851
IL Arlington Heights, LoDan Elctrns. 708-398-5311
MN Eitzen, Capacitor Assocs. 507-495-3306

KELLY AMERICAN, INC., 640 Federal Rd., Brookfield, CT 06804, Tel: 203-775-2590, TELEX: 4750159ELECABUL, FAX: 203-775-9048; *Sls. Mgr.:* Robert Buckley

KELMET, INC., 569 W. Covina Blvd., San Dimas, CA 91773, Tel: 714-599-0954, FAX: 714-599-2835; Empl.: 6; *Sls. Mgr.:* Paul Hodge

KELTEC FLORIDA, INC., MICROWAVE PRO, P.O. Box 2917, Ft. Walton Bch., FL 32549-2917, Tel: 904-244-0043, FAX: 904-243-0103; FSC No.: 09062; Empl.: 350; *Sls. Mgr.:* I. Rampurawala

KELTECH INC., 7508 Hitech Rd., Roanoke, VA 24019, Tel: 703-362-8466, FAX: 703-362-3957; Empl.: 35; *Sls. Mgr.:* William Sinclair, Gen. Mgr.

KELTRON CORPORATION

FAX: 617-899-9602

KELTRON CORP. High Voltage Power Supply Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, TELEX: 948197; Empl.: 170; *Sls. Mgr.:* T. Chadurjian ..... **D•1099**

KELTRON CORP., Miniprinter/Security Systems Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, TELEX: 948197, FAX: 617-899-9602; FSC No.: 18662; Empl.: 250; *Sls. Mgr.:* Steven P. Sargent ..... **D•1099**

Local Sales Offices & Reps

CA Canoga Pk., Dolphin Tech Entprs. 818-710-1966
IL Palatine, Key Entprs. 708-991-2144
MD Baltimore, Advanced Tech. Sls., Inc. ... 301-323-3140
NY Amsterdam, Traxonics 518-843-1445
PA Oreland, Precision Mktg. Grp. 215-233-9233
WI South Milwauke, Key Entprs. 414-762-2323

Local Distributors

AL Decatur, Mgt. Security, Inc. 205-355-3030
CA San Francisco, SF Fire & Burg. 415-861-0994
DC District of Columbia, Ellenco Inc. 301-927-4370
FL Miami, Glanz Technlg., Inc. 305-893-1269
GA Albany, Tri-L Sys. 912-888-1266
IL Chicago, Natl. Guardian Alarm 312-775-8600
MA Georgetown, B & B Engrg. 508-352-6402
MI Bloomfield Hills, W.E. Healy & Assocs. 313-335-9245
NC Raleigh, National Security 919-821-1150
OK Tulsa, Pendergraph, Inc. 918-835-8403
TX Amarillo, Firehawk Safety Sys. 806-374-9613
WI Brookfield, John Guetzke & Assocs., Inc. 414-784-5929

KELVIN INDUSTRIES, INC., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, Tel: 818-990-1192, FAX: 818-995-6460; FSC No.: 19587; Empl.: 180; *Sls. Mgr.:* R. A. Featherston

KEMET®

FAX: 803-963-6521

KEMET ELECTRONICS CORPORATION, Box 5928, Greenville, SC 29606, Tel: 803-963-6621, TELEX: 57-0496, TWX: 810-287-2536; FSC No.: 31433; Empl.: 6,200; *Sls. Mgr.:* Robert Taylor; *Dist. Mgr.:* Dan Manly ..... **A•1082-1083**

Refer to Kemet, Union Carbide Corp., Elctrns. Div. for sales office information and for distributor listings.

Local Sales Offices & Reps

AL Huntsville 205-830-1090
AZ Tempe 602-831-2151
CA Encino 818-609-7561
CA Newport Beach 714-640-9320
CA Santa Clara 408-986-0424
CO Englewood 303-220-0759
FL Ft. Lauderdale 407-394-2326
FL Orlando 407-855-8886
GA Norcross 404-441-7701
IL
IL Schaumburg 708-517-1030
IN Carmel 317-844-7756
MD Columbia 301-992-5600
MA Wakefield 617-245-4646
MI Farmington Hills 313-489-5850
MN Edina 612-929-4642
NY Elmsford 914-347-4390
NY Liverpool 315-451-0720
NC Raleigh 919-872-2877
OH Columbus 614-885-3330
OK Tulsa 918-664-8592
PA Exton 215-363-8310
SC Greenville 803-242-5789
TX Austin 512-458-3181
TX Irving 214-556-0009
WA Kirkland 206-828-4853

Local Distributors

CA Agoura Hills, Time Elctrns. 818-707-2890
CA Compton, Harper SID 213-979-5090
CA Culver City, Hamilton/Avnet Elctrns. .. 213-558-2100
CA Los Angeles, Bell Inds. 213-826-6778
CA Sunnyvale, Capsco Sls., Inc. 408-734-3020
CO Denver, Integrated Elctrns. 303-292-5537
DE Wilmington, J.V. Elctrns. 508-657-6523
GA Gaithersburg, Pioneer Technlgs. 301-921-0660
IL Chicago, Newark Elctrns. 312-784-5100
NJ Old Bridge, Arm Bar Inds. 201-679-3377
NM Albuquerque, Alliance Elctrns. 505-292-3360
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY Central Islip, Semicap Elctrns. 516-582-4400
NY Hauppauge, L.I., Jaco Elctrns. 516-273-5500
NY Westbury, Schweber Elctrns. 516-876-4000
NC Greensboro, Golden Elctrns. 919-294-4653
NC Greensboro, Hammond Elctrns. 919-275-6391
OH Cleveland, Pioneer Elctrns. 216-587-3600
TX Fort Worth, TTI Elctrns. 817-831-8300
Can Vancouver, B.C., Deskin Sls. 604-324-8343

KEMLON PRODUCTS & DEVELOPMENT COMPANY, 6310 Sidney, Houston, TX 77021, Tel: 713-747-5020, FAX: 713-747-0049; Empl.: 165; *Sls. Mgr.:* Bob Horton

KEMTRON CIRCUITS & ELCTRNS. CORP., 110 S. Long Bch. Rd., Rockville Centre, NY 11570, Tel: 516-766-2772; Empl.: 7; *Sls. Mgr.:* Walter Carlock

KENMAR MANUFACTURING SERVICES, Kenmar Business Groups, Inc., 3020 Barrow Drive, Raleigh, NC 27604, Tel: 919-876-6049, FAX: 919-876-6292; Empl.: 35

M.S. KENNEDY CORP., 8170 Thompson Rd., Cicero, NY 13039, Tel: 315-699-9201, FAX: 315-699-8023; FSC No.: 51651; Empl.: 60; *Sls. Mgr.:* Greg Overend

KENTRON, INC., P.O. Box 142, Cedarburg, WI 53012-0142, Tel: 414-377-3733, FAX: 414-377-3733; *Sls. Mgr.:* Kenneth L. Krolski

KEN-TRON MFG., INC., 610 Industrial Dr., Owensboro, KY 42301, Tel: 502-684-0431, TELEX: 20-4305, FAX: 502-684-0435; Empl.: 100; *Sls. Mgr.:* R. Thompson

KEPCO
THE POWER SUPPLIER™

FAX: 718-767-1102

KEPCO, INC., 131-38 Sanford Ave., Flushing, NY 11352, Tel: 718-461-7000, TWX: 710-582-2631; Empl.: 300; *Sls. Mgr.:* Frank Toich ..... **D•1837-1870**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown, Inc.	205-830-9224
AZ	Phoenix, Aztec Entprs.	602-431-8401
CA	Carson, TRITEK	213-515-1590
CA	San Diego, Earle Assocs., Inc.	619-278-5441
CA	Sunnyvale, N-S Westronics	408-745-1102
CO	Denver, Aztec Entprs.	303-779-5285
CT	Bethel, Ray Perron & Co., Inc.	203-798-0261
CT	Waterbury, R. Perron Co.	203-756-9684
DC	Washington, Eastern Instrmn. Corp.	301-384-8500
FL	Ft. Lauderdale, W. A. Brown Instrs., Inc.	305-581-6444
FL	Melbourne, W. A. Brown Instrs., Inc.	407-723-0766
FL	Orlando, W. A. Brown Instrs., Inc.	407-648-9660
GA	Atlanta, W. A. Brown Instrs., Inc.	404-449-7160
KS	Kansas City, ATECH, Div. of ATA, Inc.	913-268-9644
MD	Baltimore, Eastern Instrmn. Corp.	301-792-7039
MA	Boston, R. Perron Co.	617-449-6162
MI	Plymouth, EQS	313-445-7924
MN	Plymouth, Kepco Inc.	612-559-1128
MO	St. Louis, ATECH, Div. of ATA, Inc.	314-949-9075
NM	Albuquerque, Aztec Entrps.	505-262-1688
NY	Liverpool, NTS Assocs., Inc.	315-451-1091
NC	Cary, W. A. Brown Instrs., Inc.	919-460-1120
OH	Chesterland, EQS	216-729-2222
OK	Tulsa, Airep Elctrns.	918-592-7711
OR	Beaverton, H. Levinson Co.	503-690-1312
TX	Austin, Airep Elctrns.	512-327-0778
TX	Dallas, Airep Elctrns.	214-349-4360
TX	Houston, Airep Elctrns.	713-952-5395
UT	Ogden, Aztec Entprs., Inc.	801-467-4675
WA	Seattle, H. Levinson Co.	206-382-1300
WI	Milwaukee, Star Engineering	414-645-3680
Can	Downsview, Ont., Rayonics	416-736-1600
Can	Ottowa, Ont., Rayonics	613-521-8251
Can	St. Laurent, Que., Rayonics	514-335-0105

KEPRO CIRCUIT SYSTEMS, 630 Axminister Dr., Fenton, MO 63026-2992, Tel: 314-343-1630, FAX: 314-343-0668; FSC No.: 5999; Empl.: 17; *Sls. Mgr.:* Jeff R. Keil; *Dist. Mgr.:* Jeff R. Keil

KEPTEL/ARMIGER, 56 Park Rd., Tinton Falls, NJ 07724, Tel: 800-526-3697, 201-389-8800; Empl.: 300; *Sls. Mgr.:* Kathy Plesnarski; *Dist. Mgr.:* Larry Bucknell

KESSLER-ELLIS PRODS., 120 1st Ave., Atlantic Highlands, NJ 07716, Tel: 201-291-0500, 800-631-2165, TELEX: 13-2496-, FAX: 201-291-8097; FSC No.: 28222; Empl.: 85

KESTER

FAX: 708-390-9338

KESTER SOLDER DIV., Litton Sys., Inc., 515 E. Touhy Ave, Des Plaines, IL 60018, Tel: 708-297-1600; Empl.: 350; *Sls. Mgr.:* Nick Bohun; *Dist. Mgr.:* Carl Voelkel ..... **C•1701**

Local Sales Offices & Reps

CA	Anaheim	714-871-0280
NJ	Newark	201-589-0246

KETEMA
RODAN DIVISION

FAX: 714-630-4131

KETEMA/RODAN DIVISION, 2900 Blue Star St., Anaheim, CA 92806, Tel: 714-630-0081, TWX: 910-591-1684; FSC No.: 15454;DESC-EQP-75-1387; Empl.: 170; *Sls. Mgr.:* Jack H. Moore ..... **B•1846-1848**

Local Sales Offices & Reps

AL	Huntsville, Alpha Mktg.	205-533-0766
AZ	Phoenix, TC Elctrn. Sls., Inc.	602-994-5153
AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Chatsworth, Wes-K/Raltech	818-700-0933
CO	Westminster, Straube Assocs.	303-426-0890
IL	Inverness, Heartland Tech. Mktg.	708-358-6622
IN	Ft. Wayne, Menze Sls. Co.	219-747-5616
KS	Parker, S. W. Assocs., Inc.	913-898-6552
MA	Framingham, Marathon Sls. Ltd.	508-875-3566
MN	Mendota Hgts., G-II Sls.	612-454-3086
MO	St. Louis, Abrams & Assocs.	314-569-0447
NJ	Bellmawr, TAI Corp.	609-933-2600
NY	Melville, Comtronic Assocs.	516-249-0505
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
NC	Charlotte, Arthur, Harris Assocs.	704-542-9338
WI	Brookfield, Heartland Tech. Mktg.	414-792-0920
TX	Houston, R-Squared Elctrns.	713-820-3210
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Vancouver, R. Over Sls.	206-695-6179

Local Distributors

AZ	Tempe, Elctrn. Supp.	602-276-1199
CA	Los Alamitos, Permag Pacific Corp.	213-594-6515
CA	Riverside, Elctrn. Supp.	714-543-9214
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	Sunnyvale, Permag Sierra	408-738-1080
CO	Denver, Permag Corp.	303-693-6612
GA	Norcross, Permag S.E. Div.	404-448-4998
IL	Elk Grove Vl, Permag Cen. Div.	312-956-1140
MA	Billerica, Permag N.E. Div.	617-663-7500
MN	Eden Prairie, Permag Minnesota Div.	612-934-4635
NY	Hauppauge, Fairmont Elctrns.	516-231-3313
NY	Hicksville, Permag Atlantic Div.	516-822-3311
OH	Toledo, Permag Magnetics Div.	419-385-4621
TX	Richardson, Permag S.W. Div.	214-699-1121
WA	Bellevue, Permag N.W. Div.	206-882-2507
Can	Mississauga, Ont., R-Theta, Inc.	416-890-0221

KEWAUNEE SCIENTIFIC CORP., Technical Workstation Div., 901 FM 20, P.O. Box 930, Lockhart, TX 78644, Tel: 512-398-5292, TELEX: 752706, FAX: 512-398-5104; Empl.: 165 (This Location) 800 (Company Wide); *Sls. Mgr.:* Frank Johnson, Dir. Sls./Mktg.

Keystone
CARBON COMPANY

FAX: 814-781-7648

KEYSTONE CARBON, Thermistor Div., 1935 State Street, St. Marys, PA 15857, Tel: 814-781-1591; FSC No.: 75-263; Empl.: 1200; *Sls. Mgr.:* John A. Brock; *Dist. Mgr.:* John A. Brock ..... **B•1849-1851**

Local Sales Offices & Reps

CA	Redwood City, Hickey Inds. Sls.	415-594-9978
CA	San Diego, ProSales	619-571-1133
CT	Wethersfield, L.J. Labant	203-529-0048
GA	Marietta, J.J. Arnold	404-427-1062
IL	Palatine, David J. Brock	708-359-0955
IN	Fort Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-876-9000
IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127
KS	Shawnee, Benson Engrg.	913-491-4446
MI	Birmingham, Mi, Gregory J. Lukas	313-642-9115
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, Dave Marrone	612-566-6573
NY	Rochester, Foster & Wager	716-385-7744
OH	Cincinnati, R.O. Whitesell & Assocs.	513-528-5644
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
NC	Cary, J. E. Shea	919-481-2475
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
TX	Dallas, Benson Engrg.	214-352-7541
TX	Houston, Benson Engrg.	713-333-3112
EXP	Great Neck NY, Minthorne Int'l.	516-487-0700

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AZ	Phoenix, Allied Elctrns.	602-437-9080
AR	Little Rock, Newark Elctrns.	501-225-8130
CA	Torrance, Allied Elctrns.	213-373-8828
CO	Denver, Newark Elctrns.	303-373-4540
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Ft. Lauderdale, Newark Elctrns.	305-587-2372
GA	Norcross, Allied Elctrns.	404-446-8595
HI	Aiea, Newark Elctrns.	808-487-8951
ID	Boise, Newark Elctrns.	208-342-4311
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Indianapolis, Allied Elctrns.	317-875-0448
IA	Bettendorf, Newark Elctrns.	319-359-3711
KS	Lenexa, Allied Elctrns.	913-599-6227
KY	Louisville, Allied Elctrns.	502-452-2293
LA	Metairie, Allied Elctrns.	504-885-1195
MD	Columbia, Newark Elctrns.	301-964-4482
MA	Billerica, Allied Elctrns.	508-667-7921
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Thief River Falls, Digi-Key Corp.	800-344-4539
MS	Jackson, Newark Elctrns.	601-956-3834
MO	Earth City, Allied Elctrns.	314-291-7031
NE	Omaha, Newark Elctrns.	402-392-1221
NH	Nashua, Allied Elctrns.	603-883-3006
NJ	Frenchtown, Sintec	201-996-4093
NM	Albuquerque, Newark Elctrns.	505-883-6181
NY	Fairport, Allied Elctrns.	716-425-3850
NC	Charlotte, Newark Elctrns.	704-535-5650
OH	Solon, Allied Elctrns.	216-248-4200
OK	Tulsa, Newark Elctrns.	918-832-7004
OR	Portland, Allied Elctrns.	503-245-4225
PA	Pittsburgh, Newark Elctrns.	412-343-9090
RI	Cranston, Newark Electrns.	401-943-3340
SC	Greenville, Newark Elctrns.	803-288-9610
TN	Memphis, Allied Elctrns.	901-367-2895
TX	Fort Worth, Allied Elctrns.	817-336-5401
UT	Salt Lake City, Newark Electrns.	801-484-8611
VA	Virginia Beach, Allied Elctrns.	804-363-8662
WA	Seattle, Allied Elctrns.	206-547-2827
WV	Charleston, Newark Elctrns.	304-345-6505
WI	New Berlin, Allied Elctrns.	414-796-1280
Can	Mississauga, Ont., Newark Elctrns.	416-675-8351

KEYSTONE ELECTRONICS CORP., 31-07 20th Rd., Astoria, NY 11105-2017, Tel: 718-956-8900, TELEX: 35-3700, FAX: 718-956-9040; FSC No.: 91833; Empl.: 80; *Sls. Mgr.:* Charles Gold

KEYTEK INSTRUMENT CORP., 260 Fordham Rd., Wilmington, MA 01887, Tel: 508-658-0880, TELEX: 951389 KEYTEK BURL, FAX: 508-657-4803; *Sls. Mgr.:* Michael Hopkins

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TX	Hurst, McGarrah & Assocs.	817-268-3557

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CO Littleton, Vic Myers Assocs. 303-730-7313
FL Cape Canaveral, Teqspec 407-783-3444
FL Palm Harbor, Teqspec 813-942-6006
HI Honolulu, Honolulu Elctrns. 808-949-5564
IL Elmhurst, Sector Engrg. Sls. 708-530-7850
IN Indianapolis, Sector Engrg. Sls. 317-253-9221
KS Lenexa, Midtec Assocs. 913-541-0505
MD Wheaton, Brimberg Sls. 301-946-2670
MA Billerica, Eastronix 508-670-2400
MI Bloomfield Hills, MacKellar Assoc. Inc. 313-335-4440
MN Minneapolis, Sector Engrg. Sls. 612-378-2123
MO St. Louis, Midtech Assocs. 314-275-8666
NJ Ridgefield Park, Scientific Dvcs. East 201-440-1400
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UT Salt Lake City, Vic Myers Assoc. Inc. .. 801-581-1760
WA Bellevue, Syntek, Inc. 206-462-7700
WI Milwaukee, Sector Engrg. Sls. 414-352-8280
PR San Juan, David S. Ternent 809-762-2688
Can Burnaby, BC, Interfax Sys., Inc. 604-430-1410
Can Nepean, Ont., Interfax Sys., Inc. 613-726-8888
Can Rexdale, Ont., Interfax Sys., Inc. 416-674-8970
Can St. Laurent, Que., Interfax Sys., Inc. 514-336-0392

KILO INTERNATIONAL, 1952 Billings Ave., Provo, UT 84606, Tel: 714-593-4626, FAX: 714-596-8023; FSC No.: 05129; Empl.: 50; *Sls. Mgr.:* James T. Davis; *Dist. Mgr.:* James T. Davis

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CA Campbell, Kottmeier Assocs. 408-371-8700
CA La Habra, Cygnus Sls. Engrg. Corp. ... 213-691-2993
FL Orlando, Comp. Design Mktg. 407-240-3903
GA Atlanta, Electro Tech 404-262-1522
IL Elgin, Gassner & Clark, Inc. 312-695-9540
IA Cedar Rapids, Seltec Sls. Corp. 319-364-7660
KS Overland Pk., Spectrum Sls. 913-648-6811
NH Nashua, Bell Controls 603-882-6984
NM Albuquerque, Cleveland Entprs., Inc. .. 505-265-7893
NY Great Neck, Trionic Assocs. 516-466-2300
NY Rochester, Lamb Comp., Inc. 716-323-1250
NC Winston-Salem, DGW, Inc. 919-768-7166
OH Cleveland, Electronic Components, Inc. 216-331-5330
OH Columbus, Electronic Comp., Inc. 614-231-2318
OH Miamisburgh, Electronic Comps., Inc. 513-866-3340
OR Tigard, Components West, Inc. 503-684-1671
TX Dallas, Caton Sls. Co. 214-243-4718
WA Redmond, Components West, Inc. 206-885-5880
Can Brit. Columbia, Macom Agencies, Ltd. 604-271-2661

KINEMETRICS/SYSTEMS, Kinemetrics, Inc., 222 Vista Ave., Pasadena, CA 91107, Tel: 818-795-2220, TELEX: 67-5402, FAX: 818-795-0868; Empl.: 65; *Sls. Mgr.:* Mel Lund

KINEMETRICS/TRUETIME, 3243 Santa Rose Ave, Santa Rosa, CA 95407, Tel: 707-528-1230, TELEX: 176687(TRUETIME SARO), FAX: 707-527-6640; Empl.: 45; *Sls. Mgr.:* R. J. Dielman

KINETICSYSTEMS, 11 Maryknoll Dr., Lockport, IL 60441, Tel: 815-838-0005, TWX: 910-638-2831, FAX: 815-838-4424; Empl.: 135; *Sls. Mgr.:* Norman R. Ellison, Dir. Domestic Sls.

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AZ Phoenix, C.T. Carlberg Assocs. 602-468-0750
CO Denver, Parker-Webster 303-841-4888
GA Norcross, Benchmark Tech. Sls. 404-446-1711
IL Rolling Hills, Eagle Tech. Sls. 708-991-0700
IA Cedar Rapids, Contact Manufacturer 818-281-9788
MD Gaithersburg, Contact Manufacturer .. 818-281-9788
MO Florissant, Contact Manufacturer 818-281-9788
MO St. Louis, Rush & West Assocs. 314-965-3322
NY Tuckahoe, Disty-Brown Sls. 800-933-4789
NC Raleigh, Benchmark Tech. Sls. 919-850-0633
PA Ft. Washington, Contact Manufacturer 818-281-9788
VA Front Royal, Contact Manufacturer 818-281-9788
WI Colgate, Contact Manufacturer 818-281-9788

Local Distributors

AZ Phoenix, C.T. Carlsberg & Assocs. Inc. 800-888-1408
CA Chatsworth, Passive Comps. Inc. 818-700-8838
CA Los Angeles, Electric Switches Inc. ... 800-252-4640
CA Milpitas, Sierra West 408-945-1050
CA Mission Viejo, Opto Plus, Inc. 714-380-8654
CA San Diego, Southland Comps. Inc. 619-673-3800
CA Santa Maria, Garrett/IEU Inc. 805-922-6383
CA Simi Valley, Tri-Electro Sls., Inc. 805-527-3317
CO Englewood, Computech Mktg. 303-773-3981
CT Norwalk, Cobra Comps., Inc. 203-847-6442
CT Sudbury, KSA of New England 508-443-5881
FL Boca Raton, N.R.C. Elctrns., Inc. 407-241-8600
FL Clearwater, Atlantic Elctrns., Inc. 813-531-5900
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MA W. Springfield, Astrex 800-445-9763
MO St. Louis, Ric-Tronics, Inc. 314-997-4707
MO St. Louis, Rush & West 314-965-3322
NJ Pennsauken, Astrex 800-257-7713
NJ Tenafly, Michelle Assocs. 201-894-8964
NY East Syracuse, ADR Technlgs., Inc. ... 315-437-7087
NY Endwell, Astrex 800-252-8711
NY Endwell, Elctrns., Inc. 607-754-3823
NY Tuckahoe, Disty-Brown Sls. Co. 914-933-4789
NC Raleigh, Benchmark Tech. Sls., Inc. ... 919-850-0633
TX Austin, Wofford Elctrns., Inc. 512-339-1131
TX Carrollton, LCD Elctrns., Inc. 800-245-0342
TX Dallas, Orion Assocs. 214-241-3505
TX Richardson, Ewing Elctrns., Inc. 214-231-6725
WA Bellevue, Luscombe Engrg. 206-223-1541
EXP Los Angeles, Kingbright USA Corp. ... 818-281-9788

KINGS ELECTRONICS CO., INC., 40 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-5000, TELEX: 6818293; Empl.: 550; *Sls. Mgr.:* Fred Pack; *Dist. Mgr.:* Ed Lagarto/F. Dellaiancano

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KISTLER INSTRUMENTS CORP., 75 John Glenn Dr., Amherst, NY 14221-2171, Tel: 716-691-5100, FAX: 716-691-5226; Empl.: 67; *Sls. Mgr.:* Mike Murphy

KISTLER-MORSE, P.O. Box 3009, Redmond, WA 98073, Tel: 206-881-8000, FAX: 206-883-4893; *Sls. Mgr.:* Sesh Velamoor

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KLOCKNER MOELLER, 25 Forge Pkwy., Franklin, MA 02038, Tel: 508-520-7080, FAX: 508-520-7084; Empl.: 250; *Sls. Mgr.:* T. Thornton; *Dist. Mgr.:* P. Feruglio

KMC SYSTEMS, INC., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432, Tel: 201-447-0007, FAX: 201-447-0014; Empl.: 35; *Sls. Mgr.:* E. Verder

KMS ADVANCED PRODUCTS, INC., 700 KMS Place, P.O. Box 1868, Ann Arbor, MI 48106-1868, Tel: 313-769-1780, FAX: 313-769-8660; Empl.: 150; *Sls. Mgr.:* Al Schalk

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KNOWLES ELECTRONICS, INC., 1151 Maplewood Dr., Itasca, IL 60143, Tel: 708-250-5100, TELEX: 433-0330, FAX: 708-250-0575; *Sls. Mgr.:* W. Jeff Taylor

KNURR USA INC., Knurr A.G., 1890 N. Voyager Ave., Simi Valley, CA 93063, Tel: 805-526-7733, FAX: 805-584-8371; Empl.: 20; *Sls. Mgr.:* Georg Wolf (acting)

KOA

FAX: 814-362-8883

KOA SPEER ELECTRONICS, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, Tel: 814-362-5536, TELEX: 91-4404; FSC No.: 09021; Empl.: 3000; *Sls. Mgr.:* L. G. Holzwarth; *Dist. Mgr.:* L. Rice .... **A•1002, 1085, 1834, 1930-1934**

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CA	Garden Grove, ELSCO Elctrns.	714-891-4621
Can	Mississauga, Ont., Indigo Elctrns.	416-670-0284
Can	Montreal, Que., Indigo Elctrns.	514-696-6104
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Caltron Comps.	408-980-0181
CO	Boulder, R. G. Entprs.	303-447-9211
CT	Plainville, Northeast Representatives	203-747-2423
FL	Altamonte Springs, APM Assocs.	407-869-6831
FL	Ft. Lauderdale, APM Assocs.	305-978-9941
FL	Tampa, APM Assocs.	813-886-2457
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Arlington Hgts., C. L. Greenslade Sls.	708-593-3450
IN	Fort Wayne, John F. Kilfoil	219-483-6208
KS	Overland Pk., Spectrum Sls.	913-648-6811
LA	Covington, Cartwright & Bean	504-892-1780
MA	Hingham, Northeast Representatives	617-749-8700
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Edina, Grayden & Flemmer	612-941-1120
MS	Jackson, Cartwright & Bean	601-981-1170
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Mont Vernon, Northeast Representatives	603-880-8199
NJ	Cherry Hill, Metz-Benham Assoc.	609-424-0404
NM	Albuquerque, SynTech	505-266-7951
NY	East Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Endwell, Tri-Tech Elctrns.	607-754-1094
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Fishkill, Tri-Tech Elctrns.	914-897-5611
NY	Great Neck, MOS Assocs.	516-487-3966
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, John F. Kilfoil	513-791-6150
OR	Tigard, Earl & Brown Co.	503-639-2100
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Lewisville, Jim Hughes	214-221-1536
WA	Redmond, Earl & Brown Co.	206-885-5064
PR	San German, Digit-Tech Sls.	809-892-4260
Can	Calgary, Alb., A. Deskin Sls.	403-270-4440
Can	Edmonton, Alb., A. Deskin Sls.	403-466-2106
Can	Kanata, Ont., Indigo Elctrns.	613-831-3107
Can	Transcona, Manit., A. Deskin Sls.	204-224-1321
Can	Vancouver, B.C., A. Deskin Sls.	604-324-8343

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AL	Huntsville, Reptron	205-722-9500
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CA	Santa Ana, TTI	714-641-9393
AZ	Tempe, Shelley- Ragon	602-894-2058
AZ	Tempe, T.T.I.	602-431-1191
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Campbell, Lartronics	408-379-6454
CA	Chatsworth, MIL-Comm Distrs.	818-998-3111
CA	Chatsworth, Shelley-Ragon	818-998-3333
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Fountain Valley, Comps. Ctr.	714-979-0433
CA	Garden Grove, Natl. Elctrns.	714-892-7749
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CA	Irvine, KELEX	714-863-1230
CA	Milpitas, T.T.I.	408-946-5577
CA	Mission Hills, T.T.I.	818-891-8885
CA	San Diego, Shelley-Ragon	619-453-7133
CA	San Diego, T.T.I.	619-748-2025
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, Jaco	408-432-9290
CA	San Jose, Shelley Ragon	408-432-0600
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Sunnyvale, SAI	408-745-0800
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CA	Tustin, Jaco Elctrns.	714-258-9003
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CT	Wallingford, T.T.I.	203-284-7474
CT	Wallingford, Utronics	203-265-2724
FL	Boca Raton, Jaco Elctrns.	407-241-7943
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Orlando, TTI	407-859-1000
FL	Tampa, Reptron	813-855-4656
FL	Tampa, Reptron Elec.	813-854-2351
FL	Tampa, Shelley-Ragon	813-623-6560
FL	W. Palm Beach, Atlantic Elctrns.	407-686-8553
GA	Norcross, Reptron	404-446-1300
GA	Norcross, T.T.I.	404-662-0911
IL	Bensenville, Goold Elctrns.	708-860-7171
IL	Glendale Heights, Shelley-Ragon	708-529-9977
IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IL	Rosemont, Advent Elctrns.	708-298-4210
IL	Schaumburg, Reptron Elctrns.	708-882-1700
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Baltimore, Radio Elec. Svc. Co.	301-931-8200
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MD	Columbia, Jaco Comps.	301-995-6620
MD	Columbia, T.T.I.	301-995-1331
MA	Billerica, Baldwin Comp. Ctr.	617-667-6710
MA	Chelmsford, Shelly-Ragon	508-250-9666
MA	Norwood, EMTEL Electronics	617-769-9500
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, North Star Elect.	508-657-5155
MA	Wilmington, T.T.I.	508-658-4700
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Hibbing, Minn Tech Elctrns.	218-262-5228
MN	Minnetonka, Reptron	612-938-0000
MN	Minnetonka, T.T.I.	612-933-8555
MN	St. Paul, Shelley-Ragon Elctrns.	612-642-2828
MO	Independence, Shelley-Ragon Elctrns.	816-254-3410
MO	St. Louis, Franklin Elctrns.	314-429-3111
NE	Lincoln, Scott Elctrns.	402-466-8221
NV	Las Vegas, Kiesub Corp.	702-733-3888
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Mount Laurel, TTI Inc.	609-234-6400
NJ	Mt. Laurel, Capstone Elctrns.	609-727-7800
NJ	Rockaway, Nasco	201-625-7777
NM	Albuquerque, Betatron	505-821-1122
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Buffalo, Summit Distrs.	716-887-2845
NY	Hauppauge, Jaco	516-273-5500
NY	Melville, S.A.I.	516-293-2710
NC	Raleigh, Reptron	919-832-3117
NY	Rochester, Summit Distrs.	716-334-8110
NY	Ronkonkoma, Baldwin Comp. Ctr.	516-588-5700
NY	Ronkonkoma, Prime Comps.	516-737-1730
NY	Ronkonkoma, T.T.I.	516-737-2000
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Raleigh, Jaco	919-876-7767
NC	Raleigh, Resco-Raleigh	919-781-5700
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Cleveland, Roberts Elect. Corp.	216-238-1711
OH	Columbus, T.T.I.	614-848-5770
OH	Independence, TTI	216-328-9755
OH	Solon, Reptron	216-349-1415
OH	Worthington, Reptron	614-436-6675
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Murphy Elctrns.	503-642-2001
NC	Raleigh, Capstone Elctrns.	919-954-0600
PA	Erie, Rem Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	Philadelphia, Shap	215-969-3300
PA	Trevose, Sager Electronics	215-464-4336
RI	Pawtucket, Major Edwards	401-725-7400
TX	Addison, Jaco/QC Elctrns.	214-733-4300
TX	Carrollton, Capstone Elctrns.	214-380-9049
TX	Fort Worth, TTI	817-847-6666
TX	Ft. Worth, Carlton Bates	817-831-0395
TX	Ft. Worth, T.T.I.	817-831-8300
TX	Ft. Worth, T.T.I. Inc.	817-595-3100
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Jaco	214-235-9575
WA	Redmond, JACO Electronics	206-881-9700
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Redmond, Shelley-Ragon	206-883-2220
WA	Redmond, T.T.I.	206-882-0291
WI	Oconomowac, G W Elctrns.	414-567-9445
Can	Calgary, Alb., A. Deskin Sls.	403-270-4440
Can	Edmonton, Alb., A. Deskin Sls.	403-468-3019
Can	Markham, Ontario, Semad	416-475-3922
Can	Transcona, Manit., A. Deskin Sls.	204-224-1321
Can	Vancouver, B.C., A. Deskin Sls.	604-324-8343

KOEP PRECISION STANDARDS, INC., 121 Helen Street, 2nd Fl, South Plainfield, NJ 07080, Tel: 201-757-2220/2277, FAX: 201-757-2332; FSC No.: 57114; Empl.: 4; *Dist. Mgr.:* N/A

KOLIN INDS., Box 300, Pound Ridge, NY 10576, Tel: 914-764-5775, FAX: 914-764-5386; Empl.: 30; *Sls. Mgr.:* J. Kolinsky

KONTES, Kimble Div. of Owens/IL, 1001 Spruce St., Vineland, NJ 08360, Tel: 800-223-7150, TWX: 510-687-8967

KONTRON ELEKTRONIK-US KONTRON ELEKTRONIK GMBH-SUB. BM, 66 Cherry Hill Dr., Beverly, MA 01915, Tel: 508-927-6575, FAX: 508-927-6511; Empl.: 30

KOOLTRONIC, INC., Hamilton Ave., Hopewell, NJ 08525, Tel: 609-466-3400, TELEX: 843345, FAX: 609-466-1114; Empl.: 200; *Sls. Mgr.:* John J. Drages

KOOLTRONIC, INC., 1700 Morse Avenue, Ventura, CA 93003, Tel: 805-642-8521, FAX: 805-658-2901; Empl.: 200

KRAFT DYNATRONIX, INC., 105 Power St., Amery, WI 54001, Tel: 715-268-8118, 800-826-7172, FAX: 715-268-8183; Empl.: 28; *Sls. Mgr.:* R. W. Kappler; *Dist. Mgr.:* R. W. Kappler, Natl. Sls. Mgr.

KRECKMAN, HERB, CO., 27 Spruce Cabin Road, Cresco, PA 18326, Tel: 717-595-2212, FAX: 717-595-2024; Empl.: 4

KR ELECTRONICS, INC., 91 Avenel St., Avenel, NJ 07001, Tel: 908-636-1900, FAX: 908-636-1982; FSC No.: 55259; Empl.: 20; *Sls. Mgr.:* none ..... **A•1682-1683**

Local Sales Offices & Reps

CO	Englewood, Tech. Mktg. Co.	303-770-8994
OH	Kettering, Frank Bold & Assocs.	513-298-6145
TX	Richardson, Jim Wisdom & Assocs., Inc.	214-470-9093

KRENZ ELECTRONIC, INC., 1020 Calle Cordillera Ste.107, San Clemente, CA 92672, Tel: 714-361-2433, FAX: 714-361-2434; Empl.: 75; *Sls. Mgr.:* Alex Schlag, VP

KRISTEL CORPORATION, 833 Industrial Dr., West Chicago, IL 60185, Tel: 708-293-0850, FAX: 708-293-1255; Empl.: 35; *Sls. Mgr.:* Kevin Michael

KRL

FAX: 603-624-0634

KRL/BANTRY COMPONENTS, INC., 160 Bouchard St., Manchester, NH 03103, Tel: 603-668-3210; FSC No.: 18235; Empl.: 100; *Sls. Mgr.:* Bert A. Spiller ..... **A•1935-1940**

Local Sales Offices & Reps

TX	Grand Prairie, Claybrook & Assocs.	214-262-1188
CA	Mtn. View, Francisco & Assocs.	415-962-1717
CA	Sepulveda, Gil & Assocs.	818-894-1262
FL	Boca Raton, Sls. Specialists	813-754-1329
IN	Indianapolis, CC Electro Sls.	800-423-7799
NH	Amherst, D. A. Crowley & Assocs.	603-673-7050
NY	Port Washington, Ashtec	516-767-0336
NY	Rochester, H. C. Johnson Agencies	716-586-0777
OH	Akron, Augnat Assocs.	216-273-1211
TX	Dallas, Claybrook & Assocs.	214-690-9881
PA	Wyndmoor, Precision Mktg. Grp.	215-233-9233
TX	Houston, Milco Mktg.	713-723-5003
TX	Richardson, Milco Mktg.	214-738-2716
UT	Salt Lake City, Sage Assocs.	801-467-5451
WA	Seattle, The Harry Levinson Co.	206-382-1300

Local Distributors

MA	Billerica, Baldwin Comps.	617-667-6710
NY	Ronkonkoma, Baldwin Comps. Center	516-588-5700,800-645-5608
PA	Harrisburg, Ad-Tech	717-939-8337

KROHN-HITE CORP., Avon Indl. Pk., Bodwell St., Avon, MA 02322, Tel: 508-580-1660, FAX: 617-583-8989; Empl.: 35 ..... **A•1684; D•1279**

Local Sales Offices & Reps

AL	Huntsville, Gentry Assocs.	205-837-0692
AZ	Phoenix, Odyssey 1	602-246-8846
CA	Huntington Bch., Sci-Dev West	714-840-3501
CA	San Jose, Scientific Devs. West	408-554-0455

CO	Englewood, Odyssey 1	303-773-8176
FL	Ft. Lauderdale, Gentry Assocs.	305-791-8405
FL	Orlando, Gentry Assocs.	305-859-7450
FL	Tampa, Gentry Assocs.	813-886-0720
GA	Atlanta, Gentry Assocs.	404-998-2828
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-649-6996
LA	Gretna, Gentry Assocs.	504-367-3975
MD	Baltimore, Sci-Rep	703-385-0600
MI	Detroit, EQS Sys.	313-961-3042
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Ramsey Assocs.	314-878-5042
NJ	Englewood, Sci. Devices E.	201-871-3916
NM	Albuquerque, Odyssey 1	505-265-6645
NY	Syracuse, Labtronics	315-455-7314
OH	Chesterland, EQS Sys.	216-729-2222
OH	Columbus, EQS Sys.	614-228-3453
WA	Bellevue, Sci. Dvcs., N.W.	206-747-5189
PA	Pittsburgh, EQS Sys.	216-729-2222
PA	Spring House, Scientific Devices East	215-643-3335
SC	Columbia, Gentry Assocs.	803-772-6786
TN	Knoxville, Gentry Assocs.	615-584-0281
TX	Houston, Barnhill Assocs.	713-444-1733
VA	Fairfax, Sci-Rep	703-385-0600
WA	Bellevue, Sci. Dvcs. N. W.	206-747-5169
WI	Milwaukee, Berndt Assocs.	414-545-8400

KRYSTINEL CORP., 126 Pennsylvania Ave., Paterson, NJ 07509, Tel: 201-345-8900, TWX: 710-988-5931, FAX: 201-345-1172; Empl.: 200; *Sls. Mgr.:* William Perkins ,Mgr.Customer Service

KSI, See Kaiser Systems, Inc.

K-SYSTEMS OF TEXAS, INC., 11501 Rojas Dr. Ste. P, El Paso, TX 79936, Tel: 915-598-9769, TELEX: WUI 6502763972, FAX: 915-593-2080; Empl.: 4; *Sls. Mgr.:* J.C. Kates

K-TRONICS, See U. S. Elco Inc. (Under Elco)

K-TWO INDUSTRIES, 4331 Miranda Ave., Palo Alto, CA 94306, Tel: 408-720-9316; Empl.: 5

KULITE SEMICONDUCTOR PRODS., INC., One Willow Tree Rd., Leonia, NJ 07605, Tel: 201-461-0900, TELEX: 685-3296, FAX: 201-461-0990; Empl.: 350

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Local Sales Offices & Reps

AL	Huntsville, Jim Springer, Inc.	205-883-4163
AZ	Scottsdale, Dave Menegey Assocs.	602-994-9519
CA	Hollywood, B. J. Wolfe Entprs.	213-877-5518
CA	Walnut Creek, Dale-Dahl Assocs.	415-933-9595
CO	Boulder, Measurement Cnslts.	303-449-7506
FL	Bonita Springs, United Sls. Assocs.	813-947-4115
IL	Carpentersville, Precision Meas. Prods., Inc.	312-426-4446
MA	Brockton, JHL Assocs.	508-580-1703
MI	Madison Heights, WKM Assocs.	313-588-2300
MN	Minneapolis, Trask Engrg.	612-537-2434
MO	St. Louis, Ozark Elctrn. Mktg.	314-423-7200
NJ	Glen Gardner, United Sls. Assocs.	813-947-4115
NM	Albuquerque, Amonette Entprs.	505-344-4143
NY	Fairport, D.H. Brennan	716-223-7935
OH	Cleveland, WKM Assocs.	216-524-5930
OH	Dayton, WKM Assocs	513-434-7500
PA	Doylestown, United Sls. Assocs.	813-947-4115
PA	Pittsburgh, WKM Assocs.	412-892-2953
TX	Dallas, Seaton Corp.	214-980-9860
UT	Centerville, MC 2	801-298-3388
WA	Seattle, Brett Assocs.	206-431-8090

KULKA (DIALIGHT CO.), See H.H. Smith, NT-T Inc.

KURZ INSTRUMENTS INC., 2411 Garden Rd, Monterey, CA 93940, Tel: 800-424-7356, TELEX: 172275; FSC No.: 94-24-11681; Empl.: 72; *Sls. Mgr.:* Tom Setliff

K-W MANUFACTURING CO., INC., P. O. Box 508, Prague, OK 74864, Tel: 405-567-2285, TELEX: 4932625, FAX: 405-567-4153; Empl.: 60; *Sls. Mgr.:* Freda Pickard

KYCON CABLE & CONNECTOR, INC., 1772 Little Orchard St., San Jose, CA 95125, Tel: 408-295-1110, FAX: 408-295-8054; Empl.: 9; *Sls. Mgr.:* Wendy Wuerth; *Dist. Mgr.:* Wendy Wuerth **C•1422-1423, 1765**

Local Sales Offices & Reps

AZ	Tempe, ACS of Arizona	602-731-9711
CA	Aliso Viejo, Pro Assocs.	914-588-2700
CA	San Jose, Kycon Cable & Connector, Inc.	408-295-1110
CA	San Jose, Kycon Sls. Off.	408-295-1110
FL	Clearwater, Dan-Tech Sls.	813-791-4551
FL	Miramar, Dan-Tech Sls.	305-963-6142
GA	Norcross, Pinnacle Mktg.	404-621-0212
KY	Lexington, Protocol Sls.	606-272-4203
MA	Sudbury, KSA of New England	508-443-5881
MO	Chesterfield, Weisler and Assocs.	314-537-0010
NJ	Oakland, Relay Specialties	800-526-5376
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OH	Twinsburg, Protocol Sls.	216-425-2569
OR	Beaverton, Quest Mktg.	503-641-7377
TX	Dallas, Weisler and Assocs.	214-437-2386
WA	Bellvue, Quest Mktg.	206-747-9424

Local Distributors

MA	Ashland, Quality	508-881-6500
NC	Raleigh, Resco Raleigh	919-781-5700

KYOCERA AMERICA, INC., 8611 Balboa Avenue, San Diego, CA 92123, Tel: 619-576-2766, TELEX: 47Z3069; Empl.: 1,150; *Sls. Mgr.:* Rick Sigliano

KYOCERA NORTHWEST, Electronic Components Group, 5701 E. Fourth Plain Blvd., Vancouver, WA 98661, Tel: 206-696-2840, FAX: 206-695-5836; FSC No.: 0FDX0; Empl.: 450; *Sls. Mgr.:* Koji Kanatani; *Dist. Mgr.:* Phil Elliott, Dist. Sales

LAB-LINE INSTRUMENTS, 15th & Bloomingdale, Melrose Park, IL 60160, Tel: 708-450-2600, TELEX: 6781028, FAX: 708-450-0943; Empl.: 225

LABORATORY TECHNOLOGIES CORP., 400 Research Dr., Wilmington, MA 01887, Tel: 508-657-5400, TELEX: 989695, FAX: 508-658-9972; Empl.: 31; *Sls. Mgr.:* Neil Parmenter

LABTRONICS INC., 75 Rickson Ave., Guelph, Ont., Canada N1G 3B6, Tel: 519-767-1061

LAFRANCE CORP., Entprs & Exec Aves, Philadelphia, PA 19153-3893, Tel: 215-365-8000, TELEX: 506-082, FAX: 215-365-4420; Empl.: 502; *Sls. Mgr.:* J. Singer

LAFRANCE CORP., PACTEC DIV., See PacTec Div., LaFrance Corp.

LAKE SHORE CRYOTRONICS, INC., 64 E. Walnut St., Westerville, OH 43081, Tel: 614-891-2243, TELEX: 24-5415, FAX: 614-891-1392; *Sls. Mgr.:* David L. Calvelage

LA MARCHE MFG., 106 Bradrock Dr., Des Plaines, IL 60018, Tel: 708-299-1188, TELEX: 28-2526; FSC No.: ;15736; Empl.: 225

LABORATORY TECHNOLOGIES CORP., 400 Research Drive., Wilmington, MA 01887, Tel: 508-657-5400, TELEX: 989695, FAX: 508-658-9972; Empl.: 30

LAMBDA ELECTRONICS INC., 515 Broad Hollow Rd., Melville, NY 11747-3700, Tel: 516-694-4200, FAX: 516-293-0519; Empl.: 1200; *Sls. Mgr.:* John Valenti

LAMBERT ENGINEERING INC., 601 N.W. Harmon Blvd., Bend, OR 97701, Tel: 503-388-2623, FAX: 503-388-1794; Empl.: 9

LAMB INDUSTRIES, INC., 6585 S.W. Raleighwood Ln., Portland, OR 97225, Tel: 503-297-8878, 800-824-9374, TELEX: 263373LAMBUR, FAX: 503-297-8879; Empl.: 5; *Sls. Mgr.:* Gary Rhode; *Dist. Mgr.:* Joanne McIntyre **B•1728-1729**

Local Sales Offices & Reps

CA	Canoga Park, Acorp Inds.	818-700-2991
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Diego, Sigma Elctrns.	619-565-2000
IA	Des Moines, Mid State Distrbg.	515-244-7231
MN	Fridley, Voyager Elctrns.	612-571-7766
MO	St. Louis, Wes Garde	314-567-7776
NE	Omaha, Mid State Distrbg.	402-592-5965
WA	Redmond, Priebe Elctrns.	206-881-2363

Local Distributors

CA	San Carlos, Logan Elctrns.	415-594-0700
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Van Nuys, EW Elctrns.	714-857-4422
CA	Van Nuys, Wes-Garde	213-873-4802
CT	Hartford, Wes-Garde	203-527-7705
FL	Lakeland, Wes-Garde	813-644-7564
IL	Carrol Stream, Wes-Garde	312-653-1460
MN	Minneapolis, Tor/Tec Corp.	612-866-3662
NY	Freeport, KRP Elctrns.	516-623-3346
OH	Westerville, Wes-Garde	614-885-0319
OR	Portland, Radar Elctrns.	503-232-3404
TX	Dallas, Wes-Garde	214-357-1768
WA	Seattle, Radar Elctrns.	206-282-2511
WI	Mequon, Lakeview Elctrns.	414-377-8250

LAMP TECHNOLOGY, INC., 1645 Sycamore Ave., Bohemia, NY 11716, Tel: 516-567-1800, FAX: 516-567-1806; Empl.: 20; *Sls. Mgr.:* Janet Lang

LAMPTRONIX CO., LTD.

FAX: 815-455-7916

LAMPTRONIX CO., LTD., 81 N. Williams St., Crystal Lake, IL 60014-4443, Tel: 815-455-0400; FSC No.: 61342; *Sls. Mgr.:* Karen Huizenga **B•1173**

Local Sales Offices & Reps

CA	Signal Hill, Leo Miller Co.	213-498-6063
IL	Tinley Park, South Lake Comps.	708-532-4055
IN	Indianapolis, D-M Assocs.	317-842-4424
CA	Westlake V1., Casco	818-889-7889
NJ	Moutainside, H.G. Richter, Inc.	201-233-4615
NC	Raleigh, Eastern Elctrns.	919-876-7591
PA	Phonexville, Richter Co.	215-495-6176
RI	Warwick, Ertronics, Inc.	401-732-3567

LAMTECH ELECTRONICS, 620 Easy Street, Garland, TX 75042, Tel: 214-272-3504, FAX: 214 272 7176; FSC No.: O7R487; Empl.: 100; *Sls. Mgr.:* Phillip Rasor; *Dist. Mgr.:* Phillip Rasor

LANCE INDUSTRIES, 13001 Bradley Avenue, Sylmar, CA 91342-3832, Tel: 818-367-1811, FAX: 818-362-3594; *Sls. Mgr.:* Jerry Updyke; *Dist. Mgr.:* Joe Barris

LAND INFRARED, Land Instruments Intl. Inc., 2525 Pearl Buck Road, Bristol, PA 19007, Tel: 215-781-0700, 800-523-8989, FAX: 215-781-0723; Empl.: 25; *Sls. Mgr.:* Richard Parello

LANDIS & GYR, INC., See Maxmar Controls Inc.

L & L SPECIAL FURNACE, 20 Kent Rd., Aston, PA 19014, Tel: 215-459-9216, FAX: 215-459-3689; Empl.: 20; *Sls. Mgr.:* Greg Lewicki; *Dist. Mgr.:* Stephen Lewicki

L & R MFG. CO., 577 Elm St., Kearny, NJ 07032, Tel: 201-991-5330, FAX: 201-991-5870; Empl.: 180; *Sls. Mgr.:* Robert Lasky

LANGLEY:FLEET AEROSPACE, INC., P.O. Box 2911, San Diego, CA 92112, Tel: 619-264-3181, FAX: 619-264-4329; FSC No.: 83549; Empl.: 110; *Sls. Mgr.:* H.J. Sauer

LANSING INSTRUMENT CORP., P.O. Box 730, Ithaca, NY 14851-0730, Tel: 607-272-3265, 800-847-3535, FAX: 607-277-1953; *Sls. Mgr.:* Fred B. Widding ..... **C•1063**

LARK ELECTRONICS, INC., Box 390, New York, NY 10040, Tel: 212-569-0430; FSC No.: 52682

LARK ENGINEERING CO., Baier & Baier Inc., 27151 Calle Delgado, San Juan Capistrano, CA 92675, Tel: 714-240-1233, FAX: 714-240-7910; FSC No.: 33174; Empl.: 25

LARSON INSTRUMENT, Greenbush Rd., Orangeburg, NY 10962, Tel: 914-359-3800, FAX: 914-365-1581; Empl.: 18; *Sls. Mgr.:* A. D. Stephens

LASER CONCEPTS, Omega Organization Intl., P.O. Box 33623 E, Seattle, WA 98133, Tel: 206-364-7881, FAX: 206-542-1157; Empl.: 35; *Sls. Mgr.:* Roberta Forsythe

LASER DIODE, INC., Morgan Crucible, 1130 Somerset St., New Brunswick, NJ 08901, Tel: 201-249-7000, TWX: 710-998-0597, FAX: 201-249-9165; Empl.: 170; *Sls. Mgr.:* Stephen Lerner; *Dist. Mgr.:* Stephen Lerner

LASER PRECISION CORP., 1231 Hart St., Utica, NY 13502, Tel: 315-797-4449, TELEX: 646803; Empl.: 180; *Sls. Mgr.:* Jim Nerschook

LASERTECHNICS, INC., 5500 Wilshire Ave.,N.E., Albuquerque, NM 87113, Tel: 505-822-1123, TELEX: 757222, FAX: 505-821-2213; Empl.: 66; *Sls. Mgr.:* Keith Green; *Dist. Mgr.:* Keith Green

LASER TECHNOLOGY, INC., 10624 Ventura Blvd., N. Hollywood, CA 91604, Tel: 818-763-7091, TELEX: Cable-LASTEC (No. Hollywood), FAX: 818-763-7382; Empl.: 20; *Sls. Mgr.:* Richard Alfonso

LAUBE TECHNOLOGY, 6400 Variel Ave., Woodland Hills, CA 91367, Tel: 818-703-1188, FAX: 818-716-0422; Empl.: 20; *Sls. Mgr.:* Arnold Aloi; *Dist. Mgr.:* Teri Harrington

LAUREL™

FAX: 714-645-1239

LAUREL ELECTRONICS, INC., 709 Kings Rd., Newport Beach, CA 92663, Tel: 714-646-6846; Empl.: 4 ..... **D•1359-1361**

LAZER DATA, Electro Corporation, 2400 Diversified Way, Orlando, FL 32804, Tel: 1-800-843-2700; Empl.: 75; *Sls. Mgr.:* Dick Wheeler

L-COM®

FAX: 508-689-9484

L-COM INC., 1755 Osgood St., N. Andover, MA 01845, Tel: 508-682-6936; Empl.: 20; *Sls. Mgr.:* Scott Black ..... **C•1424-1425; D•1281-1285**

LCT ELECTRONIC CORPORATION, 700 N.Valley St., Suite K, Anaheim, CA 92801, Tel: 714-991-7317, FAX: 714-991-3661; FSC No.: 3613, 3643, 3861; Empl.: 9; *Sls. Mgr.:* Lee R. Couts ..... **C•1683**

Local Sales Offices & Reps

CA Arcadia, Van Gott & Assocs., Inc. 818-445-9728, FAX:818-445-5019
CA Santa Clara, Norcal Repco 408-988-1643, FAX:408-727-9351
CO Denver, Candal, Inc. 303-692-8484, FAX:303-692-8416
GA Atlanta, Grady Duckett Sls. Co. 404-634-7279
IN Indianapolis, Elctrn. Sls. & Eng. Inc. 317-849-4260, FAX:317-841-0231
KS Lenexa, Midtec Assocs., Inc. 913-541-0505, FAX:913-541-1729
MA Haverhill, L-K Assocs., Inc. 508-373-1313, FAX:508-373-8024
MI Farmington Hills, W.R. Hummon & Assoc. Inc. 313-474-0661,FAX:313-474-8162
MN Paul Ericson & Assoc. Inc. 612-831-5016, FAX:612-831-8266
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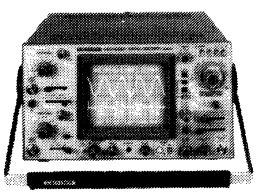

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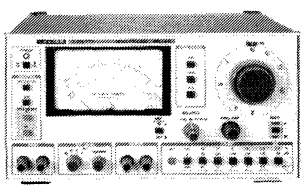

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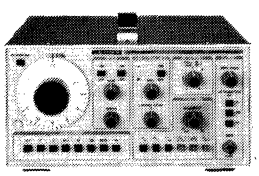

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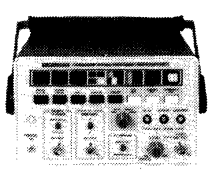

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LINE ELECTRIC PRODUCTS, P.O. Box 327, Hartford, CT 06141, Tel: 203-659-3573, 1-800-331-1137, FAX: 203-659-3576; FSC No.: 07065; Empl.: 35; *Sls. Mgr.:* Teo Babun; *Dist. Mgr.:* Bill Harris ..... **B•1537**

Local Sales Offices & Reps

CT	W. Hartford, Component Concept	203-523-4066
GA	Norcross, Electramark, Inc.	404-446-7915
Can	Brossard, Que., DB Lectro, Inc.	514-672-7029

Local Distributors

AL	Birmingham, MG Elctrns.	205-328-4525
CA	Covina, Selecta Switch	818-967-4119
CA	Havward, Electro Comps.	415-783-5800
CA	Los Angeles, Master Distrs.	213-452-1229
CA	San Diego, Shanks & Wright	714-239-0176
CT	E. Hartford, R & S Elctrn. Distrs.	203-528-9901
CT	Fairfield, Indl. Elec.	203-255-9547
FL	Hialeah, Atlas Elec. Supp.	305-885-8941
FL	Miami, Miramar Elec. Sys.	305-871-4072
GA	Rome, Battey Machine	404-291-4141
IL	Elk Grove Village, Elk Grove Elec.	312-956-6350
IN	Marion, Myers Radio Supp.	317-664-7394
KY	Louisville, Cameron & Barkley	919-758-2507
MA	Allston, Hilco Elec. Supp.	617-783-2600
MA	Lynn, Land Elctrns. Supp., Inc.	617-592-2220
NY	Nanuet, BJ Inds.	914-623-2660
NC	Forest City, Lucky One	704-245-8053
NJ	Jersey City, Cuny & Gerber	201-653-0222
NJ	Linden, Turtle & Hughes	201-574-3600
NJ	Piscataway, Fromm Elec.	209-981-0400
NJ	Secaucus, Franklin & Smith	201-864-0555
NM	Hobbs, K & S Elec. Co.	505-393-3114
NY	Baldwinsville, Scibetta Distrs.	315-622-3993
NY	Bronx, Smith Elctrns.	212-292-4670
NY	New York, Blan Elctrns.	212-233-6288
OH	Cincinnati, Cincinnati Controls	513-530-0049
OH	Cleveland, Specialized Comp. Sls. Co., Inc.	216-464-0405
OH	Dayton, John A. Becker Co.	513-226-1341
PA	Philadelphia, F & C Sls. Co.	215-228-5656
TX	San Angelo, Gunter Wholesale Co.	915-655-9181

LINEMASTER SWITCH, 29 Plaine Hill Rd.,P.O Box 238, Woodstock, CT 06281-0238, Tel: 203-974-1000, FAX: 203-974-0691; FSC No.: 979180; Empl.: 190

LINSEIS, INC., P.O. Box 666, Princeton Junction, NJ 08550, Tel: 609-799-6282, 800-RECORDER, FAX: 609-799-7739; *Sls. Mgr.:* Michael Bissell ..... **D•1420**

LISK, G. W., CO., 2 South St, Clifton Springs, NY 14432, Tel: 315-462-2611, TELEX: 71-6854113, FAX: 315-462-7661; Empl.: 300; *Sls. Mgr.:* D.J. Riggs; *Dist. Mgr.:* D.J. Riggs

LITEON

FAX: 408-942-1527

LITE-ON INC., 720 S. Hillview Dr., Milpitas, CA 95035, Tel: 408-946-4873; Empl.: 1100; *Sls. Mgr.:* Michael Barnes; *Dist. Mgr.:* Mark King ..... **A•2098-2099; B•1092-1095**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrn. Assoc.	205-881-5031
AZ	Mesa, System Sls. of AZ.	602-464-9989
CA	Agoura, Quadrep Southern	818-597-0222
CA	Irvine, Quadrep Southern	714-727-4222
CA	San Diego, Quadrep Southern	619-560-8330
CA	San Jose, Quadrep, Inc.	408-432-3300
CO	Lakewood, Candal, Inc.	303-935-7128
CT	Middletown, Gerber Sls.	203-347-3000
FL	Altamonte Spgs., Semtronics Assoc. Inc.	407-831-8233
FL	Clearwater, Semtronics Assoc. Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronics Assoc. Inc.	305-731-2484
GA	Atlanta, Beacon Elctrn. Assoc.	404-256-9640
IL	Itasca, Circuit Sls. Inc.	312-773-0200
IN	Fort Wayne, Corrao Marsh, Inc.	219-482-2725
IN	Greenfield, Corrao Marsh, Inc.	317-462-4446
IA	Cedar Rapids, Hitec Central, Inc.	319-396-3228
MD	Glen Burnie, Third Wave Solutions	301-290-5990
MA	Burlington, Gerber Sls.	617-229-1150
MI	Brighton, AP Assocs.	313-229-6550
MN	Minneapolis, Comstrand	612-788-9234
MO	Bridgeton, Hi-Tec Central	314-731-7243
NJ	Morristown, Andrews & Andrews	201-569-8800
NJ	Totowa, R.O.I. Sls. Co.	201-812-9606
NM	Albuquerque, System Sls. of Az.	505-889-2901
NC	Raleigh, Beacon Elctrn. Assoc.	919-787-0330
OH	Dublin, Sales Plus	614-889-8362
OH	Mentor, Sales Plus	216-942-7811
OR	Portland, Q.R./Crown, Inc.	503-620-8320
PA	Willow Grove, Tech Sales Assoc.	215-784-0170
TN	Knoxville, Beacon Elctrn. Assoc.	615-689-2141
TX	Houston, RAM Elctrn. Sls., Inc.	713-855-0768
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Can Pointe Claire, Quebec, Designtronics 514-695-3124
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LITTELFUSE, INC., 800 E. Northwest Hwy., Des Plaines, IL 60016, Tel: 708-824-1188, 708-824-0400, FAX: 708-824-3024; Empl.: 1700; *Sls. Mgr.:* David Hanley; *Dist. Mgr.:* Michael Budde ..... **B•1372-1373**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean, Inc. 205-830-1540
AZ Tucson, Clemick & Assocs. 602-749-4003
AR Little Rock, Erickson Sls., Inc. 501-455-0618
CA Burlingame, Wm. J. Purdy Co. 415-347-7701
CA Irvine, Gravley & Assocs. 714-852-9994
CO Denver, The Lindberg Co. 303-758-9033
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IL Mt. Prospect, The Dombrow Co. 708-253-3631
IN Indianapolis, L. M. DeVoe Co. 317-842-3245
IA Cedar Rapids, T.L. Dowell Assoc. 319-364-3880
KS Overland Park, T. L. Dowell & Assocs. 913-599-1100
LA Chalmette, Erickson Sls. Inc. 504-271-1976
MD Silver Spring, Mid-Atlantic Sls. Co. 301-593-7749
MA Framingham, Coakley, Boyd & Abbett, Inc. 508-820-0800
MA W. Bridgewater, Coakley,Boyd & Abbott, Inc. 508-559-6700
MI Farmington Hills, R. C. Merchant Co. .. 313-476-4600
MI St. Joseph, R. C. Merchant 616-983-7378
MN Edina, M. Foster Tech. Sls., Inc. 612-941-9790
MO St. Louis, T. L. Dowell & Assocs. 314-849-4234
NJ Englewood, MOS Mktg. Assoc. 201-569-2071
NM Albuquerque, The Lindberg Co. 505-881-1006
NY Binghamton, R.W. Mitscher Co., Inc. ... 607-724-6561
NY Clarence, R. W. Mitscher Co., Inc. 716-759-2350
NY New York, MOS Mktg. Assoc. 516-487-3966
NY Pittsford, R. W. Mitscher Co., Inc. 716-586-4012
NY Rochester, R. W. Mitscher Co., Inc. 716-227-0839
NY Utica, R.W. Mitscher Co., Inc. 315-724-3947
NC Charlotte, Cartwright & Bean, Inc. 704-536-0303
NC Raleigh, Cartwright & Bean,Inc. 919-876-4130
OH Centerville, Bear Mktg., Inc. 513-436-2061
OH Richfield, Bear Mktg., Inc. 216-659-3131
OR Portland, J. E. Belusko Co. 503-222-4279
PA Harrisburg, Beil & Whitaker, Inc. 717-564-6900
PA Narberth, Bresson Assocs., Inc. 215-664-6460
PA Pittsburgh, Bear Mktg., Inc. 412-531-2002
TN Knoxville, Cartwright & Bean, Inc. 615-693-7450
TX Dallas, Elcom Mktg., Inc. 214-241-2166
TX Dallas, Erickson Sls., Inc. 214-739-5833
VA Charlottesville, Mid-Atlantic Sls. Co. ... 804-973-8099
Can Pickering, Ont., A. C. Simmonds 416-839-8041

LITTON ELECTRON DEVICES, 960 Industrial Rd., San Carlos, CA 94070, Tel: 415-591-8411, TWX: 910-376-4900, FAX: 415-591-5623; Empl.: 800

LITTON ELECTRON DEVICES, Litton Systems, Inc., 1215 South 52nd St., Tempe, AZ 85281, Tel: 602-968-4471, TELEX: 910-950-0149, FAX: 602-966-9055; FSC No.: 55311; Empl.: 708; *Sls. Mgr.:* C. M. Wood, Byron Harding, Mktg. Mgrs.; *Dist. Mgr.:* C. M. Wood, Byron Harding,Mktg. Mgrs.

LITTON ENCODER DIV., 20745 Nordhoff St., Chatsworth, CA 91311, Tel: 818-341-6161, TWX: 910-494-1229, FAX: 818-882-4553; FSC No.: 17080; Empl.: 150

LITTON LASER SYSTEMS, CLS OPERATIONS, 5 Jeffrey Drive, South Windsor, CT 06074, Tel: 203-289-3551

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FAX: 703-953-1841

LITTON POLY-SCIENTIFIC, Div. of Litton Industries, 1213 N. Main St., Blacksburg, VA 24060-3100, Tel: 800-336-5917, 703-953-4751, TWX: 710-875-3694; Empl.: 800 ..... **B•1218-1223, 1283-1292**

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AZ Phoenix, Dick Palmer 602-242-0910
CA Huntington Beach, Mike Baggetta 714-968-0434
CA Woodland Hills, Bob Billington 818-347-0603
FL Fern Park, Blair Engrg. 305-834-1244
MA Sturbridge, Russ Persson 203-871-8900
MI Stockbridge, Erhart Engrg. 517-851-8770
MN Prior Lake, Midwest Meridian 612-447-8222
KS Olathe, Technical Sls. Assoc. 913-829-2800
NY Mineola, Kahn Assocs. 516-742-1900
TX Dallas, Blair Engrg. 214-241-5655
OH Medina, Stress Analysis Svcs. 216-725-7733
TX Garland, Carey, McMahill & Associates 214-681-1414
WA Bellevue, Thorsen Co. 206-455-9180

LITTON POTENTIOMETER DIV., 750 So. Fulton Ave., Mt. Vernon, NY 10551, Tel: 914-664-7733, TWX: 710-562-0129, FAX: 914-664-2466; FSC No.: 04454;Multiple; Empl.: 300; *Sls. Mgr.:* Sales Director

LITTON SOLID STATE, Litton Systems, Inc., 1504 Mc Carthy Blvd., Milpitas, CA 95035, Tel: 408-433-0933, FAX: 408-954-9652

LIXI, INC., 1438 Brook Dr., Downers Grove, IL 60515, Tel: 708-620-4646, FAX: 708-620-7776; Empl.: 17; *Sls. Mgr.:* Tom Nguyen; *Dist. Mgr.:* Andy Xydakis

LJ TECHNICAL SYSTEMS, 19 Power Drive, Hauppauge, NY 11788, Tel: 516-234-2100, FAX: 516-234-2656; Empl.: 25; *Sls. Mgr.:* Christopher Rowe

LMB HEEGER, INC., 6400 Fleet St., Commerce, CA 90040, Tel: 213-728-5108, FAX: 213-728-4740; *Sls. Mgr.:* Robert Heeger

lmi CONNECTORS INC

FAX: 518-298-5371

LMI CONNECTORS INC., 34 West Service Rd., Champlain, NY 12919, Tel: 518-298-5360; *Sls. Mgr.:* David Asseraf; *Dist. Mgr.:* David Asseraf ..... **C•1442-1445**

Local Sales Offices & Reps

AL Huntsville, Over & Over, Inc. 205-837-7105
AZ Phoenix, Piatt Sls. 602-957-3570
CA Arcadia, Van Gott & Assocs. 818-445-9728
CA San Diego, Van Gott & Assoc. 714-698-7774
CT Bloomfield, The Newscott 203-243-8514
CT Killingsworth, Newscott Co. 203-663-2338
FL Altamonte Springs, Over & Over, Inc. 407-332-1222
FL Coral Springs, Over & Over, Inc. 305-753-7050
FL Tampa, Over & Over, Inc. 813-626-9100
GA Norcross, Over & Over 404-449-6505
IL Glenview, Prime Dvcs. 708-729-2550
IN Columbus, Connect 21 502-426-8955
KS Olathe, G.M. Brown & Assocs. 913-829-3086
KY Louisville, Connect 21 502-426-8955
MD Millerville, Components & Assemblies 301-987-0034
MA Needham Heights, The Newscott Co. 617-444-1923
MN Eden Prairie, Electro Mark 612-944-5850
MO Florissant, G.M. Brown & Assocs. 314-839-3600
NJ Medford, The McCoy Grp. 609-953-0770
NY Bohemia, JSA 516-244-2584
NY Champlain, LMI Connectors, Inc. 518-298-5360
NY Rochester, Lamb Comps. 716-328-6350
NC Charlotte, Over & Over, Inc. 704-542-9111
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OH Columbus, McFadden Sls. 614-761-3177
PA Easton, The McCoy Grp. 215-363-0350
WI Oak Creek, Prime Dvcs. 414-263-3900
Can Montreal, Que., Avotronics 514-697-2135
Can Toronto, Ont., Avotronics 416-475-2019

Local Distributors

AZ Tempe, Control Design Supp. 602-829-7981
CA Anaheim, Control Design Supp. 714-821-6173
CA Fullerton, Interconnect Specs. 714-773-0411
CA San Carlos, Control Design Supp. 415-592-4806
CA San Diego, Control Design Supply 619-457-9822
CA Santa Ana, BDS Elctrns. 714-662-1050
CO Denver, Control Design Supp. 303-296-1922
CT Wallingford, Control Design Supp. 203-269-9955
FL Altamonte, Control Design Supp. 305-788-3220
FL Pompano Beach, Control Design Supp. 305-782-1311
GA Stone Mountain, Control Design Supp. 404-979-3500
IL Chicago, Control Design Supp. 708-307-8944
IL Chicago, Leeds 312-625-3800
IL Schaumburg, Control Design Supp. ... 708-307-8900
IN Indianapolis, Control Design Supp. 317-788-4559
IA Marion, Control Design Supp. 319-373-2923
KS Kansas City, Control Design Supp. 913-362-4248
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Woburn, Control Design Supp. 617-932-9404
MN Minneapolis, Control Design Supp. 612-721-1628
MO St. Louis, Control Design Supp. 314-426-3150
NJ Union, Avanti 201-964-0333
NY Canandaigua, Advacom 716-396-9050
NY Whitestone, Power Electro Supp. 718-767-1447
NC Charlotte, Control Design Supp. 704-588-4410
PA Malvern, Control Design Supp. 215-296-0150
TX Arlington, Bell Comp. Sls. 817-461-5303
TX Austin, Wofford Elctrns. 512-339-1131
TX Dallas, Control Design Supp. 214-358-1441
TX Dallas, Wofford Elctrns. 214-320-0294
TX Houston, Wofford Elctrns., Inc. 713-847-3583
UT Nephi, Control Design Supp. 801-623-2977

WA Kent, Control Design Supply 206-251-6323
WI New Berlin, Control Design Supp. 414-784-1015
Can Calgary, AB, Memco 403-258-3399
Can Edmonton, AB, Wholesale Electronics 403-451-2180
Can Montreal, Que., Ferrotronic Components 514-341-3450
Can Montreal, Que., Megastar Electronics 514-329-0042
Can Ottawa, Ont., Z.E.I. 613-526-2911
Can St. Laurent, Que., Z.E.I. 514-342-6211
Can Ste-Foy, Que., Z.E.I. 418-681-1262
Can Surrey, B.C., Memco 604-590-1553
Can Toronto, Ont., Z.E.I. 514-674-7220
Can Victoria, B.C., Pacific Coast Electronics 604-385-5111

LMI CONNECTORS INC., 8415 Dalton Rd., Town of Mount Royal, Canada H4T 1V5, Tel: 514-733-8311, FAX: 514-733-8440

LNR COMMUNICATIONS, INC., 180 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-7111, TELEX: 221620, TWX: 510-227-9871, FAX: 516-273-7119; FSC No.: 51049; Empl.: 200; *Sls. Mgr.:* F. Kelly, Dir. Mktg.

LOCKHEED SANDERS, INC., EMC Dept., 95 Canal St, Nashua, NH 03061-2004, Tel: 603-885-3602, TELEX: 94-3430, TWX: 710-228-1894, FAX: 603-885-5133; FSC No.: 94117; *Sls. Mgr.:* (EMC) R. Bossart

LOCTITE LUMINESCENT SYS., INC., LocTite Corp., Etna Rd., Lebanon, NH 03766, Tel: 603-448-3444, TELEX: 710-366-0607, FAX: 603-448-3452; Empl.: 200

LOCUS, INC., Box 740, State College, PA 16804, Tel: 814-466-6275, FAX: 814-466-3341; *Sls. Mgr.:* Ellwood E. Brem

LOCUS, Kaman, PO Box 740, State College, PA 16804, Tel: 814-466-6275; *Sls. Mgr.:* Ellwood E. Brem

LOCUS COMPUTING CORP., 9800 La Cienega Blvd., Inglewood, CA 90301-4440, Tel: 213-670-6500, FAX: 213-670-2980; Empl.: 275

LOCUS INC., 1842 Hoffman Street, Madison, WI 53704, Tel: 608-244-0500, FAX: 608-244-0528; Empl.: 18

LODESTONE PACIFIC, 4065 E. La Palma Ave. Bldg. G, Anaheim, CA 92807, Tel: 714-630-1343, FAX: 714-630-8480; FSC No.: OJWU1; Empl.: 11; *Sls. Mgr.:* Mark Soukup ..... **A•1210-1211**

Local Sales Offices & Reps
IL Chicago, Charles Atwater Assoc. 708-668-2303
MA Boston, Anchor Engrg. Corp. 508-898-2724
NY Long Island, Kahgan Brody Assoc. 516-538-2300
PA Easton, Kendon Co. 215-253-3100
VA Roanoke, A.B. Kreger Co. 703-989-4738
Intl Frankfurt, Germany, BFI 06074 4098-0
Intl Hong Kong, P. Leo & Co. Ltd. 5-413655
Intl London, England, Cirkit 0992-444111
Intl Milano, Italy, BFI 2-33100535
Intl Paris, France, BFI 145-330137
Intl Roskilete, Denmark, BFI 488-8289900
Intl Sollenton, Sweden, BFI 488 828 9900

LOGICAL DESIGN GROUP, INC., 6301 Chapel Hill Rd., Raleigh, NC 27607, Tel: 919-851-1101, FAX: 919-851-2844; Empl.: 22; *Sls. Mgr.:* Cam McPhee; *Dist. Mgr.:* Barbara Boyette

LOGICAL DEVICES, INC., 1201 N.W. 65th Place, Fort Lauderdale 33309, Tel: 305-974-0967, FAX: 305-491-6956; *Sls. Mgr.:* Bob Sims

LOGIC BEACH INC., 8033 Pasadena Ave., La Mesa, CA 91941, Tel: 619-698-3300, FAX: 619-469-8604; Empl.: 10; *Sls. Mgr.:* David Parks; *Dist. Mgr.:* David Parks

LOGI COMP ELECTRONICS, INC., 1009 W. Boston Post Rd., Mamaroneck, NY 10543, Tel: 914-698-9332, FAX: 914-698-9456; Empl.: 6

LOGICOMP ELCTRNS., INC., See Pres-Air-Trol Corp.

LOGIC TECHNOLOGY, INC., 1090-B L'Avenida, Mtn. View, CA 94043, Tel: 415-967-1007, FAX: 213-641-4691; FSC No.: 51019; *Sls. Mgr.:* Mel Morgan

LOGIMETRICS, 121-03 Dupont St., Plainview, NY 11803, Tel: 516-349-1700, TELEX: 7608152, FAX: 516-349-8552; FSC No.: 33013; Empl.: 75; *Sls. Mgr.:* Eugene Blum

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Local Sales Offices & Reps
AL Huntsville, R.O. Whitesell & Assocs. ... 205-883-5110
AZ Scottsdale, Logitek 805-527-4700
CA Campbell, Shur Sls., Inc. 408-374-5577
CO Englewood, Advanced Technlg. Mktg. 303-789-2606
CA Simi Valley, Logitek 805-883-7608
CT Hartford, Dynamic Sls. of New England 203-693-6567
FL Longwood, R. O. Whitesell & Assoc. .. 407-682-6662
GA Norcross, R.O. Whitesell & Assocs. ... 404-449-9190
IN Indianapolis, R.O. Whitesell & Assocs. 317-359-9283
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KY Pewee Valley, R.O. Whitesell & Assocs. 502-241-1441
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MO Southfield, R.O. Whitesell & Assocs. .. 313-559-5454
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OH Dayton, R.O. Whitesell & Assocs. 513-298-9546
OK D&O Engrg. Co. 316-686-2808
NY Mendon, Tech Mark 716-624-3840
PA Pittsburgh, R.O. Whitesell & Assocs. .. 412-963-6161
TN Nashville, R.O. Whitesell & Assocs. ... 615-352-4760
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VT Burlington, Dynamic Sls. of New England 802-863-6665
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WA Kirkland, Skye-Tek 206-828-2115
Can Lachine, Que., Electrodesign Ltd. 514-636-4838

LONG ISLAND TRANSFORMER & INDUCTOR COMPANY, INC., 882 Wallace Ave., Baldwin, NY 11510, Tel: 516-766-5644; Empl.: 5

LONGSHINE TECHNLG. INC., 2013 N. Capitol Ave., San Jose, CA 95132, Tel: 408-942-1746, FAX: 408-942-1745; Empl.: 300

LORAIN PRODUCTS, Reliance Electric, 1122 F St., Lorain, OH 44052, Tel: 216-288-1122, TELEX: 98-0505, TWX: 196131; Empl.: 1200; *Sls. Mgr.:* T. F. McFadden

LORAL DATA SYSTEMS, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, FAX: 813-378-1893; FSC No.: 06141; Empl.: 900; *Sls. Mgr.:* F. V. Bud Hinkel

LORAL DATA SYSTEMS, Data Recorders, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, FAX: 813-378-1893; FSC No.: GS-00K-8301-S0078; Empl.: 750; *Sls. Mgr.:* Steve Hoff

LORAL FAIRCHILD, Imaging Sensors, 1801 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2500, TWX: 910-373-2110, FAX: 408-433-2508; *Sls. Mgr.:* Jim Johnson; *Dist. Mgr.:* Jim Johnson

LORAL MICROWAVE-FSI, Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824, Tel: 508-256-4113/8101, TWX: 710-343-0404, FAX: 508-937-3748; FSC No.: 26629; Empl.: 90; *Sls. Mgr.:* D. Langan

LORAL MICROWAVE NARDA, 435 Moreland Rd., Hauppauge, NY 11788, Tel: 516-231-1700, TWX: 510-221-1867, FAX: 516-231-1711; FSC No.: 99899; Empl.: 400; *Sls. Mgr.:* Robert Nopper

LORAL MICROWAVE-NARDA WEST, 214 Devcon Dr., San Jose, CA 95112-4210, Tel: 408-436-4400, FAX: 408-436-8476; FSC No.: 8F150; Empl.: 200; *Sls. Mgr.:* Leon Becker

LORAL MICROWAVE-WAVECOM, 9036 Winnetka Ave., Northridge, CA 91324, Tel: 818-882-3010, TELEX: 6502408147; FSC No.: 28979; Empl.: 109

LORAL TERRACOM, Sub. of Loral Corp., 9020 Balboa Ave., San Diego, CA 92123, Tel: 619-278-4100, TELEX: TERRACOM A SDG 18-2774, FAX: 619-292-1140; *Sls. Mgr.:* Michael A. Lapadula

LORCH ELECTRONICS:DIV. OF VERNITRON CORP., 2801 - 72nd St., No., St. Petersburg, FL 33710, Tel: 813-347-2181, FAX: 813-347-3881; FSC No.: 29971; Empl.: 50; *Sls. Mgr.:* Carol McCoy ..... **A•1751**

Local Sales Offices & Reps
AZ Phoenix, J.F. Hurlbut 602-952-2079
CA Los Angeles, McDougall/McLauglin Co. 213-477-8556
CO Golden, J. F. Hurlbut Co. 303-279-7796
KY Ft. Mitchell, G. W. Thelen Co., Inc. 606-341-8181
MO St. Louis, Engrg. Svcs. 314-997-1515
NH Amherst, D.A.Crowley & Assocs., Inc. .. 603-673-7050
NJ W. Orange, E-F Tech. Sls. 201-731-7203
NJ W. Orange, E-F Tech. Sls., Inc. 201-731-7203
NY Liverpool, R & D Assocs. 315-457-0100
NY Plainview, E-F Tech. Sls. 516-942-7400
OH Chagrin Falls, G.W. Thelen Co.,Inc. 216-543-1095
PA Glenside, Koebert Assocs., Inc. 215-887-2310
TX Plano, Zeus Engrg. 214-423-2027
WA Seattle, G. M. Gillett & Assocs. 206-284-3344
EXP NY, Great Neck, Ad. Auriema 516-487-0700
Can La Salle, Que., Electrodesign, Ltd. 514-363-0245

LORLIN TEST SYSTEMS, 8 Lakeside Office Pk. 599 North Ave., Wakefield, MA 01867, Tel: 617-245-9044, FAX: 617-246-5822; Empl.: 45; *Sls. Mgr.:* Paul Pedigo

LORTEC POWER SYSTEMS, INC., 145 Keep Court, Elyria, OH 44035-2214, Tel: 216-327-5050, FAX: 216-327-9628; Empl.: 65; *Sls. Mgr.:* Dale Lamirand

LOVE CONTROLS CORP., 1475 S. Wheeling Rd., Wheeling, IL 60090, Tel: 708-541-3232, TELEX: 297115, FAX: 708-541-7366; FSC No.: 8L919; Empl.: 72; *Sls. Mgr.:* James Nolan; *Dist. Mgr.:* Jim Clark

low key

FAX: 508-281-6321

LOW KEY CORPORATION, Strong Group, 105 Maplewood Ave., P.O. Box 1195, Gloucester, MA 01930, Tel: 508-281-0448; Empl.: 25; *Sls. Mgr.:* Brian Hendricks ..... **B•1820-1821**

Local Sales Offices & Reps
AL Huntsville, MacKay Smith Assocs. 205-539-8005
CO Englewood, Elctrn. Comp. Sls. 303-762-9576
CT Weatherfield, Compak 203-563-4784
FL Orlando, MacKay Smith Assocs. 407-423-4353
GA Tucker, MacKay Smith Assocs. 404-496-9913
IL Skokie, Electro Tech Mktg. 312-676-3151
IN Greenfield, France Entprs. 317-462-6098
MD Baltimore, Hagy Assocs. 301-529-3995
MA Westford, Bucher Assoc. 508-692-7503
NJ Lebanon, F.F. Sylvester Assocs. 201-735-2488
NY Coram, F.F. Sylvester Assocs. 516-473-2018
NC Raleigh, MacKay Smith Assocs. 919-847-2277
PA Newtown Sq., Hagy Assocs. 215-459-0504
UT Salt Lake City, Elctrn. Comp. Sls.

LSI LOGIC CORP., 1551 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-8000, TELEX: 172153; *Dist. Mgr.:* John Mucciaro

LTI, INC., 363 St. Paul Blvd., Carol Stream, IL 60188, Tel: 708-668-8886, FAX: 708-668-9480; Empl.: 60; *Sls. Mgr.:* Mike Khetarpal

LTX CORPORATION, LTX Pk. @ University Ave., Westwood, MA 02090, Tel: 617-461-1000, TELEX: 4430108, FAX: 617-326-5895; Empl.: 1,500; *Sls. Mgr.:* Roger Blethen, Sr. V.P. Sls.

LUCAS DEECO CORP., 31047 Genstar Road, Hayward, CA 94544-7831, Tel: 415-471-4700, FAX: 415-489-3500; *Sls. Mgr.:* Bill Lepior, Natl; *Dist. Mgr.:* Brian Frey, Intl.

LUCAS DURALITH CORPORATION, 525 Orange St., Millville, NJ 08332, Tel: 609-825-6900, TWX: 609-825-6345 -; Empl.: 375; *Sls. Mgr.:* Leroy Nopper, V.P. Sls.; *Dist. Mgr.:* Nick Tonkery, Sls. Mgr. ..... **B•1822**

Local Sales Offices & Reps
CA Anaheim, Lucas Duralith-Western Div. 714-776-6700
NH Milford, Lucas Duralith-AKT Div. 603-672-0470
NJ Millville, Lucas Duralith-Eastern Div. .. 609-825-6900

LUCAS EPSCO, INC., 99 South St., Hopkinton, MA 01748-2204, Tel: 508-435-2400, TELEX: 95-1110, FAX: 508-435-2022; FSC No.: 15894; Empl.: 240; *Sls. Mgr.:* John M. Shalhoub

Local Sales Offices & Reps

IA	Cedar Rapids, Midwest Tech. Sls., Inc.	319-365-4011
KS	Lenexa, Midwest Tech. Sls., Inc.	913-888-5100
MO	St. Charles, Midwest Tech. Sls., Inc.	314-441-1012
NY	Huntington, CDB Entprs. Inc.	516-692-5200
NY	Syracuse, I. A. Holtze	315-479-6641
OH	Dayton, R. A. Ehlert Assocs., Inc.	513-253-9197
TX	Dallas, Kruvand Assoc., Inc.	214-437-3355

LUCAS LEDEX INC., P.O. Box 427, 801 Scholz Dr., Vandalia, OH 45377-0427, Tel: 513-898-3621, TELEX: 6874241/6874243, FAX: 513-898-8624; FSC No.: 81840; Empl.: 450; *Sls. Mgr.:* T. C. Ristoff ..... **B•1629-1631, 1731, 1915**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg., Inc.	205-722-0440
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	San Diego, Interstate Mktg. Assocs.	619-693-3220
CA	Saratoga, Testco, Inc.	408-253-1900
CA	Woodland Hills, Interstate Mktg. Assocs.	818-883-7606
CO	Englewood, Integrated Motion Sys.	303-792-5516
CT	Bloomfield, SIR-Assocs.	203-243-9343
FL	Deerfield, Techn. Mktg. Assocs.	305-427-1090
FL	Largo, Techn. Mktg. Assocs.	813-531-4405
FL	Orlando, Techn. Mktg. Assocs.	407-857-3760
GA	Duluth, DHR Mktg., Inc.	404-564-0529
IL	Elk Grove Vl., Control Sls., Inc.	312-595-2110
KS	Leawood, Thunderbird Tech. Sls. & Svcs.	913-642-7220
KS	Wichita, Thunderbird Tech. Sls. & Svcs.	316-636-5777
MA	Westford, SIR Assocs.	508-692-2500
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Minneapolis, Josco/Melius, Inc.	612-861-3343
MO	Maryland Heights, Thunderbird Tech. Sls. & Svcs.	314-298-8940
NY	Clark Mills, KLM-Garner Co.	315-853-6126
NY	Oceanside, Bittan Assocs., Inc.	516-678-6222
NY	Pittsford, KLM-Garner Co.	716-381-8350
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Nashville, DHR Mktg., Inc.	615-331-2745
TX	Austin, ION Assocs., Inc.	512-794-9007
TX	Grand Prairie, ION Assocs., Inc.	214-647-8225
TX	Houston, ION Assocs., Inc.	713-537-7717
WA	Bellevue, Testco, Inc.	206-454-7422
WA	Vancouver, Testco, Inc.	206-693-7262
WI	Brookfield, Control Sls., Inc.	414-797-9500

LUCAS SCHAEVITZ, 7905 N. Route 130, Pennsauken, NJ 08110-1489, Tel: 609-662-8000, TWX: 710-892-0714; FSC No.: 93190; Empl.: 201; *Sls. Mgr.:* Mike Finnerty

LUCAS WEINSCHEL, P.O. Box 6001, Gaithersburg, MD 20884-6001, Tel: 301-948-3434, TELEX: 440702, FAX: 301-948-3625; FSC No.: 93459; *Sls. Mgr.:* Curtis W. Crews

LUCAS WESTERN INC., Electro Systems Division, 610 Neptune Ave., Brea, CA 92621, Tel: 714-671-4500, TWX: 910-240-3603, FAX: 714-671-4503; Empl.: 175; *Sls. Mgr.:* Jerry Neumayer

LUCAS ZETA, INC., Lucas Aerospace, Inc., 2811 Orchard Parkway, San Jose, CA 95134, Tel: 408-434-3600, FAX: 408-433-0205; FSC No.: 31260; Empl.: 280; *Sls. Mgr.:* Richard Wood

LUFF RESEARCH, 22 N. Tyson Ave., Floral Park, NY 11001, Tel: 516-358-2880, FAX: 516-358-2757; Empl.: 5; *Sls. Mgr.:* R. Scheer

LUFT INSTRUMENTS, INC., Hillside Rd., P.O. Box 214, Lincoln, MA 01773, Tel: 617-259-9215, FAX: 617-259-9215; Empl.: 12

LUMEX OPTO/COMPONENTS, INC., 292 E. Hellen Rd., Palatine, IL 60067-6955, Tel: 708-359-2790, FAX: 708-359-8904; Empl.: 125; *Sls. Mgr.:* Hank Zabanski; *Dist. Mgr.:* Tanya Bons

LUMITRON, PO Box 267, Summit, NJ 07902-0267, Tel: 201-273-8998, FAX: 201-273-0853; FSC No.: 51702; Empl.: 20; *Sls. Mgr.:* Gil Chassie

LUNAIRE ENVIRONMENTAL, INC., Lunaire Limited, 4 Quality St., Williamsport, PA 17701, Tel: 717-326-1770, FAX: 717-326-7304; Empl.: 130; *Sls. Mgr.:* Stu Lunick

LUNDAHL INSTRUMENTS, INC., Ezra C. Lundahl Inc., 429 South Main, Logan, UT 84321, Tel: 801-753-7300, FAX: 801-753-7490; Empl.: 17; *Sls. Mgr.:* Val Potter

LUTRON ELECTRONICS CO., 205 Suter Rd., Coopersburg, PA 18036, Tel: 215-282-3800, TELEX: 847475, TWX: 510-651-3755; Empl.: 378; *Sls. Mgr.:* John McKiernan; *Dist. Mgr.:* Robert Van Horne

LUTZE, INC., 38 Fairfield Place, West Caldwell, NJ 07006, Tel: 201-227-2371, 800-447-2371, FAX: 201-227-2954; Empl.: 6

LUXO LAMP CORP., P.O. Box 951, Port Chester, NY 10573, Tel: 914-937-4433, FAX: 914-937-7016; Empl.: 150; *Sls. Mgr.:* Robert H. Newton

LXD

FAX: 216-786-8711

LXD, INC., 7650 First Place, Cleveland, OH 44146, Tel: 216-786-8700, TELEX: 98-5442 LXD BCWD; FSC No.: 66706; Empl.: 100; *Sls. Mgr.:* Patrick Bowen; *Dist. Mgr.:* Patrick Bowen ..... **B•1097-1099**

Local Sales Offices & Reps

AL	Madison, DTM Inc.	205-837-5062
CA	Redwood City, James S. Heaton Co.	415-367-9000
CO	Littleton, MRC	303-794-4684
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
CT	Seymore, Sturdy Corp.	203-888-1480
ID	Boise, N.R. Schultz Co.	208-377-8686
IN	Fort Wayne, RL Bontempo Assoc.	219-478-1057
IN	Indianapolis, R. L. Bontempo Assocs.	317-293-8312
KS	Prairie Village, C. Logsdon & Assocs.	913-381-3833
MA	Wellesley Hills, Sturdy Corp.	617-235-2330
MN	Minneapolis, George Russell & Assocs.	612-854-1166
MO	St. Louis, C. Logsdon & Assocs.	314-849-5125
NH	Derry, Sturdy Corp.	603-434-8440
NJ	Haddonfield, Sunday O'Brien	609-429-4013
NJ	Westwood, Jarms Elctrns.	201-666-9390
NC	Raleigh, Eastern Elctrns.	919-876-7591
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OR	Beaverton, N.R. Schultz Co.	503-643-1644
TX	Austin, THT Sls.	512-835-2796
TX	Dallas, THT Sls.	214-783-1501
WA	Bellevue, N.R. Schultz Co.	206-764-1890
Can	Concord, Ont., ITT Multicomponents	416-736-1144

LYDALL INC., MANNING DIV., P.O. Box 328, Troy, NY 12181, Tel: 518-273-6320, FAX: 518-273-6361; Empl.: 185; *Sls. Mgr.:* Ray Dugan

LYNN ELECTRONICS, 915 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-677-6700, 800-523-6075, TWX: 510-667-1988, FAX: 215-364-2944; FSC No.: 19151; Empl.: 125; *Sls. Mgr.:* H. T. Colas

LYNTRONICS, INC., 569 Acorn St., Unit 5, Deer Park, NY 11729, Tel: 516-243-6397, FAX: 516-243-0232; FSC No.: OBSY 9; Empl.: 12; *Sls. Mgr.:* Gary L. Miller .... **D•1467**

LYN-TRON, INC., 3150 Damon Way, Burbank, CA 91505, Tel: 213-849-6211, 800-423-2734, FAX: 818-840-9581; FSC No.: 05791; Empl.: 85; *Sls. Mgr.:* Kory L. Wardle; *Dist. Mgr.:* Kory L. Wardle

LYON METAL PRODUCTS, INC., Box 671, Aurora, IL 60507, Tel: 708-892-8941, FAX: 1-800-367-6681; Empl.: 600; *Sls. Mgr.:* J. L. Wiebusch

LYTRON INCORPORATED, Dragon Court, Woburn, MA 01801, Tel: 617-933-7300, TELEX: 951-934, FAX: 617-935-4529; Empl.: 75; *Sls. Mgr.:* Edwin Carell

LZRelectronics,inc.

FAX: 301-670-0436

LZR ELECTRONICS, INC., 8051 Cessna Ave., Gaithersburg, MD 20879, Tel: 301-921-4600; Empl.: 35; *Sls. Mgr.:* John Andreoli; *Dist. Mgr.:* Greg Mozingo ..... **B•1823; C•1446-1462, 1766-1769; D•1042-1043, 1878-1889**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe	602-264-7971
CA	Los Alamitos, Power Specialists	213-594-9418
CA	San Jose, Bytec Sls.	408-435-8004
CA	Simi Valley, Power Specialists	805-581-4785
CO	Arvada, Mountain High Mktg.	303-422-2573
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Melbourne, Jim Kennedy Assocs.	407-676-6875
AL	Huntsville, Dean Assocs., Inc.	205-534-2255
MD	Lutherville, DGR	301-583-1360
MA	Norwood, JMG, Inc.	617-762-5333
NJ	Clifton, ROI Sls.	201-340-1515
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	Victor, Net Sls.(Upper NY)	716-924-1844
OH	Troy, S-Tek	408-435-8004
OH	Mason, S-TEK	513-339-5233
PA	West Chester, TCA Assocs.	215-692-6853
MN	Richfield, Clap Rep Co.	612-861-2191
NJ	Totowa, R.O.I. Sls.	201-812-9606
WA	Lynnwood, Blair Hirsch Co.	206-774-8151
WI	Genoa City, Vine Sales, Inc.	414-279-3871
Can	Scarborough, Cantronics Ltd.	416-297-8668

MABUCHI MOTOR AMERICA CORP., 475 Park Ave. South, New York, NY 10016, Tel: 212-686-3622, TELEX: 23-4374, TWX: MABU, FAX: 212-532-4263; Empl.: 10,000 ..... **B•1293**

PANAFAX: 212-532-4263

Local Sales Offices & Reps

MI	Detroit, Mabuchi Motor America Corp.	313-370-9090

MACCOR, INC., 2805 W. 40th Street, Tulsa, OK 74107, Tel: 918-446-1874, FAX: 918-445-1496; FSC No.: 6625; *Sls. Mgr.:* Andrew D. MacKay

MACHINE COMPONENTS CORP., 70 Newtown Rd., Plainview, NY 11803, Tel: 516-694-7222, FAX: 516-694-7252; FSC No.: 15531; Empl.: 46; *Sls. Mgr.:* D. L. Dubov

MACOM, INC., 43 Second Ave., Bldg. 8, Burlington, MA 01803, Tel: 617-272-3000, TELEX: 94-9464, TWX: 710-332-6789

M/A-COM CONTROL COMPONENTS DIV., M/A-COM, 21 Continental Blvd., Merrimack, NH 03054-4343, Tel: 603-424-4111, TWX: 710-336-0674, ESYLNK: 62038279, FAX: 603-424-6580; FSC No.: 16179; Empl.: 750

M/A-COM GOVERNMENT PRODUCTS, INC., 10713 Gilroy Rd., Hunt Valley, MD 21030, Tel: 301-771-0077, FAX: 301-771-6025; FSC No.: 29644; *Sls. Mgr.:* Frederick D. Reynolds

M/A-COM LASER DIODE, INC., See Laser Diode, Inc., Div. of Morgan Crucible

M/A COM LTD., Humphrey Rd., Dunstable, Bedfordshire, England LU5 4SX, England, Tel: 44(582)471200, TELEX: 82295; Empl.: 500; *Sls. Mgr.:* D. McGuinness

M/A-COM OMNI SPECTRA, INC., 140 Fourth Avenue, Waltham, MA 02254-9101, Tel: 617-890-4750, FAX: 617-890-2381; FSC No.: 26805; Empl.: 750

M/A-COM PHI, INC., M/A COM, Inc., 1742 Crenshaw Blvd., Torrance, CA 90501, Tel: 213-320-6160, TWX: 910-349-6651, FAX: 213-618-9191; FSC No.: 50998; Empl.: 260; *Sls. Mgr.:* Charlie Hancock

MACROAMP INC., P.O. Box 1512, Ukiah, CA 95482, Tel: 707-462-2222, FAX: 707-462-4103; Empl.: 25

MACRODYNE INC., 4 Chelsea Pl., Box 376, Clifton Pk., NY 12065, Tel: 518-383-3800, FAX: 518-383-0049; Empl.: 16; *Sls. Mgr.:* Clifford J. Jurus

MACROLINK, 1500 N. Kellogg Drive, Anaheim, CA 92807, Tel: 714-777-8800, FAX: 714-777-8807; Empl.: 40; *Sls. Mgr.:* Bill Goodale

MACROMATIC DIVISION, Milwaukee Elctrns. Corp., 7817 W. Clinton Ave., Milwaukee, WI 53223, Tel: 414-358-4000, FAX: 414-358-4001; FSC No.: 98664; Empl.: 100-150; *Sls. Mgr.:* James Scholler

MACRONETICS, See Veeco Instrs. Inc.

MAG-CON, 1626 Terrace Dr., St. Paul, MN 55113, Tel: 612-633-8820, FAX: 612-633-1851; Empl.: 40; *Sls. Mgr.:* Gene Litzau

MAG DEV INC., 17 Downing Three, Pittsfield, MA 01201, Tel: 413-442-6368, FAX: 413-443-9107; Empl.: 10

MAG-HEAD ENGINEERING CO., 686-Mendelssohn Ave., Minneapolis, MN 55427, Tel: 612-545-1321, FAX: 612-545-0335; FSC No.: (Cage) 0DU70; Empl.: 30; *Sls. Mgr.:* Anthony T. Price

MAGNA-POWER ELECTRONICS, INC., 135 Route 10, Whippany, NJ 07981, Tel: 201-428-1197, TELEX: 201-428-2853; FSC No.: 7V550; Empl.: 10 ..... **D•1891**

MAGNATROL VALVE CORP., 67 Fifth Ave., Hawthorne, NJ 07507, Tel: 201-427-4341, FAX: 201-427-7611; *Sls. Mgr.:* R. Kretschmer

MAGNECOMP

FAX: 803-878-0507

MAGNECOMP, INC., P.O. Box 625, Gravley Rd., Pickens, SC 29671, Tel: 803-878-4700; Empl.: 10; *Sls. Mgr.:* T. Sullivan ..... **A•2252**

MAGNECRAFT ELECTRIC CO., 1910 Techny Road, Northbrook, IL 60062-5376, Tel: 708-564-8800, TWX: 910-221-0122, FAX: 312-564-3027; FSC No.: 94696; Empl.: 700; *Sls. Mgr.:* Wiley Greenwood; *Dist. Mgr.:* Wiley Greenwood

MAGNELAB CORPORATION

FAX: 303-447-1588

MAGNELAB, 7315 Red Deer Dr., Boulder, CO 80301-4696, Tel: 303-442-6700; FSC No.: 58439; Empl.: 25; *Sls. Mgr.:* Carl A. Forsberg ..... **A•1209, 2253-2257**

Local Sales Offices & Reps

CA	San Diego, Mesa Sls. & Engrg.	619-278-8021

MAGNETEK, Transducer Products, 650 Easy St., Simi Valley, CA 93065, Tel: 805-581-3985, FAX: 805-583-1526; FSC No.: 65998; Empl.: 37; *Sls. Mgr.:* Dave Snyder

MAGNETEK DEFENSE SYSTEMS, MagneTek, Inc., 901 E. Ball Road, Anaheim, CA 92805, Tel: 714-956-9200, FAX: 714-956-5397; Empl.: 450; *Sls. Mgr.:* Ty Fredericksen

MAGNETEK TRIAD, 1124 E. Franklin St., Huntington, IN 46750, Tel: 219-356-7100, FAX: 219-356-3148; Empl.: 963; *Sls. Mgr.:* Mark Decker ..... **A•2259-2263**

MAGNETIC CIRCUIT ELEMENTS, 1540 Moffett St., Salinas, CA 93905, Tel: 408-757-8752, FAX: 408-757-5478; FSC No.: 09349; Empl.: 30; *Sls. Mgr.:* Lisa Battaglia

Local Sales Offices & Reps

CA	Fremont, R-C Elctrns.	415-656-8490
WA	Bellevue, Advanced Power Comps. ...	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945

MAGNETIC COILS, INC., See MCI Transformer Corporation

MAGNETIC COMPONENT ENGINEERING CO., 11379 Playa Street, Culver City, CA 90230, Tel: 213-398-4761, FAX: 213-572-1691; FSC No.: 52634; Empl.: 12; *Sls. Mgr.:* L.D. Montgomerie

Local Sales Offices & Reps

AZ	Phoenix, C.T. Carlberg Assocs.	602-468-0750
CA	Culver City, Magnetic Comp. Engrg. ...	213-398-4761
CA	San Jose, Silicon Valley Sls.	408-432-1967
MN	Minneapolis, A. J. Warner Co., Inc.	612-823-8272
NJ	Englewood, Cooper Assocs.	201-871-4985
NY	Rochester, Irondequoit Inds.	716-544-6257
NM	Albuquerque, C.T. Carlberg Assocs. ...	505-836-1448

mi

FAX: 317-549-0502

MAGNETIC INSTRUMENTATION, 8350 E. 48TH ST., Indianapolis, IN 46226, Tel: 317-545-2102, TELEX: 27-2111; Empl.: 35; *Sls. Mgr.:* Peter Stolpe ..... **D•1290**

MAGNETICO INC.

FAX: 516-758-7408

MAGNETICO INC., 182 Morris Ave., Holtsville, NY 11742, Tel: 516-654-1166; FSC No.: 10581; Empl.: 65 ..... **A•2264-2265**

MAGNETIC RADIATION LABS, 690 Hilltop Drive, Itasca, IL 60143, Tel: 708-285-0800, FAX: 708-285-0807; Empl.: 43; *Sls. Mgr.:* Ken Phillips

MAGNETICS, Spang & Co., Box 391, Butler, PA 16003-0391, Tel: 412-282-8282, TWX: 710-373-3821, FAX: 412-282-6955; Empl.: 750; *Sls. Mgr.:* J. F. Huth

MAGNETIC SHIELD CORPORATION, Perfection Mica Co., 750 North Thomas Dr., Bensenville, IL 60106, Tel: 708-766-7800, TWX: 910-256-4815, FAX: 708-766-2813; FSC No.: 06682; Empl.: 43 ..... **C•1698-1699**

Local Sales Offices & Reps

CA	Foster City, Polach & Bensinger Inc. ..	415-578-8200
CA	Woodland Hills, Cal-Ward Sls. Co.	213-883-2202
FL	Orlando, Ludlum Assoc. Co.	305-894-7761
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MI	Livonia, Amtech Reps.	313-474-8300
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NM	Albuquerque, IMEC	505-883-9010
NJ	Morristown, Kenneth L. Love Assocs.	201-540-0204
NY	Plainview, Robert Smith Assoc.	516-932-3975
OR	Hillsboro, Temco Northwest	503-648-8171
PA	Newton Square, W. Reeves Assocs. ..	215-356-7500
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SC	Walhalla, Overton Assoc.	803-638-7101
TX	Dallas, Allied Components,Inc.	214-238-0408
WA	Bothell, Temco Northwest	206-821-5434

MAGNETIC TECHNOLOGIES CORP., 770 Linden Avenue, Rochester, NY 14625, Tel: 716-385-9010, FAX: 716-385-5625; Empl.: 65; *Sls. Mgr.:* Gordon H. McNeil

MAGNETOELASTIC DEVICES, Box 625, Pittsfield, MA 01202, Tel: 413-445-5608, FAX: 413-442-3750

MAGNETROL INTERNATIONAL, 5300 Belmont Rd., Downers Grove, IL 60515-4499, Tel: 708-969-4000, FAX: 708-969-9489; *Sls. Mgr.:* Roger T. Piegza, Natl. Sls. Mgr.

MAGNET SALES & MFG. CO. INC., 11248 Playa Court, Culver City, CA 90230-6127, Tel: 213-391-7213, 800-421-6692, FAX: 213-390-4357; FSC No.: 17853; Empl.: 55; *Sls. Mgr.:* Chris Nanji; *Dist. Mgr.:* Chris Nanji

MAGNOS, 9 Bonazzoli Ave., Unit 17, Hudson, MA 01749, Tel: 508-562-1173, TELEX: 951417MAGN, FAX: 508-562-1175; Empl.: 5 ..... **D•1291**

MAGNUM MICROWAVE CORP., 4575 Cushing Pkwy., Fremont, CA 94538, Tel: 415-657-9898, FAX: 415-490-3351; FSC No.: 59277; Empl.: 105; *Sls. Mgr.:* Harry L. Fowler

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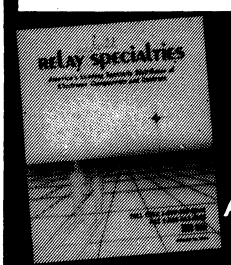

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MAGTECH CONTROLS, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073, Tel: 619-428-5581, FAX: 619-428-5090; FSC No.: 10112; Empl.: 200; *Sls. Mgr.:* R. Campbell ..... **B•1294**

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GA	Dunwood, Hugh Assoc.	404-396-5848
IL	Northbrook, Howard Benjamin	708-272-2900
MA	Burlington, Kitchen & Kutchin	617-229-2660
MO	St. Louis, Rush & West	314-965-3332
NJ	Cherry Hill, Lanson Assocs.	609-424-4670
NY	Jericho, Metro Tech. Sls.	516-935-3330
NY	Syracuse, T-Squared Elctrns., Inc.	315-463-8592
NY	Victor, T-Squared Elctrns., Inc.	716-924-9101
OH	Dayton, Rixan Assocs.	513-222-0011
TX	Dallas, CMR	817-379-6540
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
VA	Fredericksburg, Vernitron	703-752-4499

MAG-TEK, 20725 S. Annalee Ave., Carson, CA 90746, Tel: 213-631-8602, TWX: 510-600-0621 MAG TEK CRSN, FAX: 213-631-3956; *Dist. Mgr.:* Shelley Schira

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FAX: 804-722-1194

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NH	Amherst, D.A. Crowley & Assocs.	603-673-7050
NY	Rockville Centre, S-I Assocs., Inc.	516-536-4242
NY	Upstate, Inactive Comp. Sls.	315-445-9600
NC	Raleigh, F.B.D. Sls. Corp.	919-832-0202
OH	Cleveland, RK Comps.	216-642-9312
OR	Beaverton, UniComp, Inc.	503-643-1645
SC	Mauldin, Carl Hart	803-288-2323
TX	Plano, Mega Tech Mktg., Inc.	214-423-6342
VA	Danville, F.B.D. Sls.	804-836-1499
VA	Hampton, Maida Dev. Co.	804-723-0785
VA	Manassas(Northern), F.B.D. Sls. Corp.	703-369-7212
WA	Snohomish, UniComp, Inc.	206-568-0511
Can	Dundas, D. J. Hyslop & Co.	416-628-0266

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MA	Lee, Francis Biasin	413-243-0970
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NM	Albuquerque, IMEC	505-294-1124
TX	Dallas, S & B Sls.	214-369-5936

MALCO, DIV. OF MICRODOT, INC., See Microdot, Interconnect Sys. Div.

MALLORY BATTERY, See Duracell Intl.

MALLORY CONTROLS, Emerson Electric Canada, P.O. Box 210, 1079 Parkinson Rd., Woodstock, Ont., Canada N4S 7W8, Tel: 519-539-4891, TELEX: 23 MOY 001, FAX: 519-539-6684; FSC No.: 37942;76055; *Sls. Mgr.:* Joe Labonte; *Dist. Mgr.:* Joe Labonte ..... **A•1091, 2064-2065**

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OH	Cleveland, ESI	216-831-9555,FAX:216-831-8647
TX	Dallas, Eltec Sls.	817-268-2896,FAX:817-282-3010

MALLORY CONTROLS, Emerson Electric, 2831 Waterfront Pkwy-E. Drive, Indianapolis, IN 46214, Tel: 317-328-4010, FAX: 317-328-4244; Empl.: 2,000; *Sls. Mgr.:* Lewis Jones

MALLORY/NORTH AMERICAN CAPACITOR CO., 4760 Kentucky Ave., Indianapolis, IN 46241, Tel: 317-856-3731, TELEX: 317-687-6090, FAX: 317-856-2500; Empl.: 450; *Dist. Mgr.:* Tom Green, V.P. Sls. & Mktg.

MANAGE, INC., Fibre Optics Elctrns. Sys. Grp., P.O. Box 175, 40 Nichols Rd., Chicopee, MA 01014, Tel: 413-592-9123, FAX: 413-594-4891; Empl.: 33; *Sls. Mgr.:* David Menard

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CA	San Francisco, Manhattan Elec. Cable Corp.	800-423-4040
GA	Atlanta, Manhattan Elec. Cable Corp.	800-356-4796
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IN	Indianapolis, Wiltrout Sls., Inc.	317-577-7500
MA	Holliston, Manhattan Elec. Cable Corp.	800-255-1429
MN	Maple Grove, North Central Sls.	800-829-2885
NJ	Bridgeton, Manhattan Elec. Cable Corp.	800-225-2293
NJ	Fairfield, Manhattan Elec. Cable Corp.	800-888-0146
OH	Cleveland, Manhattan Elec. Cable Corp.	800-966-9473
TX	Houston, Manhattan Elec. Cable Corp.	800-392-4928
WA	Redmond, Elctrn. Mktg. Grp., Inc.	206-882-0962

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CA	El Toro, Sourcery Wire & Cable	714-380-0466
CA	Long Beach, John B. Rudy Co.	213-636-6934
CA	Oakland, Brill Elctrns.	415-834-5888
CA	San Jose, Compass Comps.	408-432-7575
CA	Santa Clara, Trinity Elctrns.	408-980-9011
CO	Denver, CSID	303-292-9594
CT	Greenwich, Wise Comps.	203-531-4880
FL	Orlando, Hammond Elctrns.	407-849-6060
FL	Pensacola, Elctrn. Supp. Co.	904-432-6916
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FL	Tampa, Dow Elctrns.	813-626-5195
LA	Harahan, MG Elctrns.	504-733-0070
MD	Owings Mill, Cameo Elctrns.	800-227-7077
MA	Burlington, QPL	617-229-2424
MA	Hudson, Metro Wire & Cable	508-562-6288
MA	Woburn, Pacer	617-935-8330
MI	Madison Heights, Quad Elctrns.	800-969-9220
NY	Johnson City, Help Elctrns.	607-729-3528
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NY	Mt. Vernon, QAR/All American	914-699-2224
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NY	Syracuse, Newark Elctrns.	315-437-6611
OH	Cincinnati, Hughes Peters	800-543-4483
OH	Columbus, Hughes Peters	800-282-1262
OH	Strongsville, Calvert Wire & Cable	800-321-1203
OH	Yellow Springs, Electroshield	800-662-1054
PA	Allentown, P. A. Peters	800-322-9583
PA	Harrisburg, Cumberland Elctrns.	800-692-7425
PA	Montgomeryville, Pytronic Inds.	800-562-5780
TN	Memphis, Bluff City Elctrns.	901-345-9500
TX	Austin, Wholesale Elctrn. Supp.	512-478-9568
TX	Houston, Houston Wholesale Elctrns.	713-644-8320
TX	Houston, Kent Elctrns.	713-780-7770
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VT	Bethel, Clifford of Vermont	802-234-9921
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Woodinville, Northwest Wire & Cable	206-486-8342

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MARCONI INSTRUMENTS, 3 Pearl Court, Allendale, NJ 07401, Tel: 201-934-9050, FAX: 201-934-9229; *Sls. Mgr.:* Carl Pepple, Gen. Mgr. ..... **D•1292**

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IN Indianapolis, K. Meyers 317-573-0966
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MA Westford, ICS Assocs. 508-765-5131
MA Westford, ICS Assocs. 508-692-3545
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IL Schiller Pk., Wm. R. Bolles 312-678-7888
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MA Waltham, Datcom 617-891-4600
MI Canton, L. George & Assoc. 313-454-0580
MN Minneapolis, Technical Comps. Grp. .. 612-536-9512
MO Florissant, Mid/West Co. 314-837-3361
NJ Colonia, Heft & Ficarra 201-381-5193
NY Lynbrook, Heft & Ficarra 516-599-3351
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SC Greenville, Electrolock Inc. 803-297-9830
TN Murfreesboro, Alpha Mktg. 615-896-6102
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EXP Plymouth Meeting, Pa., Ballogh & Thrall 215-825-5710
Can Rexdale,Ont, True North Technology 416-744-2233

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AR Little Rock, Hisco 501-568-3105
CT Manchester, IMS Inc. 203-288-7005
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FL Orlando, Hammond Elctrns., Inc. 407-841-1010
FL Orlando, Marshall 407-767-8585
IL Chicago, Newark 312-784-5100
MA Needham, Cronin 617-449-5000
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Rochester, Masline Elctrns.,Inc. 716-546-5373
PA Philadelphia, Powell Elctrns. 215-365-1900
WI Milwaukee, Marsh Elctrns. 414-475-6000

MARK POLARIZED CORP., 25 Davids Dr., Hauppauge, NY 11788, Tel: 516-273-1122, FAX: 516-436-7257; FSC No.: 5895; Empl.: 10; *Sls. Mgr.:* Ronald M. Miller

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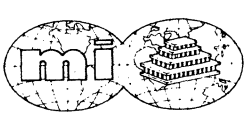
MARLEE SWITCH CO., 933-D N. Central Ave., Upland, CA 91786, Tel: 714-982-8988, FAX: 714-982-8989; Empl.: 10; *Sls. Mgr.:* LeRoy Tichy



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MARLOW INDUSTRIES, INC., 10451 Vista Park Rd., Dallas, TX 75238-1645, Tel: 214-340-4900, TWX: 910-860-5161; FSC No.: 55686; Empl.: 160; *Sls. Mgr.:* John Nelson; *Dist. Mgr.:* David Marlow ..... **C•1630-1631**

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MARSH-MCBIRNEY, INC., 4539 Metropolitan Court, Frederick, MD 21701, Tel: 800-368-2723, 301-874-5599, TWX: 710-828-0083, FAX: 301-874-2172; Empl.: 90; *Sls. Mgr.:* K. Steiding

MARSH PRODUCTS, INC., Spectrum Companies, Intl., 336 McKee St., Batavia, IL 60510, Tel: 708-879-8008, FAX: 708-879-8072

MARTEL ELECTRONICS, 8a Industrial Way P.O. Box 897, Salem, NH 03079, Tel: 603-893-0886, FAX: 603-898-6820; *Sls. Mgr.:* David DeVries

MARTIN SOUND PRODS. INC., 28 Alpha Park, Cleveland, OH 44143-2297, Tel: 216-442-2286, FAX: 216-442-7713; Empl.: 4; *Sls. Mgr.:* Christopher Martin; *Dist. Mgr.:* Christopher Martin

MARWAY
PRODUCTS INC.

FAX: 714-973-2931

MARWAY PRODS. INC., 311 N. Clara St., Santa Ana, CA 92703, Tel: 714-973-1800; FSC No.: 60955; Empl.: 23; *Sls. Mgr.:* Tom Goreth ..... **D•2212-2213**

Local Sales Offices & Reps

AZ Glendale, Sunbird Inds, Inc. 602-439-0134
CA Milpitas, Ward Elctrn. Packaging Sls. .. 408-945-0420
CA Santa Ana, Marway Prods., Inc. 714-973-1800
CO Monument, Sunbird Inds., Inc. 719-481-2900
CT Meriden, PCS-Power Conversion Sys. 203-235-4886
FL Land O' Lakes, AJ's Power Source, Inc. 813-996-2583
MD Landover, Sel-Tronics, Inc. 301-341-2700
MA Hopkinton, Eastern Sys. Inc. 508-435-2151, 508-435-2517
NH Londonderry, PCS- Power Conversion Sys. 603-434-2371
TX Richardson, Interactive Comp. Sls. 214-669-2277
WA Bellvue, Underwood Hanify 206-643-1793

MASTECH, INC., Lorlin Test Systems, Precision Rd., Danbury, CT 06810, Tel: 203-744-0096, TELEX: 7104565030; Empl.: 57; *Sls. Mgr.:* L. Sanders Corbit

MASTER APPLIANCE CORP., 2420 18th St., Box 68, Racine, WI 53403, Tel: 414-633-7791, TELEX: 269-505; FSC No.: 83284; Empl.: 54; *Sls. Mgr.:* Don Royer, Natl. Sls. Mgr.; *Dist. Mgr.:* F.W. Krescanko, Int'l. Sls. Mgr.

MASTER BOND, 154 Hobart St., Hackensack, NJ 07601, Tel: 201-343-8983, FAX: 201-343-2132; FSC No.: 59504; Empl.: 16; *Sls. Mgr.:* James Brenner

Distributor

MASTER DISTRIBUTORS, P.O. Box 25662, Los Angeles, CA 90025, Tel: 213-452-1229 ..... **A•1247, 1632, 1739, 1948, 2166, 2308, 2420; B•1152, 1210, 1313, 1350, 1384, 1390, 1466, 1506, 1526, 1557, 1577, 1632, 1730, 1770, 1792, 1852, 1890; C•1052, 1348, 1410, 1478, 1536, 1660, 1818** 608, 610, 611, 612, 618, 631, 632, 635, 641, 649, 651, 652, 661, 665, 667, 668, 669, 672, 689, 692, 695, 699, 700, 701, 710, 717, 720, 722, 723, 727, 731, 737, 738, 753, 755, 763, 772, 784, 789, 792, 803, 807, 808, 810, 812, 817

MEC

FAX: 213-399-8600

MASTER ELECTRONIC CONTROLS, P.O. Box 25905, Los Angeles, CA 90025, Tel: 213-452-1336, TELEX: 182041 MASTER SNM; Empl.: 74; *Sls. Mgr.:* Jamil Nizam; *Dist. Mgr.:* Belinda Valle ..... **B•1541-1544**

BRILL
ELECTRONICS
(415) 834-5888
610 E. 10th St., Oakland, CA 94606
MEC MASTER ELECTRONIC CONTROLS
(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

Local Sales Offices & Reps
CA Los Angeles, Master Distrs. 213-829-4656
CA Santa Monica, Master Distrs. 213-452-1229

Local Distributors
CA Oakland, Brill Elctrns. 415-834-5888
CA Santa Monica, Master Distrs. 213-452-1336

MATEC INSTRUMENTS, INC., 75 South St, Hopkinton, MA 01748, Tel: 508-435-9039, FAX: 508-435-5289; Empl.: 55; *Sls. Mgr.:* Harry Ives

MATERIALS RESEARCH CORPORATION, Route 303, Orangeburg, NY 10962, Tel: 914-359-4200, TELEX: 221862 MRC UR, FAX: 914-425-6075; Empl.: 780; *Sls. Mgr.:* Robert S.Kase

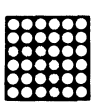
MATH ASSOCS., 2200 Shames Dr., Westbury, NY 11590, Tel: 516-334-6800, FAX: 516-334-6473

MATHEMATICAL SYSTEMS DESIGN, INC., 11835 W. Olympic Blvd., Suite 745, Los Angeles, CA 90064, Tel: 310-479-7180, FAX: 310-479-0942; *Sls. Mgr.:* Lorr Kramer

THE MATHWORKS, INC., 21 Eliot Street, So. Natick, MA 01760, Tel: 508-653-1415, TELEX: 910-240-5521, FAX: 508-653-2997

MATRIX CORP., 2260 Distributors Dr., Indianapolis, IN 46241, Tel: 317-248-2036, FAX: 317-248-8369; Empl.: 10 ..... **D•1185**

MATRIX CORP., 1203 New Hope Rd., Raleigh, NC 27610, Tel: 919-231-8000, FAX: 919-231-8001; Empl.: 65; *Sls. Mgr.:* Michael Bryant

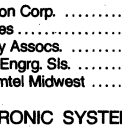


FAX: 818-222-2304

MATRIX SYSTEMS CORP., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, Tel: 818-222-2301; FSC No.: 33281; Empl.: 75; *Sls. Mgr.:* Randy Sue Rabideau ..... **B•1545**

Local Sales Offices & Reps
AL Huntsville, Reynolds Assoc., Inc. 407-259-7000
AZ Scottsdale, Faser Techn. Sls. 602-948-4404
CA Huntington Beach, Scientific Devices-West 714-840-3501
CA San Jose, Scientific Dvcs. West 408-554-0455
CO Broomfield, Scientific Dvcs. 303-469-5145
CT Meriden, Polytek Assocs. 203-634-4499
FL Melbourne, Reynolds Assocs., Inc. 407-259-7000
FL Newport Richey/Coral Springs, Reynolds Assocs. 407-259-7000
GA Duluth, Reynolds Assoc., Inc. 407-259-7000
IL Arlington Hgts., Comtel Midwest 708-392-4040
IN Indianapolis, Comtel Midwest 317-253-1681
KS Shawnee Mission, Comtel Midwest ... 913-268-0762
MA Ashland, Polytek Assocs. 508-881-4741
MA Falmouth Hgts., RJC Assocs. 508-540-8832
MI Southfield, Comtel-Instr. 313-358-2505
MN Wayzata, Comtel Midwest 612-476-1551
MO Manchester, Comtel Midwest 314-227-7220
NY Mamaroneck, Bassin Tech. Sls. Co. ... 914-698-9358
NC Raleigh, Reynolds Assoc. 407-259-7000
OH Cleveland, Comtel Instr. 216-442-8080
OH Columbus, Comtel Instr. 614-876-8305
OH Dayton, Comtel Instr. 513-426-5310
OR Portland, Topp Engrg. Sls. 503-244-7265
PA Pittsburgh, Comtel Instr. 412-922-5720
SC Greenville, Reynolds & Assocs. 407-259-7000
TX Carrollton, Seaton Corp. 214-980-9860
UT Scientific Devices 801-973-9411
VA Fairfax, Schibley Assocs. 703-591-3008
WA Bellevue, Topp Engrg. Sls. 206-747-5400
WI New Berlin, Comtel Midwest 414-544-6042

MATROX ELECTRONIC SYSTEMS, LTD., 1055 St. Regis Blvd., Dorval, QU, Canada H9P 2T4, Tel: 514-685-2630, TELEX: 05-822798, FAX: 514-685-2853; Empl.: 450; *Sls. Mgr.:* Ed Dwyer, VP Sls.; *Dist. Mgr.:* Bruce Seidel



FAX: 714-960-6492

MATSUO ELECTRONICS, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, Tel: 714-969-2491; Empl.: 854; *Sls. Mgr.:* Ted Wiltse ..... **A•1092-1097**

Local Sales Offices & Reps
AZ Tempe, FP Sls. 602-894-5303
CA Mission Viejo, Angle Assocs. 714-582-8858
CA Redwood City, James S. Heaton Co. .. 415-367-7158
FL Plantation, Gallagher 305-473-2101
GA Norcross, Macro Mktg. 404-662-5580
IL Des Plaines, ESCO Assocs. 312-298-5310
IN Indianapolis, STB & Assocs. 317-844-9227
MD Randallstown, Chesapeake Mktg. 301-922-5997
MA Randolph, Hatch Assocs. 617-963-3306
MI Grand Rapids, DEM Elctrn. Sls. 616-364-4024
MI St. Clair Shores, DEM Elctrns. 313-777-1750
MN St. Paul, Proud Inds. 612-646-9428
NJ Ft. Lee, Neptune Elctrns. 201-461-2789
NM Albuquerque, FP Sls. 505-345-5553
OH Dayton, Dolfuss-Root & Co. 513-433-6776
OH Strongsville, Dolfuss-Root & Co. 216-238-0300
TX Plano, RAM Elctrns. 214-424-4455
OR Beaverton, N. R. Schultz 503-643-1644
PA Pittsburgh, Dolfuss-Root & Co. 412-221-4420
WA Bellevue, N. R. Schultz 206-454-0300
Can Scarborough, Ont., Bach-Simpson 416-288-9932

Local Distributors
CA Garden Grove, Capacitor Supp. 714-638-0510
CA Garden Grove, National Elctrns. 714-892-7749
CA San Diego, Southland Comps. 619-673-3800
CA San Jose, Passive Technlg. 408-435-5566
CA Santa Maria, Garrett Instrs. 805-922-0594
CA W. Covina, CSI 818-960-4761
CA Yorba Linda, Corona Elctrns. 714-283-8185
GA Norcross, Spectrum Elctrns. 404-448-1516
IL Arlington Heights, Mar/Lyn 312-364-0444
IN Carmel, Altek Elctrns. 317-848-1323
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Billerica, A. W. Mayer Co. 617-229-2255
MA Billerica, Baldwin Comps. 617-667-6710
MA Wilmington, Aved Elctrns. 617-657-6310
MN New Brighton, Parts 1 612-633-8079
NJ Fairfield, C.H.P.S., Inc. 201-882-0997
NJ Kenilworth, Ventronics 201-272-9262
NY Ronkonkoma, Baldwin Comps. 516-588-5700
PA Norristown, Century Elctrn. Comps. ... 215-631-5400
TX Dallas, C & W 817-831-0395
TX Dallas, Omni-Pro 214-233-0500
VA Charlottesville, Virginia Elctrns. 804-296-4184
Can Montreal, Que., Prelco 514-389-8051
Can N. London, CM Peterson 519-434-3204
Can Willowdale, Ont., Electro Sonic 416-494-1666

MATTHEY ELECTRONICS, Television Equipment Associates, Box 393, South Salem, NY 10590, Tel: 914-763-8893, TELEX: 493-0698, FAX: 914-763-9158; *Sls. Mgr.:* Bill Pegler

MAUELL CORP., 31 Old Cabin Hollow Rd., P.O. Box 339, Dillsburg, PA 17019-0339, Tel: 717-432-8686, FAX: 717-432-8688; Empl.: 25; *Sls. Mgr.:* Frank A. Ulrich; *Dist. Mgr.:* Frank A. Ulrich

MAUREY INSTRUMENT CORP., 4555 W. 60th St., Chicago, IL 60629, Tel: 312-581-4555, FAX: 312-581-2576; FSC No.: 03942; Empl.: 50; *Sls. Mgr.:* E. Maurey; *Dist. Mgr.:* Louis Derdzinski ..... **A•2045-2053**

Local Sales Offices & Reps
CT Killingworth, Gallagher Assocs. 203-663-2338
MA Framingham, Gallagher Assocs. 617-626-2346
TX Dallas, THT Sls. Co. 214-783-1501

Local Distributors
CA Garden Grove, Allied Elctrns. 714-554-0731
CA Santa Clara, Allied Elctrns. 408-727-1690
CO Wheatridge, Allied Elctrns. 303-425-7144
CT Ridgefield, PIC 203-451-1533
FL Margate, Allied Elctrns. 305-973-3070
MA Wilmington, Allied Elctrns. 617-942-0150
MI Battle Creek, Great Lakes Elctrns. 616-963-6282
MI Grand Rapids, SF Elctrn. Supp. 616-459-0216
MI Westland, Allied Elctrns. 313-595-6565
MO St. Louis, Allied Elctrns. 314-878-1229
NY Mineola, Allied Elctrns. 516-248-2360
NC Raleigh, Allied Elctrns. 919-821-0415
OH Akron, Stotts-Friedman 216-253-7000
OH Cincinnati, Stotts-Friedman 513-574-7701
OH Dayton, Stotts-Friedman 513-298-5555
OH Willoughby, Allied Elctrns. 216-951-0908
OK Tulsa, Allied Elctrns. 918-663-7630
PA Bala Cynwyd, Allied Elctrns. 215-267-6940
TN Knoxville, Shields Elctrns. 615-588-2421
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Allied Elctrns. 713-932-7321
VA Alexandria, Allied Elctrns. 703-836-5002
WA Seattle, Allied Elctrns. 206-767-5772

MAURY MICROWAVE CORP., 8610 Helms Ave., Cucamonga, CA 91730, Tel: 714-987-4715, FAX: 714-987-1112; FSC No.: 13047; Empl.: 100; *Sls. Mgr.:* M. A. Maury, Jr.

MAXIMUM STRATEGY, INC., 1650 B Berryessa Rd., San Jose, CA 95133, Tel: 408-729-1526, FAX: 408-729-7084; Empl.: 15; *Sls. Mgr.:* Wes Meador; *Dist. Mgr.:* Ernie Ohrenstien

MAXMAR CONTROLS INC., 99 Castleton St, Pleasantville, NY 10570, Tel: 914-747-3540, FAX: 914-747-3567; *Sls. Mgr.:* Julius Chastant; *Dist. Mgr.:* Julius Chastant

MAXON PRECISION MOTORS, INC., 838 Mitten Rd., Burlingame, CA 94010, Tel: 415-697-9614, FAX: 415-697-2887; *Sls. Mgr.:* Sam Robinson

MAXUS ELECTRONIC CORP., 2760 29th St., Boulder, CO 80301, Tel: 303-447-1226, FAX: 303-447-1446; Empl.: 6; *Sls. Mgr.:* Eric Slack

MAXWELL ELECTRONICS, P.O. Box 12033, Research Triangle Park, NC 27609, Tel: 919-846-1633; Empl.: 8; *Sls. Mgr.:* Joe Harrison

MAXWELL LABORATORIES, INC., 8888 Balboa Avenue, San Diego, CA 92123-1506, Tel: 619-279-5100, FAX: 619-279-1554; Empl.: 600; *Sls. Mgr.:* Michael M. Plum, V.P. Mktg.

MBD INTERNATIONAL, P.O. Box 870577, Dallas, TX 75287-0577, Tel: 214-788-5277, FAX: 214-404-0471; Empl.: 5; *Sls. Mgr.:* Robert McLeod; *Dist. Mgr.:* Robert McLeod

MB DYNAMICS INC., 25865 Richmond Rd., Cleveland, OH 44146-1483, Tel: 216-292-5850, TELEX: 510-601, FAX: 216-292-5614; Empl.: 45; *Sls. Mgr.:* Ed Peterson

MCCOY ELECTRONICS CO., A Sub. of Oak Industries, 100 Watts St, P.O. Box B, Mt. Holly Springs, PA 17065, Tel: 717-486-3411, TWX: 510-650-3548, FAX: 717-486-5920; FSC No.: 00136; Empl.: 450 ..... **A•1380-1387**

Local Sales Offices & Reps
AL Huntsville, Elctrn. Sls., Inc. 205-533-1735
AZ Phoenix, Sunwest Mktg. 602-893-7677
CA Chatsworth, Wes-K 818-700-0933
CA San Mateo, Melvin Sls. 415-349-7445
CO Grand Function, Krebill Comp. Sls. 303-243-8220
CO Littleton, Advanced Tech Mktg. 303-798-4200
FL Oviedo, Conley & Assocs. 407-385-3283
GA Norcross, Elctrn. Sls., Inc. 404-448-6554
IL Glendale Heights, Beta Technlg. Sls., Inc. 312-790-9886
IL Northfield, Feller Assoc. 708-446-8065
IN Kokomo, Schillinger Assoc., Inc. 317-452-4057
IA Cedar Rapids, Jack L. Tucker & Assoc. 319-362-1019
KS Lenexa, Mid-Tech Assoc. 913-541-0505
MD Towson, Dickison Sls. 301-823-0923
MA Norwood, Naton Assoc. 617-762-3224
MN Minneapolis, Dunlop Consits. 612-544-1070
NM Albuquerque, Sunwest Mktg. 505-898-6471
NY Binghamton, Foster & Wager, Inc. 607-724-7093
NY New Rochelle, Ascor Elctrns. 914-235-8838
NY Rochester, Foster & Wager, Inc. 716-385-7744
NC Cary, Elctrn. Sls., Inc. 919-467-8486
OH Cincinnati, Stegman Blaine Mktg. 513-729-1969
OR Tigard, Eltech Incorp. 503-684-3458
PA Ft. Washington, Beta Sls. 215-643-6650
TX Austin, R. F. Kimball Co. 512-443-5284
TX Richardson, R. F. Kimball Co. 214-231-3447
VA Charlottesville, PDQ Sls. 804-979-7085
WA Bellevue, Eltech. Incorp. 206-643-4330
EXP NJ, Oradell, Sylvan Ginsbury Ltd. 201-261-3200

MCCURDY RADIO INDUSTRIES LIMITED, 108 Carnforth Road, Toronto, Ont., CAN M4A 2L4, Tel: 416-751-6262, FAX: 416-751-6455; *Sls. Mgr.:* Murray Porteous; *Dist. Mgr.:* Murray Porteous

MCE SEMICONDUCTOR, INC., 1111 Fairfield Dr., West Palm Beach, FL 33407, Tel: 407-845-2837, TELEX: 44105 (MCE UI), FAX: 407-863-8275; Empl.: 58; *Sls. Mgr.:* Thomas Munn

MCFADDEN SYSTEMS, INC., 11835 E. Smith Ave., Santa Fe Springs, CA 90670, Tel: 213-948-4414, TELEX: 677161, FAX: 213-948-1291; FSC No.: 25750; Empl.: 30

MCG ELCTRNS., 12 Burt Dr., Deer Park, NY 11729, Tel: 516-586-5125, FAX: 516-586-5120; FSC No.: 29779; Empl.: 45; *Sls. Mgr.:* Don Worden ..... **B•1375-1376**

Local Sales Offices & Reps
FL Lake Mary, Pure Power,Inc. 407-333-3212
GA Atlanta, On-Track Sys., Inc. 404-451-8885
IN Indianapolis, Domino 317-841-6159

MA Woburn, EMS 617-229-6686
MI Brighton, Cesko Sls. Co. 313-227-5061
MN St. Louis Pk., Electro Midwest 612-922-7017
NJ Caldwell, RTS Data 201-228-5249
OK Oklahoma City, Computer Power 405-848-2522
OK Tulsa, Allan & Assoc. 918-663-6713
TN Alcoa, Powerforce Sys. 615-970-7584
TX Richardson, Devices, Inc. 214-991-1202
UT Salt Lake City, S&T Mktg. 801-268-8183
WV Huntington, Seco, Inc. 304-522-9732
Can Richmond Hill, Ont., Computer Power Eng. 416-764-1548

Local Distributors

GA Norcross, Alltel Supply 404-448-5210
NC Charlotte, Data Directions 704-588-5622
PA E. Oakmont, RPC Video 412-828-1414
TX Lubbock, Wesco 806-747-3256

McGILL®

FAX: 219-465-2456

MCGILL MANUFACTURING CO., INC., 909 North Lafayette Street, Valparaiso, IN 46383, Tel: 219-465-2200; Empl.: 295; *Sls. Mgr.:* Tom Morris ..... **B•1734-1736**

Local Sales Offices & Reps

AL Huntsville, James E. Heusser Agy. 205-836-3896
AR Hot Springs, Automation Supp., Inc. 501-767-5444
CA Cotati, Joseph Foster 707-792-4392
CA Oceanside, Mark Waggoner 213-904-0156
CO Northglenn, Dan Ryall 303-452-8185
CT Bristol, Eric Peterson 203-297-7464
IN Bremen, Jan Richard Stahly 219-282-3592
IA Des Moines, Jerry Bunch Electrical Sls. 515-287-7057
MI Chelsea, Rick Mayday 313-995-2965
MN Eagan, Stan Lock 612-890-9347
MS Brandon, Service Electrical Sls. 601-992-9122
MO St. Peters, Neil Klocke 314-947-2259
NJ Lauren Springs, Jim Cawood 215-359-3708
NM Albuquerque, Paul Atkinson 505-292-1222
NY Old Bethpage, Susan Razzano 718-830-5011
NY Silver Creek, Scott Earsing 716-325-3485
OH Euclid, Joe Ciulla 216-574-7164
SC Columbia, Harold Heaton 803-733-0941
TN Nashville, Richard Hardy 615-748-1150
TX Dallas, Raley Sls. Co. 214-368-1683
UT Salt Lake City, Kev Paul 801-484-9941
VA Richmond, Wynn Meredith 804-275-7970
WI Kenosha, Wally Coats 312-299-2354
Can Mississauga, Ont., Marr Elec. Ltd. 416-277-9481

MCGUIRK ELECTRONICS CO. INC., 212 So. Main St, P. O. Box 853, Middleton, MA 01949, Tel: 617-933-3500; FSC No.: 55902; Empl.: 10; *Sls. Mgr.:* R. O'Neill

MCI TRANSFORMER CORPORATION, 411 Manhattan Ave., Babylon, NY 11704, Tel: 516-587-0510, FAX: 516-587-0624; Empl.: 50; *Sls. Mgr.:* Timothy J. Williams ..... **A•2266-2276**

Local Sales Offices & Reps

MA Orange, MCI Transformer 508-544-8806
NH Nashua, Key Sls. of New England, Inc. 603-888-8742

mckENZIE
TECHNOLOGY

FAX: 415-651-1020

MCKENZIE TECHNOLOGY, 44370 Old Warm Springs Blvd., Fremont, CA 94538, Tel: 415-651-2700; Empl.: 175; *Sls. Mgr.:* Kari Trautman; *Dist. Mgr.:* Vicky Wodopianov ..... **C•1467**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean, Inc. 205-830-1540
AZ Phoenix, Mercury Engrg. Sls., Inc. 602-265-0344
CA Pleasanton, Moulthrop Sls., Inc. 415-463-0450
CA Westminster, West Elctrn. Sls., Inc. 714-898-0120
CO Denver, Donohue Sls. Co. 303-455-1719
CT Waterbury, Compak, Inc. 203-753-6431
FL Orlando, Cartwright & Bean, Inc. 407-423-1756
GA Atlanta, Cartwright & Bean, Inc. 404-368-0160
IL Chicago, Golten Assocs., Inc. 708-512-0093
MA Boston, Compak Inc. 508-568-0331
MN Twin Cities, GP Sls. Inc. 612-831-2362
MS Jackson, Cartwright & Bean, Inc. 601-981-1170
NH Derry, Compak, Inc. 603-434-8498
NY New York, Sticom 516-724-6814
NC Charlotte, Cartwright & Bean, Inc. 704-536-0303
NC Raleigh, Cartwright & Bean, Inc. 919-876-4130
OH Dayton, Electro-Mktg. 513-890-8322
OR Portland, RTS, Inc. 503-244-4123
PA Philadelphia, TCA 215-692-6853
PA Pittsburgh, Electro-Mktg. 412-823-5400
TN Memphis, Cartwright & Bean, Inc. 901-362-8345
TX Dallas, JYS Co.,/Comps. 214-349-1650
WA Seattle, RTS, Inc. 206-285-1363

Local Distributors

AL Huntsville, Allied Elctrns. Inc. 800-433-5700
AL Huntsville, Century Fastners 205-883-5344
AZ Phoenix, Force Elctrns. 602-437-1060
AZ Tempe, D.C. Elctrns. 602-438-1234
CA San Diego, Force Elctrns. 619-569-9661
CA El Segundo, Force Elctrns. 213-772-1324
CA Fountain Valley, Comps Ctr., Inc. 714-979-0433
CA Fullerton, Kent 714-773-0781
CA Los Angeles, Allied Elctrns. 714-669-4190
CA Milpitas, R&D Elctrn. Parts 408-262-7144
CA San Diego, Kent 619-271-5404
CA San Francisco, Allied Elctrns. 415-487-5250
CA Santa Clara, Abacus Elctrns. 408-732-2000
CA Santa Clara, D.C. Elctrns. 408-980-1199
CA Santa Clara, Force Elctrns. 408-748-1324
CA Santa Clara, Kent Elctrns. 408-727-9810
CA Temecula, Rancho Elctrns., Inc. 714-676-6454
CA Tustin, D.C. Elctrns. 714-259-9066
CO Denver, Alliance Elctrns. 303-433-1648
CT Danbury, Heilind Elctrns. 203-797-8600
DC Allied Elctrns. Inc. 301-423-1061
FL Clearwater, Allied Elctrns. 800-433-5700
FL Largo, Electronic Precepts 813-544-3636
FL Pompano Bch., Allied Elctrns. Inc. 305-486-0500
FL Tampa, Century Fasteners, Tampa ... 813-802-5770
GA Atlanta, Allied Elctrns. Inc. 404-377-3555
IL Bensenville, Voyager Elctrns. Corp. ... 312-860-1300
IL Chicago, Allied Elctrns. 312-697-8200
MA Boston, Allied Elctrns. Inc. 617-942-3150
MA Waltham, Vector Sls.,Inc. 617-787-2790
MA Wilmington, Heilind Elctrns. 1-800-343-5004
MN Fridley, Voyager Elctrns. 612-571-7766
MN New Brighton, Parts 1 612-633-8079
MN Stillwater, Elctrn. Depot Supp. Co. 612-439-9409
NH Atkinson, Astrum Elctrns. 603-898-3399
NY Bohemia, RBD Elctrns. 516-589-7717
NY Mineola, Allied Elctrns. Inc. 516-248-2360
NC Raleigh, Allied Elctrns. 919-876-5845
NC Raleigh, Century Elctrns. Comps., Inc. 919-782-2116
OH Cleveland, CAM RPC Elctrn. 216-461-4700
OR Beaverton, Comp. Resources, Inc. 503-641-8488
PA Pittsburgh, CAM RPC Elctrn. 412-782-3770
RI Warwick, Cal-Greg Comps. 401-738-6170
TX Allen, Prime Distbg. Co. 214-231-0170
TX Austin, Kent Elctrns. 512-834-1900
TX Dallas, Allied Elctrns. 214-553-4370
TX Dallas, Kent Elctrns. 214-669-2600
TX Farmers Branch, Force Elctrns. 214-247-9955
TX Ft. Worth, Allied Elctrns. 214-265-9341
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Force Elctrns. 713-561-8677
TX Stafford, Southwest Elctrns., Inc. 713-240-4000
WA Redmond, Pyramid/Kent 206-883-7200
WA Kent, Comp. Resources, Inc. 206-454-8666

MCL, INC., 501 S. Woodcreek Rd., Bolingbrook, IL 60440-4999, Tel: 708-759-9500, TWX: 910-683-1899, FAX: 708-759-5018; FSC No.: 16469; Empl.: 127; *Sls. Mgr.:* Frank Morgan

MCLEAN ENGINEERING, Zero Corporation, 70 Washington Rd., Princeton Junction, NJ 08550, Tel: 609-799-0100, TWX: 510-685-2543, FAX: 609-799-1081; FSC No.: 03522; Empl.: 118; *Sls. Mgr.:* Craig A. Reed; *Dist. Mgr.:* Craig A. Reed ..... **C•1632-1633**

Local Sales Offices & Reps

AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA San Mateo, Halbar Assocs. 415-349-4700
CA Van Nuys, Halbar Assocs. 818-906-3941
CO Aurora, Component Tech 303-680-9550
FL Orlando, Raycom 407-859-5504
GA Duluth, Raycom 404-476-2041
IL Elmhurst, Scott Assocs. 708-279-5681
MD Hunt Valley, Marktron 301-628-1111
MD Rockville, Marktron 301-251-8990
MA Chelmsford, JEBCO 508-256-5800
MI Livonia, Electro-Mktg. 313-421-7590
NY Rochester, Talty Assocs. 716-323-1210
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO Grandview, Harris-Hanson 816-763-6200
MO St. Louis, Harris-Hanson 314-432-3611
NJ Lebanon, Sylvester Sls. Assocs. 201-735-2488
NM Albuquerque, Fry-Gates 505-262-1525
OH Dayton, Electro-Mktg.Grp. 513-890-8322
OH N. Royalton, Electro-Mktg. Grp. 216-582-0075
PA Huntingdon Valley, Inacker Sls. 215-947-5660
PA Pittsburgh, Electro-Mktg. Grp. 412-823-5400
TX Houston, Milco Mktg. 713-469-5156
TX Plano, Milco Mktg. 214-578-1996
WA Redmond, Halbar PNW 206-882-0990
Can Guelph, Ont., Hammond Mfg. Co. 519-822-2960

Local Distributors

FL Ft. Lauderdale, Component Distrs. 305-971-4950
GA Norcross, Component Distrs. 404-441-3320
MI Ann Arbor, Wedemeyer Elctrn. Supp. Co. 313-665-8611
NC Raleigh, Component Distrs. 919-834-9465
TX Dallas, Component Distrs. 214-644-0373
Can Guelph, Ontario, Hammond Mfg. Co. .. 519-822-2960

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McLEAN MIDWEST

FAX: 612-569-0533

MCLEAN MIDWEST, Sub. of Zero Corporation, 4000 83rd Ave. N., Brooklyn Pk., MN 55443, Tel: 612-561-9400, TELEX: 29-0883; *Sls. Mgr.:* J. Buyse ..... **C•1634-1635**

Local Sales Offices & Reps

AZ Tempe, Phoenix Comp. Sls. 602-839-0248
CA Laguna Hills, Western Automation 714-859-6988
CA Oakland, Powermatic Assocs. 415-635-6825
CO Boulder, Comp. Prod. Sls. Co. 303-530-2800
GA Norcross, Hollingsworth & Still, Inc. 1-800-241-5712
IL Elmhurst, Scott Assocs., Inc. 708-279-5681
MD Rockville, Marktron, Inc. 301-251-8990
MA Chelmsford, John E. Boeing Co. 508-256-5800
MI E. Detroit, Jack M. Thorpe Co. 313-779-6363
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO St. Louis, Harris-Hanson Co. 314-432-3611
NJ Totowa, R.O.I. Sls. Co. 201-812-9606
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FAX: 512-984-2211

3M ELECTRICAL SPECIALITIES DIVISION, 6801 River Place Blvd., Bldg. 130-3N-56, Austin, TX 78726-9000, Tel: 800-328-1368; *Sls. Mgr.:* Mike Martin ..... **D•2236-2237**

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CA San Francisco 800-634-8909
CO Denver 800-328-0201
DC Washington 404-447-7170
GA Atlanta 800-241-3670
IL Chicago 800-942-3961
IN Indianapolis 800-323-4087
MA Boston 800-851-1515
MI Detroit 800-323-4087
MN St. Paul 800-392-0312
MO St. Louis 800-527-1648
NJ Newark 201-575-2000
NY Syracuse 212-285-9600
NC High Point 919-889-7181
OH Cincinnati 800-523-4441
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OH Columbus 800-523-4441
PA Philadelphia 800-524-0168
TN Memphis 800-241-3669
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TX Houston 800-442-8046
WA Seattle 206-244-7200,206-241-2250
WI Milwaukee 800-323-4087

FAX: 512-984-6972

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Local Sales Offices & Reps

CA Campbell, Olsheski & Assoc. 408-378-6003
CA Danville, Olsheski & Assoc. 415-820-9144
CA Pleasanton, Sedlak, Mike 415-462-4547
CA Valencia, Cessing Assocs. 805-295-0225
CO Wheatridge, Cluff & Assoc. 303-425-6604
CT Chesire, The Macinnis Co. 203-372-3797
FL Apopka, Cartwright & Bean, Inc. 407-889-2168
FL Deerfield Beach, Cartwright & Bean, Inc. 305-429-3400
GA Atlanta, Wallace Elctrn. Sls. 800-334-3518
IL Lombard, RMP/McBride Corp. 312-932-9090
IN Indianapolis, M & L Elctrn. Sls. 317-359-4742
IA Cedar Rapids, T. Dowell & Assoc. 319-364-3880
KS Overland Park, T. Dowell & Assoc. 913-599-1100
LA Slidell, Wallace Elctrn. Sls. 504-643-4751
MD Lisbon, S.K. MacDonald, Inc. 301-442-1590
MA Norwood, The Macinnis Co. 617-762-8090
MI Warren, Burcaw Co. 313-573-6048
MI Wyoming, Burcaw Co. 313-573-4605
MN Edina, Restronics, Inc. 612-941-9135
MO St. Louis, T. Dowell & Assoc. 314-849-4334
NJ Cherry Hill, S.K. MacDonald, Inc. 609-482-2666
NY Hauppauge, Aurora-Schmitt Assoc. 516-434-1572
NY Syracuse, T-Squared Elctrns., Co. 315-463-8592
NY Victor, T-Squared Elctrns. Co. 716-924-9101
NC Kernersville, Wallace Elctrn. Sls. 919-996-2742
OH Beachwood, Elctrns. Salemasters 216-831-9555
OR Beaverton, Pacific Mktg. Specialists ... 503-641-9373
PA Monroeville, S.K. MacDonald, Inc. 412-373-1723
TN Tullahoma, Wallace Elctrn. Sls. 800-334-3518
TX Dallas, Elcom Mktg. 214-241-2166
TX Houston, Elcom Mktg. 713-350-8064
WA Redmond, Pacific Mktg. Specialists ... 206-882-3144
Can London, Ont., David Allen

Local Distributors

AL Huntsville, Hall-Mark 205-837-8700
AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Phoenix, Hall-Mark 602-437-1200
AZ Tempe, Acacia/Deanco, Inc. 602-894-2874, 602-882-9054
AZ Tempe, Shelley-Ragon, Inc. 602-894-2058
CA Chatsworth, Hall-Mark 818-773-4500
CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA Fremont, Acacia/Deanco, Inc. 415-623-7500
CA Garden Grove, Richey/Impact Elctrns. 714-895-0060
CA Irvine, Acacia/Deanco, Inc. 714-660-0834, 213-971-2428
CA Rocklin, Hall-Mark 916-624-9718
CA San Diego, Acacia/Deanco, Inc. 619-565-4365
CA San Diego, Hall-Mark 619-268-1201
CA San Diego, Richey/Impact Elctrns., Inc. 619-271-4511
CA San Diego, Shelley-Ragon, Inc. 619-453-7133
CA San Jose, Hall-Mark 408-432-0900
CA San Jose, Powell Elctrns., Inc. 408-943-9020
CA San Jose, Richey/Impact Elctrns., Inc. 408-432-7100
CA San Jose, Shelley/Ragon 408-432-0600
CA Santa Clara, DC Elctrn. Supp. 408-980-1199
CA Torrance, Kent Elctrns. 213-320-2700
CA Tustin, DC Elctrns. 714-259-9066
CA Tustin, Hall-Mark 714-669-4700
CO Denver, CSID/Integrated Fastn. Inc. ... 303-292-9594
CO Englewood, Hall-Mark .. 303-790-1662,303-790-4991
CO Englewood, Shelley-Ragon, Inc. 303-762-0670
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CT Cheshire, Hall-Mark 203-271-1704
CT East Haven, JV Elctrns. 203-469-2321
CT Yalesville, Schaal Assocs., Inc. 203-269-3779
FL Casselberry, Hall-Mark 407-830-5855
FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
FL Largo, Hall-Mark 813-541-7440
FL Pompano Beach, Hall-Mark 305-971-9280
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
FL Winter Park, Deanco 305-671-5100
GA Marietta, Deanco 404-429-0126
GA Norcross, Hall-Mark 404-447-8000
IL Bensenville, Magnuson Elctrns. 312-595-7575
IL Wood Dale, Hall-Mark .. 312-860-3800,312-860-0239
IL Wood Dale, NEP Elctrns., Inc. 312-595-8500
IN Ft. Wayne, Bell Inds., Inc. 219-423-3422
IN Indianapolis, Bell Inds., Inc. 317-875-8200, 800-622-4814,
IN Indianapolis, Hall-Mark 317-872-8875
IN Indianapolis, Magnuson Elctrns., Inc. .. 317-247-5108
IA Cedar Rapids, Shelley-Ragon, Inc. 319-373-0525
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MO Earth City, Hall-Mark 314-291-5350
MO Hazelwood, Shelley-Ragon, Inc. 314-895-1515
MO Independence, Shelley/Ragon Inc. 816-254-3410
MO St. Charles, Lectronix, Inc. 314-946-6424, 800-325-3348
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NY Farmingdale, Addem Distrs. 516-752-9303
NY Hauppauge, Schaal Assocs., Inc. 516-434-7100
NY Ithaca, Deanco 607-257-4444
NY Medford, Shelley-Ragon, Inc. 516-447-2000
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NC Cary, Powell Elctrns. 919-467-1212
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195
NC Raleigh, Deanco, Inc. 919-851-2065
NC Raleigh, Hall-Mark 919-872-0712
OH Columbus, Elctrns. Mktg. Corp. 614-299-4161
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OH Highland Heights, Elctrns. Mktg. Corp. 216-442-3441
OH Solon, Hall-Mark 216-349-4632
OH Worthington, Hall-Mark 614-888-3313
OK Tulsa, Hall-Mark 918-254-6110
OK Tulsa, Norvell Elctrns. 918-663-1247
OR Beaverton, Acacia/Deanco, Inc. 503-646-3377
OR Beaverton, Shelley/Ragon 503-641-1691
OR Tualatin, Moore Elctrns., Inc. 503-692-5333
TX Houston, Hall-Mark 713-781-6100
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Richardson, Kent Electrns. 214-669-2600
TX Austin, Hall-Mark 512-258-8848
TX Austin, Kent Elctrns. 512-834-1900
TX Austin, Norvell Elctrns., Inc. 512-837-5555
TX Dallas, Hall-Mark 214-553-4300
TX Dallas, Hall-Mark
TX Dallas, Norvell Elctrns. 214-233-0020
TX El Paso, ERA Elctrns. 915-855-3600
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Norvell Elctrns. 713-777-1666
TX Plano, Tactic Elctrns. 214-422-0777
UT W. Valley City, Hall-Mark 801-972-1008
WA Redmond, Acacia/Deanco, Inc. 206-881-5566
WA Redmond, Shelley/Ragon Elctrns. 206-883-2220
WA Seattle, Hall-Mark 206-547-0415
WA Tukwila, Carlyle Inc. 206-251-0700
WI Milwaukee, Elctrn. Expeditors, Inc. 414-228-8100
WI New Berlin, Hall-Mark 414-797-7844

3M PHOTODYNE PRODUCTS, Dynatel Systerms Division, 3760 Calle Tecate, Camarillo, CA 93010, Tel: 805-388-8378, 800-426-8688, TWX: 910-874-2020; FSC No.: TWX 910-874-2020; 59912; Empl.: 100

3M PRIVATE NETWORK PRODUCTS, 3M, 6801 Riverplace Blvd., Austin, TX 78769-2963, Tel: 512-984-1800, 800-745-7459, FAX: 512-984-5943; Empl.: 50; *Sls. Mgr.:* R.C. Ware

MDF PRODUCTS INC., 7 Johnson Dr., Danbury, CT 06811, Tel: 203-743-3579, TELEX: 499-8051, FAX: 203-744-2704; FSC No.: 60628 ..... **D•1293**

MDM, INC., 9601 Irondale Ave., Chatsworth, CA 91311, Tel: 818-700-8400, FAX: 818-700-1938; FSC No.: 60994; Empl.: 150; *Sls. Mgr.:* Steven J. LaLonde

MDS CALIBRATION LAB. INC., 437-H Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234, FAX: 904-664-6789; *Sls. Mgr.:* Gerry Doiron

MEA DIV., See Mechanized Elctrn. Assembly Div., Universal Instrs. Corp.

MEASUREMENTS GROUP, INC., Box 27777, Raleigh, NC 27611, Tel: 919-365-3800, TELEX: 62919594, FAX: 919-365-3945

MEASUREMENT SYSTEMS, INC., 121 Water St., Norwalk, CT 06854, Tel: 203-838-5561, TELEX: 6813573; Empl.: 97; *Sls. Mgr.:* Gerard M. Lacrocque, Nat'l. Sls. Mgr. ..... **D•1138**

Local Sales Offices & Reps

AZ Scottsdale, Advent Comps. 602-481-0044
CA Anaheim, Gabriel & Assoc. 714-531-7674
IA Cedar Rapids, S & O Sls. 319-393-7331
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MA Hudson, Data Rep 508-481-0333
MN Edina, Elctrn. Sls., Inc. 612-933-9070
MO St. Louis, J. S. DeWeese Co. 314-469-7350
OH Medina, J. C. Hofstetter Co. 216-241-4880
PA Hickory, J. C. Hofstetter Co. 412-356-2305
TX Richardson, Scientific Sls. Co. 214-231-6541
VA Richmond, Robert Elctrn. Sls. 804-276-3979

MEC A/S, Industriparken 23, Ballerup, Denmark DK-2750, Tel: 011-4542973366, TELEX: 9125649, TWX: 2381-125649, FAX: 011-4542 681514; Empl.: 50

FAX: 517-782-2810

MECHANICAL PRODUCTS INC., 1824 River St. P. O. Box 729E, Jackson, MI 49204, Tel: 517-782-0391, TWX: 810-253-0827; *Sls. Mgr.:* Dave Olson .... **B•1378-1381**

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AZ Scottsdale, Advent Comps. Corp. 602-481-0044
CA Los Angeles, Universal Components Co. 213-641-4255

CA Sunnyvale, Pass Associates 408-735-9040
CO Denver, Advent Comps. Corp. 303-455-1985
FL Tampa, Florida Comp. Sls., Inc. 813-873-3622
GA Atlanta, Electro-Mech 404-447-6478
IL Barrington, Perhats Assocs. 708-381-6360
KS Prairie Village, C. Logsdon & Assoc. .. 913-381-3833
MD Pikesville, Muncy Sls. 301-484-6376
MA Danvers, C. H. Burnham Assoc. 508-774-0111
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MO St.Louis, C. Logsdon & Assoc. 314-849-5125
NH Durham, C. H. Burnham Assocs. 603-868-2282
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NY Port Washington, Ashtec, Inc. 516-267-0981
NC Raleigh, Electro-Mech 919-851-8165
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Can Pointe Claire, Que., Har Tech 514-694-6110

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FL Lakeland, Wes-Garde Comps. Grp. ... 800-282-7619
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IL Chicago, Nep Elctrns. 708-625-8400
MA Danvers, RCI 617-777-4441
MI Grand Rapids, S & F Elec. Supp. Co., Inc. 616-459-0216
MI St. Clair Shore, Spemco Switch, Inc. .. 313-771-2700
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Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can St. Laurent, Que., Tara Inds. Corp. 514-331-6550

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MECHATRONICS

FAX: 206-236-5480

MECHATRONICS INC., 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040, Tel: 206-232-4800, TWX: 910-444-4126; Empl.: 40; *Sls. Mgr.:* Jim Innes ..... **C•1636-1639**

Local Sales Offices & Reps

WA Mercer Island, Mechatronics Inc. 206-232-4800

MECO INDUSTRIES, Mechanical Engraving Co., Inc., 4500 Bullard Ave, Bronx, NY 10470, Tel: 212-324-4455, FAX: 212-324-5500; FSC No.: 99040; Empl.: 35

MEDA, INC., Macintyre Electronics Design Assocs., 11260 Roger Bacon Dr., Ste. 202, Reston, VA 22090, Tel: 703-471-1445; Empl.: 8

MEDIA RECOVERY INC., Box 1407, Graham, TX 76046, Tel: 800-527-9497, 214-630-9625 (Texas), TELEX: 73-2561; Empl.: 130; *Sls. Mgr.:* J. Ricciardi

MEGADATA CORP., 35 Orville Dr., Bohemia, NY 11716, Tel: 516-589-6800, FAX: 516-589-6858; FSC No.: 53436; Empl.: 90

MEISSNER INDUSTRIES, 551 Rte. 10, Dover, NJ 07801, Tel: 201-366-1700; Empl.: 10

MEKTRONIX TECHNOLOGY, INC., 53 Depot Rd, Goleta, CA 93117, Tel: 805-964-9669, FAX: 805-964-0797; Empl.: 5; *Sls. Mgr.:* Gregory Mayworm

FAX: 508-881-5082

MELCHER, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 800-828-9712, TWX: 5101003630; Empl.: 280; *Sls. Mgr.:* Joe DiPietro ..... **D•1892-1895**

Local Sales Offices & Reps

CA La Habra, West Coast Reps. 213-690-9960
AZ Scottsdale, Power Up Elctrn. Sls. 602-955-1105
CA Granada Hills, West Coast Reps. 818-368-7385
CA San Diego, West Coast Reps. 619-576-9203
FL Coral Springs, Graham Assocs. 305-341-5102
FL Largo, Graham Assocs. 813-539-6779
FL Melbourne, Graham Assocs. 407-773-6631
FL Orlando, Graham Assocs. 407-299-1001
FL Palm Beach Gardens, Graham Assocs. 407-622-4049
WA Snohomish, West Coast Reps. 206-483-5300
FL Winter Garden, Graham Assocs. 407-656-9369
IL Arlington Hgts., Phoenix Elctrn. Sls. ... 708-394-4422
KS Olathe, Tech. Sls. Assocs. 913-829-2800
MI Troy, CB Jensen & Assocs. 313-643-0506
MO St. Louis, Tech. Sls. Assocs. 314-521-2044
NY Wantagh, Bytec Reps. 516-781-7400
NC Winston-Salem, Murcota 919-722-9445
PA Willow Grove, Tech. Sls. Assocs. 215-784-0170
TX Richardson, Jim D. Gray & Assocs., Inc. 214-699-9976
TX Richmond, Jim D. Gray & Assocs., Inc. 713-342-1710
WI Brookfield, McMahon Inc. 414-782-3335

MELCOR

FAX: 609-393-9461

MELCOR/MATERIALS ELCTRN. PRODS., 994 Spruce St., Trenton, NJ 08648, Tel: 609-393-4178, TELEX: 84-3314; FSC No.: 32333; Empl.: 220; *Sls. Mgr.:* M.A. Levine ..... **C•1641-1644**

Local Sales Offices & Reps

CO Fort Collins, Rep Sls., Inc./Andy Cornedi 303-226-1504
CA Mountain View, Shaw Tech, Inc. 415-961-4775
NY W. Henrietta, Exogray Tech. Sls. 716-334-1340

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FAX: 213-820-6958

MELFESS FIVE, INC., 12304 Santa Monica Blvd., No. 121, Los Angeles, CA 90025, Tel: 213-826-8133, 800-533-2297; Empl.: 7; *Sls. Mgr.:* Michael S. Fisher ..... **D•1106**

MELLES GRIOT, INC., 1770 Kettering St, Irvine, CA 92714, Tel: 714-261-5600, TELEX: 678447; Empl.: 110; *Sls. Mgr.:* Kevin Chittim, VP Mktg.

MEL-RAIN CONTROLS, 42974 M-43 Hwy., Paw Paw, MI 49079, Tel: 616-657-2527, FAX: 616-657-2528; FSC No.: 639; Empl.: 20; *Sls. Mgr.:* Howard F. Walter

MEMBRANE SWITCH & PANEL CO., INC., 1537-G McFadden, Santa Ana, CA 92705, Tel: 714-541-5775; Empl.: 8

MI

FAX: 219-356-7376

MEMCOR-TRUOHM, INC., 1320 Flaxmill Rd, Huntington, IN 46750, Tel: 219-356-4300; FSC No.: 24681; Empl.: 250; *Sls. Mgr.:* Ray Vanderspool ..... **A•1946, 2054**

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
CA American Canyon, Jacobson & Assoc. 707-552-4412
CA Huntington Bch., Mil-Com Sls. 714-840-2424
FL Indialantic, Raycom 305-727-8860
GA Atlanta, Murcota 404-875-2525
IL Chicago, D. Dolin Sls. 312-286-6200
IN Ft. Wayne, Menze Sls. 219-747-5616
MI St. Clair Shores, J.M. Thorpe 313-779-6363
MO St. Charles, Hayes Elec. Sls. Co. 314-946-6677
NH Atkinson, Mark Rep Assoc. 603-382-9563
NJ Englewood Cliffs, Masin Esco 201-569-8868
NY Hauppauge, Masin Esco 516-273-3500
NY Marcellus, Mullahy Sls. Inc. 315-685-6280
NC Burlington, Murcota 919-585-1577
NC Winston-Salem, Murcota 919-723-1001
OH Cleveland, Glover Sls. 216-842-4520
PA Newtown Square, G.M. Conneen 215-353-2241
TX Dallas, SW Elctrn. Ind. 214-233-9816
TX Houston, SW Elctrn. Ind. 713-729-1670
WA Redmond, Barrett-Squibb 206-885-6991

MEMODYNE, 20 Ossipee Rd., Newton, MA 02164, Tel: 617-964-6556 (in MA), 800-255-1510, FAX: 617-964-2444; Empl.: 40; *Sls. Mgr.:* Leonard Sacon ..... **D•1100**

Local Sales Offices & Reps

AL Huntsville, Dean Assocs. 205-534-2255
AZ Scottsdale, A.M.I. 602-947-4297
CA Carson, Amasco 213-516-8561
CT Portland, BBI Elctrns. 203-342-0648
FL Orlando, DAI Sls. 305-299-7754
IL Elmhurst, Scott Assocs. 312-279-5681
MD Severna Park, Syronics 301-544-8652
MA Holbrook, McLellan Assocs. 617-767-4771
MI Detroit, EQS Sys. 313-961-3042
MI Pontiac, EQS Sys., Inc. 313-338-2280
MN Chanhassen, Jen-Ray Sys. 612-934-8607
NJ Boonton, PAF Assocs. 201-335-0680
NY Liverpool, Syronics 315-451-0968
NY Smithtown, PAF Assocs. 516-360-0940
OH Chesterland, EQS Sys. 216-729-2222
OH Columbus, EQS Sys. 614-228-3453
OH Dayton, EQS Sys., Inc. 513-236-7676
OH Huber Hgts., EQS Sys., Inc. 216-729-2222
OR Lake Oswego, Syntek 503-636-6793
PA Sellersville, Penn-Tech Sls. 215-257-2756
TX Irving, Trice Mktg. 214-255-1877
WA Kirkland, Syntek 206-488-0394

MEMORY PROTECTION DEVICES, INC., 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-293-5891, FAX: 516-752-1971; *Sls. Mgr.:* Thomas Blaha ..... **D•1469**

Local Distributors

AL Huntsville, Powell Elctrns. 205-837-5300
AL Huntsville, Resistacap, Inc. 205-883-4270
AZ Phoenix, Lynntronics 602-433-0288
CA Buena Park, Cypress Elctrns. 714-521-5230
CA Costa Mesa, Battery Specialties 800-854-5759
CA Costa Mesa, House of Batteries 714-642-8222
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA San Diego, Tauber Elctrns. 619-274-7242
CA San Jose, Powell Elctrns. 408-943-6438
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Van Nuys, Nesco Corp. 818-781-0522
CO Arvada, Denver Beta Wintronics 303-431-7161
CO Englewood, AVT, Inc. 303-779-8056
CO Englewood, Cypress Elctrns. 303-792-5829
FL Fort Lauderdale, Powell Elctrns. 305-484-8377
FL Tampa, MicroPrecision Inc. 813-854-2861
GA Norcross, Applied Power 404-263-0421
ID Boise, Kimball Elctrns. 208-342-3559
IL Morton Grove, Power Pak 312-966-6000
IN Indianapolis, North American Cap 317-856-3731
MD Annapolis Junction, Powell Elctrns. ... 301-880-3255
MA Andover, Generation Elctrns. 508-683-1177
MA Canton, Richey Impact Elctrns. 617-821-1500
MA Sharon, Adcour Inc. 617-784-8123
MA Sutton, Engrd. Assemblies and Comp. Corp. 508-865-0722
MI Brighton, Applied Power 313-227-3604
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Thief River Falls, Digi Key Corp. 218-681-6674
NJ Camden, Gen. Radio Supp. 609-964-8560
NJ Mountainside, Mars Elctrns. 201-233-0044
NJ Teterboro, Engrd. Assemblies & Comp. Corp. 201-288-4477
NY Buffalo, Summit Distrs. 716-887-2800
NY Rome, Rome Elctrns. 315-337-5400
NC Raleigh, Engrd. Assemblies & Comps. Corp. 919-790-9700
OR Beaverton, Micro Power 503-626-7086
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Dallas, Conformance Technlg., Inc. 214-233-4173
TX Dallas, Computer Comps. Corp. 214-239-0271
TX Dallas, Cypress Elctrns. 214-869-1435
TX Irving, Powell Elctrns. 214-550-0457
UT W. Valley City, Denver Beta Wintronics 801-966-0378
WI Milwaukee, Taylor Elctrns. 414-241-43321

MEMORY X, INC., 5205 Kearny Villa Way, No. 106, San Diego, CA 92123, Tel: 619-292-1151, FAX: 619-292-0774

MEMTEC CORP., 19-B Keewaydin Dr., Salem, NH 03079, Tel: 603-893-8080, FAX: 603-893-8699; Empl.: 35

MEMTRON®

FAX: 517-652-2659

MEMTRON TECHNOLOGIES, INC., 1400 Weiss St, Frankenmuth, MI 48734, Tel: 517-652-2656, 800-234-7525; FSC No.: 6 V 417; Empl.: 130; *Sls. Mgr.:* Daniel T. Ortner ..... **B•1824**

Local Sales Offices & Reps

AZ	Tucson, Intramerica Technlg.	602-326-8997
CA	San Diego, Intramerica Technlg.	619-451-3383
CA	Saratoga, Edward King & Assocs.	408-867-2111
CO	Longmont, Reliance Sls.	303-443-5660
FL	Maitland, EIR, Inc.	305-660-9600
GA	Lawrenceville, Tek-Rep Mktg., Inc.	404-963-1600
IL	Wheaton, CS Tech. Sls.	312-653-8126
IN	Indianapolis, EMCI, Inc.	317-253-1668
MA	Framingham, Stone Comp. Sls. Corp.	508-875-3266
MN	Oakdale, Complete Sls.	612-731-2923
MO	Saint Charles, Buckman & Assocs.	314-946-6201
NY	Islip, ABS Technlgs., Inc.	516-277-7010
NY	Liverpool, Syronics	315-451-0968
OH	Delaware, Bill Romine Co.	614-363-1600
PA	Southampton, Campbell Assocs.	215-322-6630
TX	Richardson, Zonk & Assocs.	214-238-7651, 214-895-9131
VA	Alexandria, Tech-Reps. Inc.	703-370-2600
WA	Renton, K. R. Jensen Sls.	206-277-2772
Can	Toronto, Ont., Reptech	416-863-9510

MENSOR CORPORATION, 2230 IH-35 South, San Marcos, TX 78666, Tel: 512-396-4200

MEPCO/CENTRALAB CORP., See Philips Components Discrete Products Division

MEP CONTROLS, Rising Sun Rd., Bordentown, NJ 08505, Tel: 609-298-7300, FAX: 609-298-1982; Empl.: 25; *Sls. Mgr.:* Thomas Thorn

MEPCOPAL

FAX: 619-481-1123

MEPCOPAL COMPANY, 11468 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-453-0332; Empl.: 160 ..... **A•2055-2057; B•1737**

Potentiometers (Cermet, Carbon) Industrial & Military

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Tempe, Philips Comps.	602-820-2225
CA	Anaheim, Philips Comps.	714-441-0385
CA	Harbor City, Refrigeration Comp.	213-325-3420
CA	Mission Hills, Philips Comps.	818-891-6299
CA	San Diego, Philips Comps.	619-453-0332
CA	Santa Clara, Philips Comps.	408-748-1563
CA	Sunnyvale, Philips Comps.	408-746-2066/2808
CO	Englewood, Philips Comps.	303-779-9696
FL	Altamonte Springs, Philips Comps.	407-339-5073
FL	Ft. Lauderdale, Philips Comps.	305-485-0115
GA	Norcross, Over & Over Inc.	404-449-6205
GA	Roswell, Philips Comps.	404-992-0150
IL	Bannockburn, GMR Sls., Inc.	312-295-8440
IL	Des Plaines, Philips Comps.	312-827-4487
IN	Ft. Wayne, Corrao Marsh	219-482-2725
IN	Green Field, Corrao Marsh, Inc.	317-462-4446
IN	Kokomo, Philips Comps.	317-456-1615
IA	Cedar Rapids, Lorenz Sls. Inc.	319-377-4666
KS	Merrian, Lorenz Sls. Inc.	913-384-6556
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Woburn, Philips Comps.	617-932-4748
MI	Farmington Hills, Philips Comps.	313-553-6000
MN	Minneapolis, Elec. Comps. Sls., Inc.	612-933-2594
MO	St. Louis, Lorenz Sls. Inc.	314-997-4558
NE	Lincoln, Lorenz Sls. Inc.	402-475-4660
NJ	Englewood, Ed Glass Assoc.	201-592-0200
NY	E. Rochester, Empire Tech. Assocs.	716-381-8500
NY	Endwell, Empire Tech. Assoc., Inc.	914-336-6575
NY	Skaneateles, Empire Tech. Assocs.	315-685-5703
NC	Charlotte, Over & Over Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
NC	Raleigh, Philips Comps.	919-782-3334
OH	Dayton, Philips Comps.	513-436-0066
OH	Wickliffe, Philips Comps.	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
NJ	Englewood Cliff, Ed Glass Assocs.	201-592-0200
PA	Willow Grove, Philips Comps.	215-659-6096
TX	Austin, Philips Comps.	512-331-8828
TX	Houston, Philips Comps.	713-987-0034
TX	Richardson, Philips Comps.	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	Milwaukee, Philips Comps.	414-228-7632
PR	Caparra Hgts., M. Anderson Co., Inc.	809-793-6544
Can	Scarborough, Ont., Philips Comps.	416-292-5161

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Scottsdale, Spirit Elctrns.	602-988-1533
CA	Sunnyvale, Hamilton/Avnet	408-743-3355
CO	Englewood, Shelley-Ragon	303-762-0670
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Orlando, TTI, Inc.	407-859-1000
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
IL	Chicago, Nep Elctrns.	312-595-8500
IN	Indianapolis, Marshall Inds.	317-297-0483
MD	Columbia, TTI, Inc.	301-995-1331
MA	Wilmington, Marshall Inds.	508-658-0830
MI	Livonia, Marshall Inds.	313-525-5850
MN	St. Paul, Shelley-Ragon	612-642-2828
NE	Omaha, Scott Elctrns.	402-734-6750
NJ	Mt. Laurel, TTI, Inc.	609-234-6400
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NC	Raleigh, Hall-Mark	919-872-0712
OH	Independence, TTI, Inc.	216-328-9755
OK	Tulsa, Hamilton/Avnet	918-252-7297
OR	Beaverton, Marshall Inds.	503-644-5050
PA	Norristown, Century Elec. Comp.	215-631-5400
TX	Ft. Worth, TTI, Inc.	817-595-3100
WA	Bellevue, Marshall Inds.	206-747-9100
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Scarborough, Ont., Philips Elctrns.	416-292-5161

MERCER ELECTRONICS, Simpson Electric Co., 853 Dundee Ave., Elgin, IL 60120, Tel: 708-697-2260, TELEX: 72-2416, FAX: 708-697-2272; *Sls. Mgr.:* Ron Barma, Adv. Mgr.; *Dist. Mgr.:* George Oskandy, Sls. Admin. Mgr.

MERCOTAC INC., 6195 Corte del Cedro E, Carlsbad, CA 92009, Tel: 619-431-7723, FAX: 619-431-0905; Empl.: 19; *Sls. Mgr.:* Bruce Enigenburg; *Dist. Mgr.:* Bruce Enigenburg ..... **B•1295**

MERCURY COMPUTER SYSTEMS, 600 Suffolk St, Lowell, MA 01854, Tel: 508-458-3100, FAX: 508-458-9580; FSC No.: 04-2741391; Empl.: 120; *Sls. Mgr.:* Graham V. Smith

MERCURY PLASTICS, A UNIT OF ZERO CORP., See Zero Plastics, A Unit of Zero Corp.

MERECO PRODUCTS DIV., Metachem Resins Corp., 1505 Main St, West Warwick, RI 02893, Tel: 401-822-9300, FAX: 401-822-9311; Empl.: 25; *Sls. Mgr.:* John E. Powell, Jr.

M

FAX: 213-828-7567

MERET OPTICAL COMMUNICATIONS, INC., An Amoco Co., 1800 Stewart St, Santa Monica, CA 90404-4998, Tel: 213-828-7496; FSC No.: 53071; Empl.: 120; *Sls. Mgr.:* Chris Walters ..... **B•1225**

For all states not listed call Meret Mn. Ofc. 213-828-7496

MERIAM INSTRUMENT, Scott Fetzer, 10920 Madison Ave., Cleveland, OH 44102, Tel: 216-281-1100, FAX: 216-281-0228; Empl.: 85; *Sls. Mgr.:* Russ Arslanian; *Dist. Mgr.:* Russ Arslanian

MERIX CHEMICAL CO., 2234 East 75th St, Chicago, IL 60649, Tel: 312-221-8242; Empl.: 15; *Sls. Mgr.:* E. O. Sonneman; *Dist. Mgr.:* E. O. Sonneman

MERRILL, INC., POB 308, 1316 Sumneytown Pike, Gwynedd Valley, PA 19437, Tel: 215-361-1297; FSC No.: 58624; Empl.: 10; *Sls. Mgr.:* J. Fournier

MERRIMAC INDUSTRIES, 41 Fairfield Pl, West Caldwell, NJ 07006, Tel: 201-575-1300, FAX: 201-575-0531; FSC No.: 12457; Empl.: 150; *Sls. Mgr.:* Tom Cox

J. R. MERRITT CONTROLS, INC., 320 Martin Luther King Dr., Norwalk, CT 06854, Tel: 203-855-9100, 800-333-5762, FAX: 203-855-1038; *Sls. Mgr.:* Earl Atkins ..... **D•1139**

Local Sales Offices & Reps

CA	Laguna Niguel, Simon & Co.	714-495-4583
CA	San Rafael, Bender Sys.	415-472-7033
FL	Lakeland, V-V Assocs., Inc.	813-858-3200
IL	Crestwood, Brisky Assocs., Inc.	708-385-5100
MI	Royal Oaks, J.H. Green Co.	313-543-1200
NY	Jamestown, William R. Arnold, Inc.	716-664-5402
OH	Solon, Black & Coulton, Inc.	216-349-1188
PA	Westchester, Lenape Inds.	215-696-7664
WA	Renton, SAS Fluid Power, Inc.	206-271-5363
Can	Mississauga, Ont., Patlon Inds., Inc.	416-624-5572

MESA POWER SYSTEMS, 2350 Meyers Ave., Escondido, CA 92029, Tel: 619-489-8162, FAX: 619-489-5718; FSC No.: 46937; Empl.: 20; *Sls. Mgr.:* Bob Posten

MESA TECHNOLOGY CORP., 9720 Patuxent Woods Drive, Columbia, MD 21046, Tel: 800-888-0567, FAX: 301-290-9171; Empl.: 106; *Sls. Mgr.:* Howard Parker

MES INDUSTRIES CO., LTD., Fl. No. 93 Lo-Li Rd., Taipei, Tel: 886-2-7363309, TELEX: 20801 MESICO, FAX: 886-2-7364109; Empl.: 25

MESUR-MATIC ELCTRNS., 10 Colonial Rd., Ste. 6, Salem, MA 01970-2294, Tel: 508-745-7000; Empl.: 18; *Sls. Mgr.:* Kosma L. Evangelidis

METALINK CORPORATION, P.O. Box 1329, Chandler, AZ 85244, Tel: 602-926-0797, TELEX: 4998050, FAX: 602-926-1198

METCAL, INC., 1530 O'Brien Dr., Menlo Park, CA 94025, Tel: 415-325-3291, FAX: 415-325-5932; Empl.: 86; *Sls. Mgr.:* Dan Frailey; *Dist. Mgr.:* Dan Frailey

METHODE ELECTRONICS, INC., 7444 W. Wilson Ave., Chicago, IL 60656, Tel: 708-867-9600, FAX: 708-867-9130; Empl.: 2000; *Sls. Mgr.:* S. Landeene; *Dist. Mgr.:* Randi Close

METHODE ELECTRONICS, INC., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008, Tel: 708-392-3500, FAX: 708-392-9404; FSC No.: 95354; Empl.: 250; *Sls. Mgr.:* Suzi Landeene; *Dist. Mgr.:* Kathy Lindsey

METRA INSTRUMENTS, INC., 1874 Lundy Ave., San Jose, CA 95131, Tel: 408-432-1110, TELEX: 296698; Empl.: 30

METRAPLEX CORP., 5305 Spectrum Dr., Frederick, MD 21701, Tel: 301-662-8000, TELEX: 697-4248 MPX CORP, FAX: 301-695-8099; Empl.: 105

METRICOR, INC., 18800 - 142nd Ave. NE, Woodinville, WA 98072, Tel: 206-483-5577, FAX: 206-485-2592; Empl.: 50; *Sls. Mgr.:* David W. Cable

METRIC SYSTEMS, 645 Anchors St, Ft. Walton Beach, FL 32548-9990, Tel: 904-244-9600, TELEX: 70-2447; FSC No.: 12339; Empl.: 700

METRIX INSTRUMENT CO., 1711 Townhurst, Houston, TX 77043, Tel: 713-461-2131, TELEX: 77-5486, FAX: 713-461-8223; Empl.: 50; *Sls. Mgr.:* W. B. Brown

METRO CIRCUITS, PJC Technologies, Inc., 205 LaGrange Ave., Rochester, NY 14613, Tel: 716-254-2980, TELEX: 716-254-2980; Empl.: 36; *Sls. Mgr.:* Darlene Gargan

METROLAB INSTRUMENTS SA, 110,Chemin du Pont-du-Centenaire, Geneva, Switzerland CH-1228, Tel: (41-22)794 11 21, TELEX: 41-22-794 11 20

METRON OPTICS INC., P.O. Box 690, Solana Beach, CA 92075-0690, Tel: 619-755-4477, FAX: 619-755-4752; Empl.: 22

METROPOLE PRODUCTS INC., P. O. Box 309, Stafford, VA 22554, Tel: 703-659-2132, FAX: 703-659-2133; FSC No.: 55908; *Sls. Mgr.:* John DePaola

METROSONICS, INC., Box 23075, Rochester, NY 14692-3075, Tel: 716-334-7300, TELEX: 853348, FAX: 716-334-2635; FSC No.: 55381; Empl.: 80; *Sls. Mgr.:* R. Branch; *Dist. Mgr.:* S. Macioulis

METRUM INFORMATION STORAGE, P.O. Box 5227, Denver, CO 80217-5227, Tel: 303-773-4581, TELEX: 45793 DVR; Empl.: 1000; *Sls. Mgr.:* C. Miller

mci

FAX: 908-679-3222

METUCHEN CAPACITORS, INC., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, Tel: 908-679-3366, TWX: 710-998-0892; FSC No.: 55969; Empl.: 25; *Sls. Mgr.:* George Wolter ..... **A•1098-1106, 1685-1687; C•1468-1471**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Prods.	205-880-1156
MD	Rockville, C.E. Tech. Elctrns.	301-666-0315
MD	Rockville, Metuchen Capacitors	301-590-0094
MA	Lowell, Underwood Sls.	617-256-8191
MO	Grandview, R. R. Burton Assocs.	816-763-5385
NJ	Brielle, EMC Technlgsts.	908-223-6699
PA	Saegertown, Multi-Phase Comps.	814-763-3640
TX	Dallas, Blackburn Assocs.	214-750-8484

MEXITRONIX (WOMAN OWNED), 2305 Northern Ave., Suite C , Kingman, AZ 86401, Tel: 602-757-9798, FAX: 602-757-8741; Empl.: 4

MEYER WIRE & CABLE CO., Div. of Cole Hersee Co., 1072 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-0817, FAX: 203-281-9648; Empl.: 45; *Sls. Mgr.:* Spencer G. Molloy, VP Sls.

MEYLAN CORPORATION, 543 Valley Rd., Upper Montclair, NJ 07043-1844, Tel: 201-744-6400, FAX: 201-744-1011; Empl.: 8; *Sls. Mgr.:* Stanley Mills

MFE INSTRUMENTS, Stocker & Yale, Inc., 133 Brimbal Ave., PO Box 490, Beverly, MA 01915-0490, Tel: 508-921-9104, 800-472-4633, ESYLNK: 953145, FAX: 508-921-9110; FSC No.: 6640,6685,6625,6660; *Sls. Mgr.:* Dennis A. Doscher; *Dist. Mgr.:* Dennis Doscher ..... **D•1421**

Local Sales Offices & Reps

MA	Natick, Andruss-Peskin Corp.	508-653-3919
NY	Buffalo, Lynn Assocs., Inc.	716-631-0054
OR	Beaverton, Thorson Co. N.W.	503-644-5900
WA	Bellevue, Thorson Co. N.W.	206-455-9180

MF ELCTRNS. CORP., 10 Commerce Dr., New Rochelle, NY 10801, Tel: 914-576-6570, FAX: 914-576-6570; FSC No.: 08111; Empl.: 100; *Sls. Mgr.:* Paul Huron ..... **A•1388-1393**

Local Sales Offices & Reps

AZ	Scottsdale, Haas & Assocs., Inc.	602-998-7195
CA	Irvine, Balzer-Wolf Assocs.	714-261-6877
CA	San Jose, Mac Tron	408-446-8224
AL	Madison, Benchmark Tech. Sls.	205-464-0033
CT	Southington, Orion Group	203-621-8371
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
MA	Peabody, The Orion Group	508-532-6266
MD	Annapolis, Rynone Assocs.	301-263-0794
MN	Edina, Peterson Sls.	612-835-5281
NY	Smithtown, T & K Sls.	516-724-3456
MN	Minneapolis, Ferrian Sls. & Assocs.	612-721-8915
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OR	Beaverton, Core II Mktg.	503-649-0877
OR	Portland, Core II	503-649-0871
PA	Prospect Park, Elf Sls. Co.	215-534-3340
PA	Prospect Park, ELF Sls.	215-534-3340
TX	Austin, Matthews & Assocs.	512-346-2969
TX	Dallas, Matthews & Assocs.	214-248-7881
UT	Salt Lake City, R 2 Mktg. Inc.	801-595-0631
WA	Seattle, Core II Mktg./VMI	206-882-2999

Local Distributors

CA	Burbank, Atwater Elctrns.	818-841-9050
NJ	Bellmawr, Mid Atlantic	609-931-5303
NY	Bohemia, RBD Elec.	516-589-7717
NY	Mt. Vernon, Janesway Elec.	914-699-6710

MFG, Parabam Div., 1130 Watsoncenter Rd., Carson, CA 90745, Tel: 213-549-5044; Empl.: 85

MFI, 12304 Santa Monica Blvd., Ste. 121, Los Angeles, CA 90025, Tel: 213-826-8133, 800-533-2297, FAX: 213-820-6958 ..... **D•1106**

MFM TECHNOLOGY, INC.
An Affiliate of **UNITRODE** Corporation

FAX: 516-467-5176

MFM TECHNOLOGY, INC., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, Tel: 516-467-5151; Empl.: 25 ..... **B•1297**

Local Sales Offices & Reps

AZ	Mesa, Motion Technlgy., Inc.	602-924-0004
MA	Quincy, Lansea Sys.	617-770-1618
IL	Barrington, Design Comps.	312-381-7842
MN	Eden Prairie, M-Tech	612-949-0847
NY	Plainview, Motion Control Sls.	516-756-5656
OH	Broadview Hts., Control Prods. Corp.	216-838-5700
OR	Portland, ControlTek, Inc.	503-641-0876
CA	Alhambra, C. E. Mello Co.	818-282-2000
CA	San Jose, Motion Control-North	408-997-0544

MG ELECTRONICS

FAX: 516-582-3229

MG ELECTRONICS, 32 Ranick Rd., Hauppauge, NY 11788, Tel: 516-582-3400; Empl.: 14; *Sls. Mgr.:* John Kibbit; *Dist. Mgr.:* Stan Grey ..... **D•1044**

MGR INDUSTRIES INC., 450B Industrial Dr., Ft. Collins, CO 80524, Tel: 303-221-2201, FAX: 303-484-4078; Empl.: 2; *Sls. Mgr.:* Jim Walton; *Dist. Mgr.:* Roger Erickson

MHOTRONICS., INC., 960 Corporate Woods Pkwy., Vernon Hills, IL 60061, Tel: 708-913-9566, FAX: 708-913-9587; Empl.: 45; *Sls. Mgr.:* David McFadden

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MICREL SEMICONDUCTOR, 560 Oakmead Parkway, Sunnyvale, CA 94086, Tel: 408-245-2500, FAX: 408-245-4175; FSC No.: 60496; Empl.: 135; *Sls. Mgr.:* Mike O'Neal; *Dist. Mgr.:* Mike O'Neal

MICROAVIONICS CORP., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-957-6904, FAX: 714-957-1614; Empl.: 15; *Sls. Mgr.:* B. H. Corzine

MICROBAR SYSTEMS, INC., 785 Lucerne Drive, Sunnyvale, CA 94086, Tel: 408-720-9300, FAX: 408-773-9475; *Sls. Mgr.:* Alexander London

MICROCAP, INC., A MicroSemi Company, 501 South Andreasen Drive, Escondido, CA 92025, Tel: 619-480-1906, FAX: 619-480-6741; Empl.: 65; *Sls. Mgr.:* Ken Miller, Sls. Mgr.

MICROCHIP TECHNOLOGY INC., 2355 W. Chandler Blvd., Chandler, AZ 85224, Tel: 602-963-7373, FAX: 602-345-3390; Empl.: 1500; *Sls. Mgr.:* Lanny Flessas; *Dist. Mgr.:* Lanny Flessas

MICRO-CIRCUIT ENGRG., See MCE Semiconductor

MICRO-CIRCUITS CO., INC., 10800 Maudlin Rd., New Buffalo, MI 49117, Tel: 616-469-2744, FAX: 616-469-2742 ..... **C•1145**

MICROCOMPATIBLES INC., 301 Prelude Drive, Silver Springs, MD 20901, Tel: 301-593-0683, FAX: 301-593-5151; Empl.: 4; *Sls. Mgr.:* Linda Esterling

MICRO CRYSTAL/DIVISION SMH, 702 West Algonquin Rd., Arlington Heights, IL 60005, Tel: 708-806-1485, FAX: 708-593-5062; *Sls. Mgr.:* William Kaczmarski; *Dist. Mgr.:* William Kaczmarski ..... **A•1395-1398**

Local Sales Offices & Reps

AZ	Scottsdale, E D P & Assoc.	602-991-6119
FL	Pompano Bch., H H P Assocs.	407-740-0320
GA	Tucker, Mackey Smith & Assoc.	404-496-9913
IL	Arlington Heights, Greenslade Sls.	708-593-3450
NH	Nashua, Bell Controls	603-882-6984
OH	Mt. Orab, Benjenn Engrg.	513-444-3175
PA	Glenside, Koebert Assocs.	215-887-2310

MICRO DATA SYSTEMS, P.O. Box 3278, Thomasville, GA 31799, Tel: 912-226-1709, TELEX: 6503406939 MCI CW; Empl.: 5; *Sls. Mgr.:* Sid Davis; *Dist. Mgr.:* Sid Davis

MICRODIMENSIONS, INC., 7345 Production Dr., Mentor, OH 44060, Tel: 216-974-8070, FAX: 216-974-1648; Empl.: 40

MICRODOT, INTERCONNECT SYSTEMS DIVISION, 201 Progress Dr., Montgomeryville, PA 18936, Tel: 215-699-5373, FAX: 215-699-5536; FSC No.: 91886; *Sls. Mgr.:* K. A. Neumuller

MICRODRY, INC., 7450 Hwy. 329, Crestwood, Kentucky 40014, Tel: 502-241-8933, FAX: 502-241-8648; Empl.: 16; *Sls. Mgr.:* John Wiedersatz

MICRO ELECTRONIC SYSTEMS, INC., 119 Northrup St., Bridgewater, CT 06752, Tel: 203-350-5004, FAX: 203-350-6966; Empl.: 4; *Sls. Mgr.:* Janine Green, V.P. Sls.

MICRO ELECTRONIC TECHNOLOGIES, 35 South St., Hopkinoon, MA 01748, Tel: 508-435-9057, FAX: 508-435-6481; Empl.: 53; *Sls. Mgr.:* Mike Levangie

MICRO-ETCH PRODUCTS, INC., 94 Dodge Ave., P.O. Box 9712, Stratford, CT 06497, Tel: 203-378-8610, FAX: 203-375-6276; FSC No.: 24846; Empl.: 42; *Sls. Mgr.:* Frank Dichiara; *Dist. Mgr.:* Frank Dichiara

MICROFLECT CO., INC., 3575 25th St. S.E., P.O. Box 12985, Salem, OR 97309-0985, Tel: 503-363-9267, TWX: 510-599-0107, FAX: 503-363-4613; Empl.: 100; *Sls. Mgr.:* John J. Kranitz

MICRO HYBRIDS, INC., 2864 Route 112, Medford, NY 11763, Tel: 516-732-3448, FAX: 516-732-3393; FSC No.: 5962; Empl.: 7; *Sls. Mgr.:* Bruce Richardson

MICRO INDUSTRIES, 691 Greencrest Drive, Westerville, OH 43081, Tel: 614-895-0404, ESYLNK: 759200, FAX: 614-882-6357

MICRO INSTRUMENT COMPANY, 2250 Micro Pl., Escondido, CA 92029, Tel: 619-746-2010, TELEX: 882205 MICROINST ESCD, FAX: 619-746-0433; FSC No.: FSCM 24836; Empl.: 40; *Sls. Mgr.:* C.Marks(East), C. Haas(West)

MICROLAB/FXR, 10 Microlab Rd., Livingston, NJ 07039, Tel: 201-992-7700, FAX: 201-992-0513; FSC No.: 00929; Empl.: 40

MICRO LAMPS, INC., 1530 Hubbard Ave., Batavia, IL 60510-1420, Tel: 708-879-0900; Empl.: 12; *Sls. Mgr.:* Edward R. Beutler

MICROMATH, INC., 2469 E. Fort Union Blvd., Salt Lake City, UT 84121, Tel: 801-943-0290, FAX: 801-943-0299; Empl.: 8

MICROMETALS, 1190 N. Hawk, Anaheim, CA 92807, Tel: 714-630-7420, 800-356-5977, FAX: 714-630-4562; FSC No.: 12856; Empl.: 80; *Sls. Mgr.:* Walt Lewis

MICRO MODE PRODS., 1870 John Towers Ave., El Cajon, CA 92020, Tel: 619-449-3844, TWX: 910-331-1673; FSC No.: 15907; Empl.: 55; *Sls. Mgr.:* V. DeMarco; *Dist. Mgr.:* V. DeMarco

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MICRO MO ELECTRONICS, INC., 742 2nd Ave. S., St. Petersburg, FL 33701, Tel: 813-822-2529, TELEX: 807-982; Empl.: 32; *Sls. Mgr.:* S. J. O'Neil ..... **B•1232, 1298-1301, 1920; D•1140-1141, 2243**

MICRO-MOUNTING DEVICES, 4092 Keith Dr., Campbell, CA 95008, Tel: 408-866-4626; FSC No.: 59058

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MICRONEL U.S., 2142F Industrial Ct., Vista, CA 92083, Tel: 619-727-7400; FSC No.: 61655; Empl.: 10; *Sls. Mgr.:* N. Linko ..... **C•1600, 1646-1649**

MICRO NETWORKS, Unitrode Corporation, 324 Clark St., Worcester, MA 01606, Tel: 508-852-5400, FAX: 508-853-8296; Empl.: 200; *Sls. Mgr.:* Skip Osgood

MICRONICS TECHNOLOGY INC., 7 Alexander Place, Glen Cove, NY 11542, Tel: 516-759-5600, FAX: 516-759-5603; *Sls. Mgr.:* Robert Herrmann, V.P. Oper. .... **A•1399**

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CA	Palo Alto, Microwave Mktg. Assoc.	415-941-9430
CA	Westlake Vl, Westtech Microwave, Inc.	818-991-9219
FL	Melbourne Beach, EDSI Sls.	407-952-1240
MD	Laurel, CSDS, Inc.	301-953-7884
NY	Melville, R.F. Elctrn. Sls.	516-420-8890
MA	Wayland, High Tech Sls.	508-653-3838
WA	Iffaquah, Seaport Tech. Sls.	206-391-6714

MICRON INDUSTRIES, 4250 Madison St., Hillside, IL 60162, Tel: 708-547-0900, FAX: 708-547-0998; FSC No.: 30882; Empl.: 115; *Sls. Mgr.:* Michael Kitun; *Dist. Mgr.:* Mike Kitun

MICRO-NOW INSTR. CO., INC., 8260 N. Elmwood St., P. O. Box 1488, Skokie, IL 60076, Tel: 708-677-4700, TELEX: RCA 297214-MICRO-UR, FAX: 708-677-0394; FSC No.: 33288; Empl.: 25; *Sls. Mgr.:* C. Arnow

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instr.	205-830-9224
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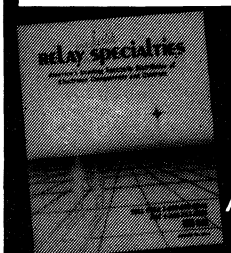

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GA	Norcross, W. A. Brown Instrs., Inc.	404-449-7160
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NY	Kings Park, USTM Tech. Mktg.	516-724-1542
WA	Seattle, Datacom	206-285-2525

MICRON TECHNOLOGY, INC., 2805 East Columbia Rd., Boise, ID 83706, Tel: 208-386-3900, FAX: 208-389-4617; Empl.: approx. 3,100; *Sls. Mgr.:* Jim Garrett

MICRO-OHM CORP., 1088 Hamilton Rd., Duarte, CA 91010, Tel: 818-3575377, FAX: 818-358-6478; FSC No.: 20940; Empl.: 109; *Sls. Mgr.:* Chas. Schwab; *Dist. Mgr.:* Chas. Schwab ..... **A•1947**

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CA	San Juan Capistrano, Craven & Assocs.	714-240-7242
IL	Lake Bluff, R & R Mktg. Assocs.	312-295-6600
MN	Maple Grove, Elctrn. Prods. For Ind.	612-784-5554
TN	Nashville, Strategic Mktg. Inc.	615-883-7882

Local Distributors

CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Huntington Bch., Wyle Labs	714-891-8008
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Diego, Shelley-Ragon	619-453-7133
CA	San Jose, Rose Elctrns.	408-943-0255
CO	Englewood, Arrow Elctrns.	303-790-4444
MN	Minneapolis, Electronic Ctr.	612-371-5200
NH	Hampstead, Astrum Elctrns.	603-329-5656
NY	New Rochelle, Derf Elctrns.	914-235-4600
NY	Oceanside, Tritech	516-678-6222
PA	McKean, Advacom	814-476-7774
TX	Ft. Worth, Industrial Elect.	817-731-7321
UT	Provo, Central Utah Elctrns. Supp.	801-373-7522
EXP	Basle, Switzerland, Siabalco W. Siegrist & Co. AG	845-962851
EXP	Huntingdale, Australia, Stewart Elctrn. Comps. Pty.	790-AA36908

MICROPAC INDS., INC., 905 E. Walnut St., Garland, TX 75040, Tel: 214-272-3571, FAX: 214-494-2281; Empl.: 200; *Sls. Mgr.:* Richard Schlueter

MICRO PALM COMPUTERS, INC., 13773-500-ICOT Blvd., Clearwater, FL 34620, Tel: 813-530-0128, FAX: 813-530-0738

MICROPHASE, 587 Connecticut Ave., Norwalk, CT 06856, Tel: 203-866-8000, FAX: 203-866-6727; Empl.: 230; *Sls. Mgr.:* F. S. Parin

MICROPLEX, INC., 1977 State College Blvd., Anaheim, CA 92806, Tel: 714-634-1535, FAX: 714-634-8375; Empl.: 30

MICROPLOT SYSTEMS, 1897 Red Fern Dr., Columbus, OH 43229, Tel: 614-882-4786, FAX: 614-882-3399; Empl.: 5; *Sls. Mgr.:* Steve Bean

MICRO PNEUMATIC LOGIC, INC., 2890 N. W. 62nd Street, Fort Lauderdale, FL 33309-1786, Tel: 305-973-6166, TELEX: 522316, FAX: 305-973-6339; Empl.: 100; *Sls. Mgr.:* Brian Irving

MICRO POWER INTL., INC., 10770 Black Mountain Rd. Ste. 248, San Diego, CA 92126, Tel: 619-271-0831, 619-271-5942; Empl.: 58

MICRO POWER SYS. INC., 3100 Alfred St., Santa Clara, CA 95056, Tel: 408-727-5350, TWX: 910-338-0154; FSC No.: 54186; Empl.: 140; *Sls. Mgr.:* Tom Hardy; *Dist. Mgr.:* Chuck Sweet

MICRO-PRODUCTS ENGINEERING CO., 230 Ridgewood Ave., Newark, NJ 07108, Tel: 201-824-8467, FAX: 201-824-5668; Empl.: 100; *Sls. Mgr.:* Gerald Muller

MICRO QUALITY SEMICONDUCTOR, INC., Microsemi Corp., 1000 N. Shiloh Rd., Garland, TX 75042, Tel: 214-272-7811, FAX: 214-487-0406; Empl.: 70; *Sls. Mgr.:* Bill Vandagriff; *Dist. Mgr.:* Bill Vandagriff

MICROSEMI CORP., 2830 S. Fairview St., Santa Ana, CA 92704, Tel: 714-979-8220, TELEX: 4720306, FAX: 714-557-5989; FSC No.: 14552; Empl.: 1200; *Sls. Mgr.:* Robert Shultz; *Dist. Mgr.:* G. Avila

MICROSEMI CORP. COLORADO, Microsemi Corp., 800 Hoyt St., Broomfield, CO 80020, Tel: 303-469-2161, FAX: 303-466-3775; Empl.: 140; *Sls. Mgr.:* Robert H. Werner; *Dist. Mgr.:* George Avila

MICROSEMI CORP. - SCOTTSDALE, Microsemi Corporation, 8700 E. Thomas Rd., P.O. Box 1390, Scottsdale, AZ 85252, Tel: 602-941-6300, TELEX: 4995412 MICROAZ, FAX: 602-947-1503; FSC No.: 860434040; Empl.: 300; *Sls. Mgr.:* Dean Foster (acting); *Dist. Mgr.:* George Avila

MICROSIGNALS INC., 38-42 9th St., L.I.C., NY 11101, Tel: 718-937-7955, 718-937-0391, 800-648-2252, FAX: 718-729-9140; Empl.: 40; *Sls. Mgr.:* Mr. Greg Villafana

MICROSONICS INCORPORATED

FAX: 617-337-4208

MICROSONICS, INC., 60 Winter St., Weymouth, MA 02188, Tel: 617-337-4200; FSC No.: 11869; Empl.: 120; *Sls. Mgr.:* John Hieber ..... **A•1401**

MICROSTAR LABORATORIES, 2863 152nd Ave. N.E., Redmond, WA 98052, Tel: 206-881-4286, FAX: 206-881-5494; Empl.: 16; *Sls. Mgr.:* Debbie Keefe; *Dist. Mgr.:* Linda Meza

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MICRO SWITCH, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, Tel: 815-235-6600, TELEX: 257499, TWX: 910-642-0922; Empl.: 3000; *Dist. Mgr.:* R. A. Garner ..... **B•1320-1321, 1738-1743, 1916-1919**

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CT	Glastonbury	203-659-6472
GA	Atlanta	404-248-2565
IL	Bensenville	312-860-3968
MA	Newton	617-969-0265
MI	Southfield	313-424-3569
MN	Minneapolis	612-830-3516
MO	St. Louis	314-569-7620
NJ	Westfield	201-233-9200
NY	Rochester	716-272-4333
NC	Charlotte	704-362-6948
OH	Brooklyn Heights	216-459-6075
OH	Dayton	513-237-4075
PA	Valley Forge	215-666-8340
TX	Dallas	214-701-2876
TX	Houston	713-780-6651
WA	Bellevue	206-453-7591
WI	Brookfield	414-784-6260
Can	Edmonton	403-483-4727
Can	Ottawa	613-224-3822
Can	Scarsdale	416-293-8111
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MICRO/SYS, 1011 Grand Central Ave., Glendale, CA 91201-3010, Tel: 818-244-4600, FAX: 818-244-4246

MICRO SYSTEMS ENGINEERING, INC., 6024 S.W. Jean Rd., Lake Oswego, OR 97035, Tel: 503-635-4016, TELEX: 151-538, FAX: 503-635-9610; FSC No.: 75800; Empl.: 200; *Sls. Mgr.:* Maury Reiter

MICROTECH, 1420 Conchester Hwy., Boothwyn, PA 19061, Tel: 215-459-3566, FAX: 215-358-4827; Empl.: 22; *Sls. Mgr.:* H. Carter

MICRO TECHNICAL INDUSTRIES, 23132 La Cadena Dr. Ste. E, Laguna Hills, CA 92653, Tel: 714-855-4326, TELEX: 371-9688, FAX: 714-855-9545; Empl.: 20; *Sls. Mgr.:* Joe Duarte

MICRO TECHNOLOGY INC., NS6 W13365 Silver Spring Dr., Menomonee Falls, WI 53051, Tel: 414-783-6080, FAX: 414-783-4959; Empl: 210

MICROTEC RESEARCH, INC., 2350 Mission College Blvd., Santa Clara, CA 95054, Tel: 408-980-1300, FAX: 408-982-8266; Empl.: 100; *Sls. Mgr.:* Derek Taylor; *Dist. Mgr.:* Derek Taylor

MICROTEK INTERNATIONAL/DEV. SYS. DIV., 3300 N.W. 211th Terrace, Hillsboro, OR 97124, Tel: 503-645-7333, FAX: 503-629-8460; Empl.: 120; *Sls. Mgr.:* Chris Bednarek

MICROTOUCH SYSTEMS, INC., 55 Jonspin Rd., Wilmington, MA 01887, Tel: 508-694-9900, TELEX: 530264, FAX: 508-694-9980; FSC No.: 935-0133; Empl.: 100; *Sls. Mgr.:* William Keller

FAX: 516-561-1117

MICROTRAN CO. INC., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, Tel: 516-561-6050; FSC No.: 00348; Empl.: 75; *Sls. Mgr.:* W. Benscher ..... **A•1212, 2130, 2278-2298**

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IL	Wheaton, CS Tech. Sls.	708-653-8126
IN	Fishers, R & D Elctrn. Sls.	317-849-2026
IA	Marion, AEM, Inc.	319-377-1129
KS	Lenexa, AEM, Inc.	913-888-0022
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Wellesley, Newscott Co.	617-235-6868
MN	Minnneapolis, RK Sales	612-571-1001
MO	St. Louis, AEM, Inc.	314-298-9900
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NM	Albuquerque, C.T. Carlberg & Assocs.	505-899-2155
NY	Marcellus, Mullahy-Welch Sls.	315-673-1009
NY	Rochester, J.G. Welch Assocs.	716-244-1100
NC	Greensboro, Arthur, Harris & Assoc.	919-275-3030
OH	Cleveland, J.O. Olsen Co.	216-838-0510
OH	Goshen, J.O. Olsen Co.	513-722-3320
PA	Pittsburgh, J.O. Olsen Co.	412-381-4254
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TX	Richardson, Spectra Sls. Corp.	214-234-3600
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CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Torrance, Kent Elctrns.	213-320-2700
CO	Englewood, Shelley/Ragon Inc.	303-762-0670
FL	Largo, Elctrn. Precepts of Florida	813-544-3636
FL	Pompano Beach, Peerless Radio Corp.	800-327-4993
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IN	Indianapolis, Bell Inds.	317-875-8200
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
MA	Hingham, Sager Elec. Supp.	617-749-6700
MN	Minneapolis, Bergquist	612-835-2322
NJ	Kenilworth, Federated Elctrns.	201-272-0505
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Lynbrook, Peerless Radio	516-593-2121
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NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Dayton, J.A. Becker Co.	513-226-1341
PA	McKeesport, Barno Radio Co.	412-751-5971
PA	Philadelphia, Shap Elctrns.	215-969-3300
TX	Austin, Kent Elctrns.	512-834-1900
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Lenert Co.	713-225-1465
TX	Richardson, Kent Elctrns.	214-669-2600
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	New Berlin, Classic Comp.	414-786-5300

MICROVISION CORP., 591 W. Hamilton Ave. Ste. 250, Campbell, CA 95008, Tel: 408-374-3158, FAX: 408-374-9394; Empl.: 15; *Sls. Mgr.:* Les Peterson

MICROWAVE APPLICATIONS GROUP, 3030 Industrial Pkwy., Santa Maria, CA 93455, Tel: 805-928-5711, TWX: 910-351-5808, FAX: 805-925-5903; FSC No.: 26357; Empl.: 63; *Sls. Mgr.:* D. W. Prigge

MICROWAVE DESIGN SVCS., INC., 437-H Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234, FAX: 904-664-6789

MICROWAVE DEVELOPMENT LABORATORIES, 10 Michigan Dr., Natick, MA 01760, Tel: 508-655-0060, TWX: 710-386-6850, FAX: 508-655-6972; Empl.: 180; *Sls. Mgr.:* R. Tucker

MICROWAVE DEVICE TECH., 1 Powers St., Lawrence, MA 01843, Tel: 508-688-6000, FAX: 508-688-6220; Empl.: 11; *Sls. Mgr.:* Murthy S. Ayyagari

MICROWAVE FILTER COMPANY, INC.

FAX: 315-463-1467

MICROWAVE FILTER INC., 6743 Kinne St., East Syracuse, NY 13057-0486, Tel: 315-437-3953, 800-448-1666, TELEX: 249-613; FSC No.: 27834; Empl.: 95; *Sls. Mgr.:* E. Bostick, Sls. & Mktg. ..... **A•1688-1695**

Local Sales Offices & Reps

MD	Laurel, CSDS, Inc.	301-490-3800
CA	Mtn. View, Pennisula Tech. Sls.	415-968-3636

Local Distributors

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CA	Torrance, Western CATV	213-539-8030
CO	Englewood, Midwest CATV	303-799-4343
FL	Boca Raton, Passive Dvcs., Inc.	407-998-0600
FL	Miami, Gendra Intl.	305-372-8845
FL	Ocala, Broadcasters Gen. Store	904-622-9058
FL	Panama City, Bay Elctrns. Supp.	904-785-7258
GA	Lawrenceville, John Weeks Entprs.	404-963-7870
IL	Skokie, Anixter Bros.	708-677-2600
IN	Richmond, Allied Broadcast Equip.	317-962-8596
KY	Highland Heights, Midwest Comms. Corp.	606-781-2200
LA	Mamou, Satellite Earth Stas.	318-468-2203
MS	Raymond, Broadcast Equip. Engrg. Sls.	601-857-8578
NE	Dakota City, ATV Research, Inc.	402-987-3771
NE	Omaha, Radio Equip. Co.	404-341-7700
NH	Bow, Earth Terminal, Inc.	603-224-5166
NJ	Union, Avanti Elctrns.	201-964-0333
NC	Pineville, S.C.M.S., Inc.	704-889-4508
PA	Horsham, Toner Cable	215-675-2053
PA	Hummelstown, Winemiller Comms.	717-566-9591
PA	Willow Grove, NCS Inds.	215-657-4690
TX	Bedford, Spectrum Megahertz	817-267-2288
UT	Salt Lake City, RIA Corp.	801-486-8822
VA	Charlottesville, Hall Elctrncs.	804-974-6466
WA	Edmonds, Glade Comms.	206-771-6891
WI	Plymouth, Hi-Tech.	414-892-6210
Can	Burnaby, B.C., Channel One Video Corp.	604-421-2288
Can	Calgary, Alberta, AVR Comms. Ltd.	403-251-0707
Can	Lavel, Que., Incospec Elctrns.	514-686-0033
Can	Markham, Ont., Cabletel Comms.	416-475-1030
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Montreal, Que., Comega Technlgs.	514-355-3105
Can	St. Leonard, Que., Trispec Comms.	514-328-2025

MICROWAVE SOLUTIONS, INC., 3200 Highland Ave., Ste 3A, National City, CA 91950, Tel: 619-474-6906, FAX: 619-474-7003; FSC No.: 65151; Empl.: 12; *Sls. Mgr.:* Edward M. Teyssier

MICROWAY INC. RESEARCH PARK, Research Park, P.O. Box 79, Kingston, MA 02364, Tel: 508-746-7341, FAX: 508-746-4678; Empl.: 49; *Sls. Mgr.:* Donald Greenbaum; *Dist. Mgr.:* Maryann Strassel

MIDAMERICA DESIGN SERVICE, Spirit of America Corp., 10206 Lima Rd., Fort Wayne, IN 46818, Tel: 219-489-2511, FAX: 219-489-2295; Empl.: 350

MIDCOM, INC., 121 Airport Dr., Watertown, SD 57201, Tel: 605-886-4385, FAX: 605-886-4486; FSC No.: 0GP22; Empl.: 300; *Sls. Mgr.:* Dean Ward ..... **A•2300-2305**

Local Sales Offices & Reps

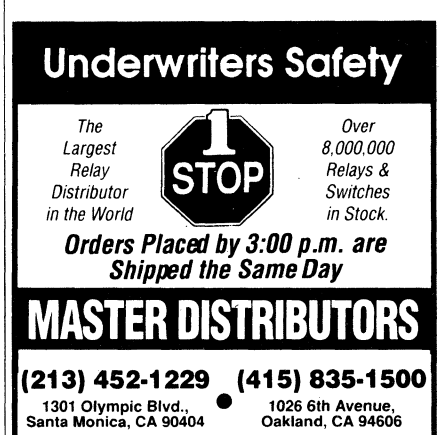
AL	Huntsville, Twentieth Century Mktg.	205-772-9999
CA	Long Beach, Solutech	213-596-5208
CA	San Diego, Pro Sls.	619-571-1133
CA	San Jose, Veer Mktg.	408-432-1818
FL	Orlando, Richmar Elctrns. Corp.	407-352-3755
GA	Norcross, Twentieth Century Mktg.	404-446-1999
IL	Downers Grove, Richmar Elctrns. Corp.	312-968-0118
IN	Indianapolis, Richmar Elctrns. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns. Corp.	319-354-8894
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3030
MN	N. Mankato, E.I. Sls.	507-345-5786
NH	Nashua, Bell Controls	603-882-6984
NJ	Medford, Champion Elctrn. Sls. Co.	609-983-0932
NC	Cary, Twentieth Century Mktg.	919-481-3370
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
TX	Round Rock, Richmar Elctrns. Corp.	512-255-2551
WI	Butler, Richmar Elctrns. Corp.	414-781-1730
Can	Gloucester, Ont., True North Technlg. Ltd.	613-837-2553
Can	Rexdale, Ont., True North Technlg. Ltd.	416-744-2233

MIDDLEBERG CORPORATION/MIDDCO CONNECTORS, 95 Albany Turnpike, Canton, CT 06019, Tel: 203-693-8361, FAX: 203-693-6403; Empl.: 20; *Sls. Mgr.:* Marty Townsend

MID-EASTERN INDUSTRIES, Technology Dynamics Inc., 100 School Street, Bergenfield, NJ 07621-2915, Tel: 201-385-0500, FAX: 201-385-0702; FSC No.: 06179; Empl.: 15; *Sls. Mgr.:* Daniel Ellenback ..... **D•1896-1899**







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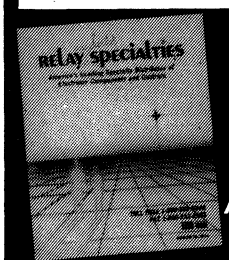
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CA	Los Angeles, Dyna Sls.	213-806-1400
FL	Land O' Lakes, AJ'S Power Source Inc.	813-996-2583
IL	Des Plains, Marsland Assocs., Inc.	312-298-2620
IN	Indianapolis, Marsland Assocs., Inc.	317-293-5437
IA	Marion, Marsland Assocs., Inc.	319-373-0566
MN	Minneapolis, Marsland Assocs., Inc.	612-545-4481
MO	St. Louis, Marsland Assocs., Inc.	314-991-1399
NM	Albuquerque, Westahl Assocs.	505-881-0995
NY	Huntington, C.R. Mayer Co.	516-692-4221
WA	Seattle, Eicher-Richards Co.	206-LA3-7888
WI	New Berlin, Marsland	414-786-6611

MIDGET LOUVER, 800 Main Ave., Norwalk, CT 06851, Tel: 203-866-2342; Empl.: 10; *Sls. Mgr.:* Helen Monroe; *Dist. Mgr.:* Helen Monroe

MIDLAND-ROSS CORP., NEL UNIT, See NEL Frequency Controls, Inc.

Midtex Relays, Inc.
FAX: 915-772-1116

MIDTEX RELAYS, INC., 9B2 Butterfield Trail, El Paso, TX 79906, Tel: 915-772-1061, 1-800-MIDTEX1, TWX: 910-240-3407, ESYLNK: 62752541; Empl.: 275; *Sls. Mgr.:* Craig Law; *Dist. Mgr.:* Bob Walasiak ..... **B•1546-1549**

Local Sales Offices & Reps

AL	Huntsville, Twentieth Century Mktg.	205-772-9999
AZ	Phoenix, More Sls.	602-788-9181
CA	Los Altos, J.W. Wilholt	415-961-3660
CA	Tustin, Schoenbachler-Dobson	714-544-1888
CO	Longmont, Reliance Sls.	303-443-5660
FL	Orlando, Richmar Elctrns.	407-352-3755
GA	Norcross, Twentieth Century Mktg.	404-446-1999
IL	Downers Grove, Richmar Elctrns.	708-968-0118
IN	Indianapolis, Richmar Elctrns.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
KS	Overland Park, M.I.N.K. Assocs.	913-341-3309
KS	Wichita, M.I.N.K. Assocs., Inc	316-838-0190

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MN	Minneapolis, Holmgren Assoc.	612-574-9983
MO	Bridgeton, M.I.N.K. Sls.	314-291-5454
NH	Nashua, Bell Controls	603-882-6984
NJ	Medford, Champion Elctrns.	609-983-0932
NM	Albuquerque, More Sls.	505-265-6265
NY	Rochester, Lamb Comps.	716-328-6350
NC	Raleigh, Twentieth Century Mktg.	919-790-9383
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OK	Tulsa, D.J. Sls.	918-663-8155
OR	Portland, Caruso Assocs.	503-246-5439
TX	Austin, D.J. Sls.	512-258-3002
TX	Dallas, DJ Sls.	214-783-8876
WA	Bellevue, Caruso Inc.	206-455-8811
Can	Ontario, Haltronics Ltd.	416-844-2121

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Control Design Supp.	602-829-7981
AR	Little Rock, Newark Elctrns.	501-225-8130
CA	Anaheim, Control Design Supp.	714-821-1516
CA	Bay Area, Hall-Mark	408-432-0900
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Orange County, Hall-Mark	714-669-4100
CA	San Carlos, Control Design Supp.	415-592-4806
CO	Santa Monica, Master Dists.	213-452-1229
CO	Denver, Integrated Elctrns.	303-292-5537
CT	Wallingford, Mid State Elctrns.	203-265-9900
FL	Altamonte Springs, Control Design	305-788-3220
FL	Ft. Lauderdale, Hall-Mark	305-971-9280
GA	Stone Mtn., Control Design	404-979-3500
IL	Chicago, Hall-Mark	312-860-3800
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Schaumburg, Control Design	312-307-8900
IN	Indianapolis, Control Design	317-788-4559
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Kansas City, Control Design	913-362-4248
KY	Louisville, Newark	502-423-0280
LA	Shreveport, Indl. Elec. Supp.	318-222-9459
MD	Columbia, Hall-Mark	301-988-9800
MA	Boston, Hall-Mark	617-667-0902
MA	Newton, Green-Shaw Inc.	617-969-8900
MA	Woburn, Control Design Supp.	617-932-9404
MI	Oak Pk., Newark	313-967-0600
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Control Design	612-721-1628
MN	Minneapolis, Hall-Mark	612-941-2600
MS	Jackson, Newark	601-956-3834
MO	St. Louis, Control Design Supp.	314-426-3150
NE	Omaha, Newark	402-392-1221
NV	Las Vegas, Newark	702-796-5090
NH	Nashua, Newark	603-888-5790
NY	Buffalo, Genesse Indl.	716-873-9661
NY	Long Island, Hall-Mark	516-737-0600
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Paterson, Feldman Bros.	201-742-7329
NY	Rochester, Masline	716-546-5373
NY	Woodside, Switches Unltd.	718-478-5000
NC	Charlotte, Control Design	704-588-4410
NC	Raleigh, Hall-Mark	919-872-0712
OH	Cinicinnati, Schuster Elec.	513-489-1400
OH	Cleveland, CAM RPC Elctrns.	216-461-4700
OK	Tulsa, Hall-Mark	918-251-1108
OR	Portland, Integrated Elctrns.	503-641-1690
PA	Malvern, Control Design Supp.	215-296-0150
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Hall-Mark	609-235-1900
PA	Pittsburg, CMD	412-678-6020
SC	Greenville, Newark	803-288-9610
TN	Memphis, Newark	901-365-8060
TX	Dallas, Control Design Supp.	214-358-1441
TX	Dallas, Force-Heiland	214-247-9955
TX	Dallas, Hall-Mark	214-553-4300
TX	El Paso, Midtex (Export)	915-772-1061
TX	Houston, Hall-Mark	713-781-6100
UT	Salt LAke City, Hall-Mark	801-972-1008
VA	Falls Church, Newark	703-522-0880
WA	Bellevue, Integrated Elctrns.	206-455-2727
WV	Dunbar, Newark	304-768-6872
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WY	Gillette, Gifford	307-682-7203
Can	Richmond Hill, Ont., Selbar Elctrns. Ltd.	416-736-0271
Can	Scarborough, Ont., Carsten Elctrns.	416-495-7705

MIDWEC, See Industrial Midwec Capacitors

MIDWEST COMPONENTS,INC., See Therm-O-Disc, Div. Midwest Component Product Group

MIDWEST MICROWAVE, 6564 South State Rd., Saline, MI 48176-9569, Tel: 313-429-4773, 800-521-4410, FAX: 313-429-1415; FSC No.: 34078; Empl.: 180; *Sls. Mgr.:* Doug Hartje, Dir. Sls. & Mktg.

MIKRON INSTR., 445 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-7330, TELEX: 361870, FAX: 201-891-1205; Empl.: 60; *Sls. Mgr.:* John Merchant

MIL-COMM DISTRIBUTORS, INC., 9400 Lurline Ave. 6C, Chatsworth, CA 91311, Tel: 818-998-3111

MIL ELECTRONICS, INC., 106 Perimeter Rd., Nashua, NH 03036, Tel: 603-882-3200, FAX: 603-881-8661; FSC No.: 07862; Empl.: 40

MILES PLATTS INC., 901 Touhy Ave., Elk Grove Village, IL 60007, Tel: 1-708-364-0363, FAX: 708-364-0614; Empl.: 7; *Sls. Mgr.:* J. L. Packwood

MILFORD RIVET & MACH., 857 Bridgeport Ave., Milford, CT 06460, Tel: 203-878-4631, TELEX: 964363, TWX: 710-462-0538, FAX: 203-878-5071; Empl.: 200

JAMES MILLEN ELCTRNS., Caywood Elec. Inc., 87 Belmont St., No. Andover, MA 01845, Tel: 508-475-7831, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* R. Jannini

MILLER DIAL CORP., 4400 N. Temple City Blvd., El Monte, CA 91731, Tel: 818-444-4555, TWX: 910-587-3438, FAX: 818-443-3267; FSC No.: 91345; Empl.: 200; *Sls. Mgr.:* P. J. Wener, V.P. Membrane

MILLER, J.W., CO., See Bell Inds.

MILLER, L.C., CO., 717 Monterey Pass Rd., Monterey Pk., CA 91754, Tel: 213-268-3611, FAX: 213-264-3203; Empl.: 45

MILLER, SANFORD, CORP., See Sanford-Miller Corp.

MILLER, W. A., CO., Mingo Loop, P.O. Box 337, Oquossoc, ME 04964-0337, Tel: 207-864-3344, 800-227-1415, FAX: 207-864-3344; Empl.: 15

MILLER-STEPHENSON CHEM. CO., INC., George Washington Hwy., Danbury, CT 06810-0950, Tel: 203-743-4447, TELEX: 643-711; *Sls. Mgr.:* Mrs. Fran Bodnar

MILLIFLECT, 37444 Sycamore St., Bldg. A, Newark, CA 94560, Tel: 415-791-5188, TELEX: 466465, FAX: 415-791-5237; FSC No.: 52426; Empl.: 39; *Sls. Mgr.:* Don Koijane; *Dist. Mgr.:* Alex Nilva

MILLIVAC INSTRUMENTS, INC., Box 997, Curry Rd. Ext., Schenectady, NY 12301, Tel: 518-355-8300, FAX: 518-356-5161; FSC No.: 85711; Empl.: 30; *Sls. Mgr.:* Jan B. Metzger ..... **D•1294**

Local Sales Offices & Reps

CA	San Diego, Advanced Prods. Sls.	619-530-0200
CA	Westlake Vl., Advanced Prods. Sls.	818-706-8351
MD	Laurel, CSDS Inc.	301-490-3800
MA	Needham, Addelco Corp.	617-444-4754
MA	Needham, Addelco, Co.	617-444-4754
GA	Atlanta, Saber Assocs.	800-327-0853
NY	Fayetteville, Martin P. Andrews	315-637-5291
AL	Huntsville, Saber Assocs.	800-327-0853
FL	Ft. Lauderdale, Saber Assocs.	800-327-0853
TX	Houston, Scientific Sls.	713-645-6218
TX	Richardson, Sci. Sls.	214-231-6541
VA	Fairfax, CSDS Inc.	703-385-0139
Can	Downsview, Ont., Tradeport Elctrns. Grp.	416-736-0866

MILL-MAX MANUFACTURING CORP., P.O. Box 300, Oyster Bay, NY 11771-0300, Tel: 516-922-6000, FAX: 516-922-9253; FSC No.: 3N087; Empl.: 200; *Sls. Mgr.:* Richard M. Weiner ..... **C•1473**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mfr's Agt.	800-633-2920
AR	Mabelvale, Erickson Sls., Inc.	501-455-0618
CA	Campbell, Patrick Conahan Assocs.	408-559-2866
CA	Dana Point, Patrick Conahan Assocs.	714-493-9822
CO	Westminister, Straube Assocs., Inc.	303-426-0890
AZ	Scottsdale, B. Breedlove	602-483-1943
FL	Boca Raton, Tech Sls. Specialists	407-391-3718
GA	Roswell, Elctrn. Mfr's Agt.	800-633-2920
IL	Elk Grove Village, Tristar Grp., Inc.	708-593-0200
IN	Indianapolis, M & L Elctrn. Sls., Inc.	317-359-4742
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MA	Scituate, Olsen Tech. Sls.	617-545-5101
MN	St. Paul, Johnson Co.	612-641-1878
NH	Nashua, Olsen Tech. Sls.	603-883-2760
NY	Bohemia, JSA Sls.	516-244-2584
NC	Raleigh, Elctrn. Mfr's Agt.	919-846-6888
OH	Kettering, Catalyst Sls. Co.	513-429-6958
OR	Milwaukie, Comtec	503-654-6626
PA	Doylestown, G. A. Recentio Assocs.	215-348-7577
PA	Pittsburgh, Catalyst Sls. Co.	412-826-3434
TX	Dallas, Erickson Sls., Inc.	214-739-5833
UT	Salt Lake City, Hendrickson Sls.	801-467-1445
WA	Bellevue, Comtec	206-453-1188
WI	Menomonee Falls, Tristar Grp., Inc.	414-628-3583
Can	Gloucester, Ont., True North Technlg., Ltd.	613-837-2553
Can	Rexdale, Ontario, True North Technlg. Ltd.	416-744-2233

FAX: 213-430-8309

MILLS RESISTOR CO., 3840 Catalina St., Los Alamitos, CA 90720, Tel: 213-598-2454; FSC No.: 34238; Empl.: 50; *Sls. Mgr.:* S. Kistner; *Dist. Mgr.:* C. Brown ..... **A•1949**

Local Sales Offices & Reps

CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Sacramento, Mills Resistor Co.	916-422-5461
CT	Rocky Hill, Jim McPhail	203-721-1802
MA	Waltham, Dynasel Assocs.	617-890-6777
OR	Gaston, SPS Elctrns.	206-323-4140
PA	Montgomeryville, Quick Response Tech. Sls.	215-362-9225
TX	Houston, Ev Smith Co.	713-649-5756
WA	Seattle, SPS Elctrns.	206-323-4140

Local Distributors

FL	Ft. Lauderdale, Jaro Elctrns.	800-327-5551
PA	Harrisburg, ADTECH	717-939-8337
PA	McKean, Advacom	814-476-7774

MILROSS CONTROLS, INC., 511 Second St. Pike, Southampton, PA 18966, Tel: 215-355-0200, TWX: 510-667-1702, FAX: 215-355-6326; FSC No.: 07047; Empl.: 100; *Sls. Mgr.:* Scott R. Tate

MILTOPE BUSINESS PRODUCTS, Miltope Grp., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, 516-756-7650, TWX: 510-221-1803, FAX: 516-756-7606; Empl.: 650

MILTOPE CORP., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803; Empl.: 750; *Sls. Mgr.:* Frederick S. Korb; *Dist. Mgr.:* William Jennings

MILWAUKEE ELECTRONICS, 7817 W. Clinton Ave., Milwaukee, WI 53223, Tel: 414-358-4000, FAX: 414-358-4001; FSC No.: 98664; Empl.: 100-150; *Sls. Mgr.:* James Scholler

FAX: 414-271-9876

MILWAUKEE RESISTOR CORP., 700 W. Virginia St., Milwaukee, WI 53204, Tel: 414-271-9900; FSC No.: 82807;15109; Empl.: 75; *Sls. Mgr.:* John Dorsha; *Dist. Mgr.:* John Dorsha ..... **A•1950-1954**

Local Sales Offices & Reps

CA	San Carlos, Electro Pacific	415-441-5541
IL	Willow Brook, PVA Corp.	708-655-3355
NC	Kernersville, Heritage Elctrl. Sls.	919-996-4484
MA	Stoughton, EECS-Mel Botsian	617-344-5139
SC	Greer, Heritage Elctrl. Sls.	803-292-1723
NY	Rochester, Gislason Sls.	716-328-7400
NY	Whitestone, M. H. Lynn co.	718-352-9233
OH	Westlake, Assocd. Elctrl. Comps.	216-835-9960

MIMIC, INC., P. O. Box 705, Islington, MA 02090-0705, Tel: 617-329-9593; Empl.: 5; *Sls. Mgr.:* S. Thurston

MINC INCORPORATED, 6755 Earl Dr., Colorado Springs, CO 80918, Tel: 719-590-1155, FAX: 719-590-7330; *Sls. Mgr.:* Mark S. A. Smith

MINCO PRODUCTS, 7300 Commerce La., Minneapolis, MN 55432, Tel: 612-571-3121, FAX: 612-571-0927; FSC No.: 09359; Empl.: 475; *Sls. Mgr.:* J. Anderson

MIN-E-CON, 3160 Pullman, Costa Mesa, CA 92626, Tel: 714-434-7312, TWX: 910-595-1144; FSC No.: 54455

MINELCO INC. | Talley™ Industries

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MINELCO INC. - A TALLEY IND., 135 S. Main St., Thomaston, CT 06787-0459, Tel: 203-283-8261; FSC No.: 07479; Empl.: 70; *Sls. Mgr.:* James A. Myles ... **B•1178**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, R. W. Riedel & Co.	213-283-7694
CA	Anaheim, M.W. Riedel & Co.	213-283-7694
CO	Centerville, West Inc.	303-477-1134
CO	Denver, West Inc.	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Longwood, Delmac	407-831-0040
GA	Atlanta, L & D, Inc.	404-395-7079
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
KS	Wichita, Magna Eng. Sls. Co.	316-744-0851
MD	North East, Magna Eng. Sls. Co.	301-398-4215
MA	Burlington, F.J.S. Assocs.	617-273-5959
MO	St. Louis, Magna Eng. Sls. Co. Inc.	314-878-4441
MO	St. Louis, Magna Eng. Sls. Co. Inc.	314-849-6590
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NY	New Hyde Park, Comp-Tech Sls.	516-593-2628
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Dayton, Electro Mktg. Grp.	513-890-8322
OR	Portland, Caruso & Assocs.	503-246-5439
TX	Roanoke, CMR	817-379-6540
WA	Bellevue, Caruso & Co.	206-455-8811
Can	Rexdale, Ont., Myelco, Inc.	416-674-1636

MINGSTON ELECTRONICS, INC., MEC Inc.(Taiwan), 14145 Proctor Ave. Unit 8, City of Industry, CA 91746, Tel: 818-330-2086, FAX: 818-330-9988; Empl.: 3; *Sls. Mgr.:* Johnny Chao

Mini-Circuits

FAX: 718-332-4661

MINI-CIRCUITS LAB., 13 Neptune Avenue, P.O. Box 350166, Brooklyn, NY 11235-0003, Tel: 718-934-4500, TELEX: 125460, 620156 (Int'l); FSC No.: 15542 ..... **A•1752-1819**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444,FAX:602-998-1236
CA	Los Altos, Cain-White & Co.	415-948-6533, FAX:415-948-0115
CA	Tustin, Youngewirth & Olenick Assocs.	714-838-5144,FAX:714-838-5321
CO	Parker, W. Howard Assocs.	303-841-5755, FAX:303-841-9272
FL	Clearwater, Beacon Microwave & Instrmn., Inc.	813-796-2378,FAX:813-796-0075
FL	Satellite Bch., Beacon Microwave & Instrmn., Inc.	407-777-6303,FAX:407-777-9131
GA	Atlanta, Beacon Microwave & Instrmn., Inc.	404-256-9640,FAX:404-256-1398
GA	Sylvester, Beacon Microwave & Instrmn. Inc.	912-776-4100,FAX:912-776-0831
IL	Mt. Prospect, Cain-Forlaw Co., Inc.	708-253-3578, FAX:708-253-6987
IL	Mundelein, Cain-Forlaw, Inc.	708-540-9962, FAX:708-540-9974
MD	Columbia, M. Lader Co.	800-442-3177, FAX:301-381-6924
MA	Waltham, Scientific Dvcs. New England Inc.	617-890-2252,FAX:617-890-5816
NM	Albuquerque, Thorson Desert States, Inc.	505-883-4343,FAX:505-889-2999
NY	Hartsdale, Spectrum Sls., Inc.	914-472-8600, FAX:914-472-0461
NY	Skaneateles, Robtron, Inc.	315-685-5731, FAX:315-685-3717
NC	Greensboro, M. Lader Co.	800-442-3177, FAX:919-674-7655
NC	Raleigh, Beacon Microwave & Instrmn., Inc.	919-781-8118,FAX:919-781-9058
OH	Worthington, Cain-Forlaw Co. Inc.	614-436-3004, FAX:614-436-3097
OR	Aloha, Cain-Sweet, Co.	503-591-0647, FAX:503-591-0856
PA	Conshohocken, M. Lader Co.	215-825-3177, FAX:215-834-8543

TX Dallas, Beacon Microwave & Instrmn. Inc. 214-437-1505,FAX:214-437-5874
TX Richardson, Beacon Microwave & Instrn., Inc. 214-437-1505,FAX:214-437-5874
TX Round Rock, Beacon Microwave & Instrmn. Inc. 512-244-6675,FAX:512-244-1883
WA Bellevue, Cain-Sweet Co. 206-462-2118, FAX:206-451-9418
PR Santurce, Beacon Elctrns. 809-728-5040, FAX:809-728-5180
Can Ottawa, Ont., Giga-Tron Assocs., Ltd. 613-225-4090,FAX:613-225-4592
Can Vancouver, B.C., Penstock/Canada ... 604-662-3475

Local Distributors

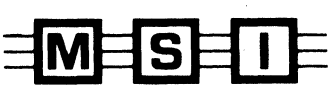
AL Huntsville, Component Distrs., Inc. 205-851-7800, FAX:205-859-2249
AZ Scottsdale, Spirit Elctrns. 602-998-1533, FAX:602-998-1427
CA Sunnyvale, Penstock, Inc. 408-730-0300, FAX:408-730-4782
FL Palm Bay, Component Distrs., Inc. 407-724-9910, FAX:407-729-6579
GA Norcross, Component Distrs., Inc. 404-441-3320, FAX:404-449-1712
IL Mt. Prospect, CFC Distrs., Inc. 708-253-3578, FAX:708-253-6987
IL Mundelein, CFC Distrs., Inc. 708-540-9962, FAX:708-540-9974
MD Columbia, MLC Distrs. 800-442-3177, FAX:301-381-6924
NC Greensboro, MLC Distrs. 919-674-8970, FAX:919-674-7655
NC Raleigh, Comp. Distrs., Inc. 919-859-3391, FAX:919-859-3396
PA Conshohocken, MLC Distrs. 215-825-3177, FAX:215-834-8543
TX Dallas, Comp. Distrs., Inc. 214-644-0373, FAX:214-644-1115
WA Bellevue, Penstock,Inc. 206-454-2371, FAX:206-451-9418

MINI COMPUTER TECHNOLOGY, 696 E. Trimble Rd., San Jose, CA 95131, Tel: 408-435-1616, TWX: 910-338-2281, FAX: 408-435-2709; Empl.: 22; *Sls. Mgr.:* John P. Lazare; *Dist. Mgr.:* John P. Lazare

MINI-SYSTEMS, INC., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, Tel: 508-695-2000, TWX: 510-600-4340, FAX: 508-695-8758; *Sls. Mgr.:* Heather Edwards ..... **A•1735**

Local Sales Offices & Reps

CT Fairfield, Wexler-Court Sls. 203-334-1122
NC Raleigh, Spears & Assocs. 919-846-9711
WA Bellevue, Advanced Power Comps. ... 206-747-9127
Can Ontario, CN, Intrade Canada 613-727-1272



FAX: 508-695-6076

MINI-SYSTEMS, INC., Thick/Thin Film Division, 20 David Rd., North Attleboro, MA 02761, Tel: 508-695-0203, TWX: 710-348-0564; FSC No.: 50316; Empl.: 163 ..... **A•1955**

Local Sales Offices & Reps

AL Huntsville, Summit Mktg. Assocs. 205-721-1701, FAX:205-721-9250
AZ Tuscon, Morrison & Fern 602-296-8181, FAX:602-296-4833
CA Brea, S.C.T.S. 213-691-1114,FAX:213-690-0504
CA Mountain View, L.S. Engrg. 415-967-5880, FAX:415-967-5884
CA Woodland Hills, S.C.T.S. 818-704-9087, FAX:818-704-8632
FL Pompano Beach, J.P. Elctrns. 305-782-6830, FAX:305-782-1640
GA Norcross, Summit Mktg. Assocs. 404-498-4530, FAX:404-498-4530
IL Elk Grove, ABC Elctrns. 708-228-1204, FAX:708-228-1249
ME Bethel, Shain Assocs., Inc. 207-836-3200
MA Belmont, Shain Assocs., Inc. 617-484-4376, FAX:617-489-3598
MA Hingham, Shain Assocs., Inc. 617-740-2334, FAX:617-740-2680
MN Minneapolis, Intertec Assocs. 612-921-8443, FAX:612-929-4488
NH Nashua, Shain Assocs., Inc. 603-881-4881, FAX:603-880-8924
NJ Princeton, Wexler-Court Sls. Co. 609-452-8670, FAX:609-452-9213
NY Rockville Centre, Milano Bros. Intl. 516-764-2200, FAX:516-764-4006
OH Maineville, G.A. Barnett Inc. 513-677-0922, FAX:513-677-0922
TX Double Oak, Carolyn Bender Assocs. 214-539-9461,FAX:214-539-7027
TX Lewisville, C & J Assocs. 214-539-0140
TX Richardson, Southwest Microwave Elctrns. 214-669-1195,FAX:214-669-0353
WA Bellevue, Advanced Power Comps. 206-747-9127, FAX:206-641-8655
Can Nepean, Ont., Intrade Canada 613-727-1272, FAX:613-727-0246

MINI-SYSTEMS, INC., Sunbelt Microelectronic Division, 237 Enterprise Rd., Deltona, FL 32725, Tel: 407-574-0208, FAX: 407-574-8262

MINNESOTA WIRE & CABLE, 1835 Energy Park Drive, St. Paul, MN 55108-2721, Tel: 612-642-1800 , 1-800-258-6922(MWCC), FAX: 612-642-9201; Empl.: 155; *Sls. Mgr.:* Paul Wagner

MINOR RUBBER CO., INC., Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6800, 800-433-6886, FAX: 201-893-1399; *Sls. Mgr.:* Tom Fitzhenry

MINT SYSTEMS CORPORATION, 1633 South Main Street, Milpitas, CA 95035-6262, Tel: 408-262-7171, FAX: 408-262-5387; *Sls. Mgr.:* Rudy Juang ..... **D•1295, 1412-1413**

MIRAGE/KLM, 16890 Church St., P.O. Box 1000, Morgan Hill, CA 95037, Tel: 408-779-7363, FAX: 408-779-8845; Empl.: 50; *Sls. Mgr.:* John J. Concialdi

MISCO/MINNEAPOLIS SPEAKER CO., INC., 3806 Grand Avenue, Minneapolis, MN 55409, Tel: 612-825-1010, FAX: 612-825-7010; FSC No.: 14208; *Sls. Mgr.:* Don Ringham

MITCHELL ELECTRONICS CORP., 84 West Grand Street, Mt. Vernon, NY 10552, Tel: 914-699-3800, TELEX: 914-699-1022; Empl.: 30; *Sls. Mgr.:* Jonathan Lerner ..... **A•2306**

MITEC ELECTRONICS, 104 Gun Avenue, Pointe Claire, Quebec, Canada H9R 3X3, Tel: 514-694-6666, FAX: 514-694-3814; FSC No.: FSCM 38494; Empl.: 125; *Sls. Mgr.:* J. Robinson

MITECH ELECTRONICS CORP., 411 Washington St., Otsego, MI 49078, Tel: 616-694-9471, FAX: 616-692-2651; Empl.: 78; *Sls. Mgr.:* Kendall Meyer

MITEL SEMICONDUCTOR DIV. OF MITEL CORP., 360 Legget Dr., PO Box 13089, Kanata, Ont., Canada K2K 1X3, Tel: 613-592-2122, TELEX: 053 3221, FAX: 613-592-6909; Empl.: 1000; *Sls. Mgr.:* Howard Tweddle; *Dist. Mgr.:* Howard Tweddle

MITEQ INC., 100 Davids Drive, Hauppauge, NY 11788, Tel: 516-436-7400, TELEX: 6718148, FAX: 516-436-7430; Empl.: 275

MITRONICS, P.O. Box 2129, Rolling Hills, CA 90274, Tel: 213-377-2022

MITSUBISHI ELECTRONICS, 991 Knox Street, Torrance, CA 90502, Tel: 213-515-3993, TELEX: 06-4703-M USA LSA, TWX: 66-4787-MELA TRNC; Empl.: 423; *Sls. Mgr.:* Bob Crooks, V.P. Sls.; *Dist. Mgr.:* Bob Crooks, V.P. Sls.

MITSUBISHI ELCTRNS. AMERICA, INC., Elctrn. Device Grp., 1050 East Arques Ave., Sunnyvale, CA 94086, Tel: 408-730-5900, TELEX: 172296, TWX: 910-339-9549, FAX: 408-730-4972; Empl.: 200; *Sls. Mgr.:* John Zucker; *Dist. Mgr.:* Roger Yee

Local Sales Offices & Reps

AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Scottsdale, SMS & Assocs. 602-998-0831
CA San Diego, Mitsubishi Elctrns. Reg. Sls. Off. 619-451-9618
CA San Diego, SC Cubed 619-458-5808
CA San Jose, QCI 408-432-1070
CA Sunnyvale, Mitsubishi Elctrns.-Reg. Sls. Off. 408-730-5900
CA Thousand Oaks, SC Cubed 805-496-7307
CA Tustin, SC Cubed 714-731-9206
CO Englewood, Mitsubishi Elctrns. Reg. Sls. Off. 303-220-0744
CO Littleton, Simpson Assocs. 303-794-8381
CT Yalesville, Comp. Rep Assocs. 203-269-1145
FL Boca Raton, Beacon Elctrns. 407-997-5740
FL Boca Raton, Mitsubishi Elctrns. 407-487-7747
FL Longwood, Beacon Elctrns. 407-332-1940
GA Atlanta, Beacon Elctrns. 404-256-9640
GA Norcross, Beacon Advanced Comps. 404-662-8190
GA Norcross, Mitsubishi Elctrns. Reg. Sls. Off. 404-448-1263
IL Mt. Prospect, Mitsubishi Elctrns.-Reg. Sls. Off. 708-298-9223
IL Rolling Meadows, Phase II Mktg. 708-806-1330
IN Fishers, Carter, McCormick, Pierce 317-842-8277
KS Overland Park, Gibb Tech 913-451-6788
MI Farmington Hills, Carter, McCormick .. 313-477-7700
MN Edina, Gibb Elctrns. Sls. 612-835-3370
MN Minnetonka, Gibb Elctrn. Sls. 612-935-4600
MN Minnetonka, Mitsubishi Elctrns.-Reg. Sls. Off. 612-938-7779
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
NJ Parsippany, METEC Sales 201-263-8898
NJ Somerset, Mitsubishi Elctrns.-Reg. Sls. Off. 201-469-8833
NY Fishkill, Mitsubishi Elctrns. Reg. Sls. Off. 914-896-0896
NY Manlius, LAMTEC 313-637-3738
NY Northport, METEC Sales 516-757-1881
NC Cary, Mitsubishi Elctrns. Reg. Sls. Off. 919-460-0404
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Cincinnati, Makin & Assocs., Inc. 513-871-2424
OH Dublin, Makin & Assocs., Inc. 614-793-9545
OH Solon, Makin & Assocs. 216-248-7370
OR Portland, ES/Chase Co., Inc. 503-292-8840
TX Austin, OM Assocs., Inc. 512-794-9971
TX Carrollton, Mitsubishi Elctrns.-Reg. Sls. Off. 214-245-0047
TX Houston, OM Assocs., Inc. 713-789-4426
TX Richardson, OM Assocs., Inc. 214-690-6746
UT Midvale, Simpson 801-566-3691
VA Sterling, Beacon North 703-478-2480
WA Kirkland, ES Chase 206-823-9595
WA Kirkland, Insight Elctrns. 206-820-8100
WI Wauwatosa, Phase II Mktg. 414-771-9986
PR San Truce, Beacon Elctrns. 818-728-5440
Can Kanata, Ont., Mitsubishi Elec. Sls. Canada, Inc. 613-591-3348
Can Mississauga, Mitsubishi Elctrns.Reg. Sls. Off. 416-670-8711

Local Distributors

AZ Scottsdale, Added Value Elctrns. 602-951-9788
AZ Tempe, Insight Elctrns. 602-829-1800
CA Agoura, Insight Elctrns. 818-707-2100
CA Irvine, Insight Elctrns., Inc. 714-727-2111
CA Orange, Western Microtechnlgy. 714-637-0200
CA San Diego, Added Value Elctrns. Dists., Inc. 614-558-8890
CA San Diego, Insight Elctrns., Inc. 619-587-0471
CA San Diego, Western Microtechnlgy. ... 619-453-8430
CA San Jose, Merit Elctrns. Inc. 408-434-0800
CA San Jose, QCI Comp. Sls. 408-432-1070
CA Saratoga, Western Microtechnlg., Inc. 408-725-1660
CA Tustin, Added Value Elctrns. Dist., Inc. 714-259-8258
CO Wheat Ridge, Added Value Elctrns. Dists. Inc. 303-422-1701
CT Milford, Milgray Elctrns., Inc. 203-878-6970
CT Wallingford, Almo Elctrns. Corp. 203-269-6801
FL Ft. Lauderdale, Hammond Elctrns., Inc. 305-973-7103
FL Miami, All American 305-621-8282
FL Orlando, Hammond Elctrns., Inc. 305-841-1010
FL Winter Pk., Milgray Elctrns., Inc. 305-647-5747
GA Norcross, Beacon Advanced Comps. 404-662-8190
GA Norcross, Hammond Elctrns., Inc. 404-449-1996
GA Norcross, Milgray Elctrns., Inc. 404-446-9777
IL Arlington Heights, Milgray Elctrns., Inc. 708-253-1212
IL Bensenville, GBL/Goold Elctrns. Corp. 708-860-7171
KS Overland Pk., Milgray Elctrns., Inc. 913-236-8800
MD Columbia, Milgray Elctrns., Inc. 301-995-6169
MD Tissup, Almo Elctrns. Corp. 301-953-2566
MA Canton, Almo Elctrns. Corp. 617-821-1450
MA Hopkinton, Interface Elctrns. Corp. 617-435-6858
MA Westwood, Comp. Rep. Comps. 617-329-3454
MA Wilmington, JV Elctrns. of Boston, Inc. 617-657-6523
MN Sterling Elctrns., Indl. Comps., Inc. 612-831-2666
NJ E. Brunswick, Almo Elctrns., Inc. 201-613-0200
NJ Marlton, Milgray Elctrns., Inc. 609-983-5010
NY Farmingdale, Milgray Elctrns., Inc. 516-420-9800
NY Rochester, Milgray Elctrns., Inc. 716-235-0830
NY Rome, Rome Elctrns. 315-337-5400
NC Greensboro, Hammond Elctrns., Inc. .. 919-275-6391
OH Cleveland, Milgray Elctrns., Inc. 216-447-1520
OR Beaverton, Western Microtechnlg., Inc. 503-629-2082
PA Maris, Almo Elctrns. Corp. 412-776-9090
PA Trevose, Almo Elctrns. Corp. 215-953-2800

SC Greenville, Hammond Elctrns. 803-233-4121
TX Dallas, Milgray Elctrns. 214-248-1603
WA Redmond, Western Microtechnlg., Inc. 206-881-6737

MKC ELECTRONICS CORP., 9205 Quivira Road, Overland Park, KS 66215, Tel: 913-894-9711, FAX: 913-894-9713; Empl.: 26

MKS INSTRUMENTS, INC., Six Shattuck Road, Andover, MA 01810, Tel: 508-975-2350, TELEX: 94-9375, FAX: 508-975-0094; Empl.: 500

MLI INDUSTRIES, INC., 3 East Main Street, Apalachin, NY 13732, Tel: 607-754-5800, FAX: 607-625-2022; Empl.: 485; *Sls. Mgr.:* Michael T. Mackenzie

MMI-MIRCO MACHINES, INC., P. O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, TWX: 910-338-0260; Empl.: 4; *Sls. Mgr.:* Frank J. Andezzone

MOBILE-TRONICS CO., INC., Box 1147, San Clemente, CA 92674, Tel: 714-361-4305, FAX: 714-361-4356; Empl.: 2

MODULAIR, 4674 Aircenter Circle, Reno, NV 89502, Tel: 702-829-2033, FAX: 702-829-2029; Empl.: 50

MODULAR AUDIO PRODUCTS, Modular Devices, Inc., Brookhaven R & D Plaza, One Roned Road, Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; *Sls. Mgr.:* C. Liptman

MODULAR DEVICES, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; FSC No.: 52202; Empl.: 65; *Sls. Mgr.:* C. Liptman ..... **B•1302; D•1901-1906**

Local Sales Offices & Reps

CA Murrieta, MIL-COM Sls., Inc. 714-677-2097
CA San Diego, Mil-Com Sls. 619-275-0641
CA Santa Clara, Integrated Tech Sls. 408-727-3406
CT Bloomfield, Zaslow Sls. Co. 203-242-7781
KS Prairie Village, Thunderbird Tech. Sls. 913-642-7220
KS Wichita, Thunderbird Tech. Sls. 316-636-5777
MD Towson, Advanced Tech. Sls., Inc. 301-296-9360
MN St. Paul, K-Rep 612-681-9510
MO Maryland Heights, Thunderbird Tech. Sls. 314-298-8940
NY Great Neck, F & F Metro Inc. 516-482-4080
NY Williamsville, NV Elect. Assoc. 716-632-1347
PA Norristown, Rivco January Inc. 215-631-1414
TX Dallas, M-Rep Co. 214-484-5711

MODULAR DEVICES INC., 4115 Spencer St, Torrance, CA 90503, Tel: 213-542-8561, FAX: 213-371-6331; Empl.: 150; *Sls. Mgr.:* A. C. Augusta

MODULAR MINING SYSTEMS, INC., 3289 E. Hemisphere Loop, Tuscon, AZ 85706, Tel: 602-746-9127, FAX: 602-889-5790; Empl.: 60; *Sls. Mgr.:* J.Michael Canty

MODULAR SYSTEMS, INC., 905 Albemarle St, Charlottesville, VA 22901, Tel: 804-295-7882; Empl.: 5; *Sls. Mgr.:* H. N. Patel

FAX: 408-496-0204

MODUPOWER, Inc., 1400 Coleman Ave., Santa Clara, CA 95050, Tel: 408-496-5796; Empl: 3; *Sls. Mgr.:* Art Fury ..... **D•1908-1910**

MOISTURE REGISTER PRODUCTS DIV., Aqua Measure Instrument Co., 1712 Earhart Court, P.O. Box 369, LaVerne, CA 91750-0369, Tel: 714-392-5833, FAX: 714-392-5838; Empl.: 25; *Sls. Mgr.:* Gabriel Cote, Jr.

MOLDCON DIV. OF CONTEX ELECTRONICS, 221 Interstate Dr., W. Springfield, MA 01089, Tel: 413-736-0371, FAX: 413-736-9716; Empl.: 200; *Sls. Mgr.:* Robert Krzynowek

MOLDTRONICS. INC., 703 Rogers St, Downers Grove, IL 60515, Tel: 708-968-7000, FAX: 708-968-5068; Empl.: 100; *Sls. Mgr.:* J.D. Wilson

MOLECU-WIRE, P.O. Box 495, Farmingdale, NJ 07727, Tel: 201-938-9473, TWX: 710-723-6943, FAX: 201-938-3189; Empl.: 125

FAX: 708-969-1352

MOLEX, INC., 2222 Wellington Ct., Lisle, IL 60532, Tel: 708-969-4550, TELEX: 25-4069; Empl.: 6300; *Sls. Mgr.:* Bill Cox; *Dist. Mgr.:* Bill Hickey ..... **C•1474**

Local Sales Offices & Reps

CA Laguna Hills, Molex 714-586-0950
CA Milpitas, Molex 408-946-4700
CO Englewood, Molex 303-779-8321
GA Roswell, Molex 404-992-3715
IL Lisle, Molex 312-969-4550
IN Indianapolis, Molex 317-299-0099
KY Louisville, Molex 502-245-8336
MA Woburn, Molex 617-935-8983
MI Troy, Molex 313-879-7400
TX Dallas, Molex 214-931-0999

Local Distributors

AL Huntsville, Hamilton/Avnet 205-837-7210
AL Huntsville, Time Elctrns. 205-721-1133
AZ Phoenix, Force Elctrns. 602-437-1060
AZ Phoenix, Sterling Elctrns. 602-437-5565
AZ Tempe, Harper S.I.D. 602-967-1464
AZ Tempe, Time Elctrns. 602-967-2000
AR Ft. Smith, Carlton Bates 501-646-8201
AR Little Rock, Carlton Bates 501-562-9100
AR Pine Buff, Carlton Bates 501-535-1354
AR Springdale, Carlton Bates 501-756-5012
CA Chatsworth, Sterling Elctrns. 818-407-8850
CA Chatsworth, Time Elctrns. 818-998-7200
CA Compton, Harper S.I.D. 213-979-5090
CA Costa Mesa, Hamilton Electro Sls. 714-641-4100
CA El Segundo, Force Elctrns. 213-772-1324
CA Garden Grove, Richey Impact Elctrns. Ltd. 714-895-0060
CA Gardena, Hamilton Avnet 213-217-6700
CA Irvine, Integrated Elctrns. Corp. 714-837-9960
CA Roseville, Hamilton/Avnet 916-925-2216
CA S. San Francisco, Peters-de Laet 415-873-9595
CA Sacramento, Integrated Elctrns. Corp. 916-363-6030
CA San Diego, Force Elctrns. 619-569-9661
CA San Diego, Hamilton Avnet 619-571-1900
CA San Diego, Harper S.I.D. 619-578-2500
CA San Diego, Richey Impact Elctrns. Ltd. 619-271-4511
CA San Diego, Sterling Elctrns. 619-271-6555
CA San Diego, Time Elctrns. 619-586-1331
CA San Jose, Harper S.I.D. 408-943-9490
CA San Jose, Integrated Elctrns. Corp. 408-435-1000
CA San Jose, Richey Western Elctrns. Ltd. 408-432-7100
CA Santa Clara, Force Elctrns. 408-748-1324
CA Sunnyvale, Hamilton Avnet 408-743-3000
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Kent Elctrns. 213-320-2700
CA Torrance, Time Elctrns. 213-320-0880
CA Tustin, Sterling Elctrns. 714-259-0900
CA Tustin, Time Elctrns. 714-669-0100
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Hamilton Avent 303-799-0663
CO Englewood, Sterling Elctrns. 303-792-3939
CO Englewood, Time Elctrns. 303-799-8851
CO Wheatridge, Bell Inds. 303-424-1985
CT Danbury, Hamilton Avnet 203-743-6077
CT Danbury, Heilind Elctrns. 203-797-8600
CT Southbury, Time Elctrns. 203-271-3200
CT Wallingford, Sager Elec. Supp. Co. 203-265-4600
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Ft. Lauderdale, Hamilton Avnet 305-767-6377
FL Ft. Lauderdale, NEWH for Ind. 305-772-5050
FL Ft. Lauderdale, Time Elctrns. 305-484-4778
FL Largo, LoDan 813-586-2851
FL Miami, Time Elctrns. 305-940-8231
FL Orlando, Hamilton/Avnet 407-657-3344
FL Orlando, Time Elctrns. 407-841-6565
FL St. Petersburg, Hamilton Avnet 813-573-3930
FL Winter Park, Hamilton Avnet 407-628-3888
GA Atlanta, Electro Air Corp. 404-351-3545
GA Duluth, Gateway Megatech 404-497-0799
GA Duluth, Hamilton/Avnet 404-446-0611
GA Norcross, Time Elctrns. 404-368-0969
IL Bensenville, Hamilton/Avnet 312-860-7700
IL Chicago, Waldom Elctrns. Inc. 312-585-1212
IL Crystal Lake, Sub-Sem, Inc. 815-459-4139
IL Hoffman Estates, Integrated Elctrns. Corp. 708-843-2040
IL Schaumberg, Time Elctrns. 708-303-3000
IN Carmel, Hamilton Avnet 317-844-9333
IN Carmel, Time Elctrns. 800-331-5114
IN Indianapolis, Gateway Megatech 317-298-0111
IN Indianapolis, PEI-Genesis 800-428-5081
IN South Bend, PEI-Genesis 800-348-2996
IN Valparasio, Gateway Megatech 219-477-4255
IA Cedar Rapids, Hamilton Avnet 319-362-4757
IA Cedar Rapids, Time Elctrns. 800-325-9085
KS Lenexa, Hamilton/Avnet 913-888-8900
KS Lenexa, Time Elctrns. 913-492-5406
KY Lexington, Hamilton Avnet 800-543-4783
LA Shreveport, Carlton Bates 318-636-9975
LA Westego, Sterling Elctrns. 504-436-1418
MD Baltimore, Hamilton Avnet 301-995-3500
MD Columbia, Sterling Elctrns. 301-290-3800
MD Columbus, Time Elctrns. 301-964-3090
MD Jessup, Gateway 301-792-7527
MA Canton, Richey/Impact Elctrns. Ltd. ... 617-821-1500
MA Hingham, Sager Elec. Supp. Co. 617-749-6700
MA Peabody, Hamilton Avnet 508-532-3701
MA Peabody, Time Elctrns. 508-532-6200
MA Wilmington, Heilind Elctrns. 508-657-4870
MA Woburn, Sterling Elctrns. 617-938-6200
MI Ann Arbor, Gateway Megatech 313-761-2980
MI Hamilton/Avnet, Hamilton/Avnet 616-243-8805
MI Novi, Hamilton/Avnet 313-347-4270
MI Troy, Empire Elctrns. 313-585-8130
MN Edina, Time Elctrns. 612-943-2433
MN Minneapolis, Sterling Elctrns. 612-831-2666
MN Minnetonka, Hamilton Avnet 612-932-0600
MO Chesterfield, Hamilton/Avnet 314-537-1600
MO Manchester, Time Elctrns. 314-391-6444
MO St. Charles, Lectronix 800-325-3348
NH Manchester, Hamilton/Avnet 603-624-9400
NH Salem, Sager Elec. Supp. Co. 603-898-1348
NJ Camden, GRS Elctrns. Co., Inc. 609-964-8560
NJ Cherry Hill, Hamilton Avnet 609-424-0100
NJ Edison, Sterling Elctrns. 908-417-1000
NJ Fairfield, Hamilton Avnet 201-575-3390
NJ Marlton, Time Elctrns. 609-596-6700
NJ Teterboro, EAC/JAMAR Corp. 201-772-6400
NM Albuquerque, Hamilton Avnet 505-345-0001
NM Albuquerque, Sterling Elctrns. 505-884-1900
NY Buffalo, Summit Dists. 716-887-2800
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Hauppauge, Time Elctrns. 516-273-0100
NY Rochester, Hamilton Avnet 716-475-9130
NY Rochester, Summit Distrs. 716-334-8110
NY Syracuse, Hamilton Avnet 315-437-2641
NC Charlotte, Time Elctrns. 704-522-7600
NC Raleigh, Hamilton Avnet 919-878-0810
NC Raleigh, Sagar Elctrl. Supp. Co., Inc. ... 919-850-9550
OH Columbus, Gateway Megatech 614-447-0222
OH Columbus, Time Elctrns. 614-761-1100
OH Dayton, Gateway Megatech 513-298-6342
OH Dayton, Hamilton Avnet 513-439-6700
OH Solon, Hamilton Avnet 216-349-5100
OH Westerville, Hamilton Avnet 614-882-7004
OH Willoughby, Gateway Megatech 216-953-0333
OK Oklahoma City, Carlton Bates 405-691-4446
OK Tulsa, Carlton Bates 918-250-1626
OK Tulsa, Hamilton Avnet 918-252-7297
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Hamilton/Avnet 503-627-0201
OR Beaverton, Integrated Elctrns. Corp. ... 503-641-1690
OR Portland, Radar Elec. 503-232-3404
OR Portland, Time Elctrns. 503-684-3780
PA McKean, Advacom 814-476-7774
PA Philadelphia, Sagar Elctrl. Supp. Co. ... 215-464-4336
PA Pittsburg, Hamilton Avnet 412-281-4150
TN Memphis, Carlton Bates 901-365-3539
TN Nashville, Carlton Bates 615-885-3232
TN Soddy-Daisy, Techni-Tronics, Inc. 615-332-2119
TX Austin, Hamilton Avnet 512-837-8911
TX Austin, Kent Elctrns. 512-834-1900
TX Austin, Sterling Elctrns. 512-836-1341
TX Austin, Time Elctrns. 512-339-3054
TX Carrollton, Sterling Elctrns. 214-243-1600
TX Dallas, Carlton Bates 214-404-9906
TX Dallas, Force Elctrns. 214-247-9955
TX Houston, Force Elctrns. 713-561-8644
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Sterling Elctrns. 713-627-9800
TX Houston, Time Elctrns. 713-530-0800
TX Irving, Harper S.I.D. 214-621-0500
TX Richardson, Kent Elctrns. 214-669-2600
TX Richardson, Time Elctrns. 214-644-4644
TX Stafford, Hamilton Avnet 713-240-7733
TX Texarkana, Carlton Bates 214-792-6923
UT Salt Lake City, Bell Inds. 801-255-9611
UT Salt Lake City, Hamilton Avnet 801-266-2022
UT Salt Lake City, Integrated Elctrns. 801-977-9750
UT Salt Lake City, Sterling Elctrns. 801-972-5444
UT Salt Lake City, Time Elctrns. 801-973-8181
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Integrated Elctrns. Corp. 206-455-2727
WA Redmond, Hamilton Avnet 206-881-6697
WA Richland, Radar Elec. 509-943-8336
WA Seattle, Radar Elec. 206-282-2511

WA Spokane, Radar Elec. 509-747-3053
WI Milwaukee, Time Elctrns. 800-331-5114
WI New Berlin, Sub Sem 800-435-6130
WI Waukesha, Hamilton Avnet 414-784-4510
PR Bayamon, NEHW for Ind. 809-798-1300

MOLI ENERGY LIMITED, 20000 Stewart Crescent, Maple Ridge, B.C., Canada V2X 9E7, Tel: 604-465-7911/1-800-663-MOLI, TELEX: 04-356708, FAX: 604-465-4398; FSC No.: 6140; Empl.: 160; *Sls. Mgr.:* Mary Connolly; *Dist. Mgr.:* Mary Connolly

MOLON MOTOR & COIL CORPORATION, 3737 Industrial Avenue, Rolling Meadows, IL 60008, Tel: 708-253-6000, FAX: 708 259-5491; *Sls. Mgr.:* William Steele

MONARCH INSTRUMENT, Monarch International Inc., Columbia Dr., Amherst, NH 03031, Tel: 603-883-3390, 800-999-3390, FAX: 603-886-3300; FSC No.: Cage Code 17500; Empl.: 24; *Sls. Mgr.:* Richard Peters, Prod. Mgr.; *Dist. Mgr.:* Myron Kasok

MONITOR PC

FAX: 619-434-0255

MONITOR PRODUCTS CO., INC., 502 Via Del Monte, Oceanside, CA 92054, Tel: 619-433-4510, ESYLNK: 629 5085; FSC No.: 54331; Empl.: 65; *Sls. Mgr.:* Robert Blasier; *Dist. Mgr.:* Robert Blasier ..... **A•1402-1407**

Local Sales Offices & Reps

AL Huntsville, CSR Elctrns. 205-533-2444
AZ Phoenix, Eltron 602-266-2164
CA Los Angeles, Monitor Prods. Co. 619-433-4510
CA Mountain View, Straube Assocs. 415-969-6060
CA Orange County, Monitor Prods. Co. ... 618-433-4510
CO Denver, Straube Assocs. 303-426-0890
CT Bloomfield, Zaslow Sls., Inc. 203-242-7781
FL Brandon, R.C. Simon & Company 813-689-6524
FL Lighthouse Pt., R.C. Simon & Company 305-941-2757
GA Atlanta, CSR Elctrns. 404-396-3720
MA Westboro, Zaslow Sls., Inc. 617-393-8150
MN Eden Prairie, Elctrn. Innovators 612-941-0830
NY Rochester, Electra Sls. 716-427-7860
NY Syracuse, Electra Sls. 315-463-1248
NC Raleigh, CSR Elctrns. 919-878-9200
PA Philadelphia, Monitor Prods. 904-725-4386
TN Knoxville, CSR Elctrns. 615-673-0222
TX Austin, Mil-Rep Assocs. 512-346-6331
TX Houston, Mil-Rep Assocs. 713-444-2557
TX Richardson, Mil-Rep Assocs. 214-644-6731

Local Distributors

AL Huntsville, Component Distrs., Inc. 205-883-7501
AL Huntsville, Resistacap, Inc. 205-883-4270
AZ Tempe, Harper SID 602-967-1464
AR Little Rock, Component Distrs., Inc. ... 501-227-6305
CA Compton, Harper SID 213-979-5090
CA San Diego, Harper SID 619-560-8545
CA San Diego, Neumann Elctrns. 619-695-3005
CA Sherman Oaks, Delay Line Distrs. 818-986-9455
CA Sunnyvale, Harper SID 408-747-0333
CA Tustin, Added Value Elctrns. 714-259-8258
CO Wheatridge, Added Value Elctrn. 303-422-1701
FL Ft. Lauderdale, Component Distrs., Inc. 305-723-8874
FL Melbourne, Rome Elctrns. 305-242-8151
GA Norcross, Component Distrs., Inc. 404-441-3320
IL Bensenville, Voyager Elctrns. 312-773-4900
MA Hudson, DSC, Inc. 617-562-6920
MN Fridley, Voyager Elctrns. 612-571-7766
NY Johnson City, Help Elctrns. 607-729-3528
NC Greensboro, Golden Elctrns. 919-294-4653
TX Dallas, Component Distrs., Inc. 214-644-0373
TX Fort Worth, C & W Supply 817-831-0395
TX Richardson, Harper SID 214-235-3177
VA Falls Church, Component Distrs., Inc. 703-241-8227

MONOLITHIC SYS. CORP., 7050 South Tuscan Way, Englewood, CO 80112, Tel: 303-790-7400, FAX: 303-790-7118; Empl.: 80; *Sls. Mgr.:* C. Edward O'Neal; *Dist. Mgr.:* C. Edward O'Neal

MONROE ELECTRONICS, INC., 100 Housel Ave., Lyndonville, NY 14098, Tel: 716-765-2254, TELEX: 756662, FAX: 716-765-9330; Empl.: 50; *Sls. Mgr.:* Brian D. Ives

MONSANTO CO., 800 N. Lindbergh Blvd., St. Louis, MO 63167, Tel: 314-694-1000, TELEX: 44-7282; Empl.: 49,197

MONTROSE PRODUCTS COMPANY, Intercole, 28 Sword Street, Auburn, MA 01501, Tel: 508-791-3161, FAX: 508-793-9862; Empl.: 250; *Sls. Mgr.:* Michael McLaughlin, OEM Sls. Mgr.; *Dist. Mgr.:* Bill Wilmot

MOODY TOOLS, INC., 43 Crompton Ave., E. Greenwich, RI 02818, Tel: 401-885-0911, FAX: 401-885-4565; Empl.: 11; *Sls. Mgr.:* J. H. Moody; *Dist. Mgr.:* D .H. Moody

MOORE PRODUCTS CO., Sumneytown Pike, Spring House, PA 19477, Tel: 215-646-7400, FAX: 215-283-6358; Empl.: 1000ò; *Sls. Mgr.:* J. McDonald

MOORE REED & CO. LTD., Southway Walworth, Andover, Hampshire SP 105AB, Tel: 0264-324155, TELEX: 47654, FAX: 0264-356561; Empl.: 150; *Sls. Mgr.:* W. North

MORGAN-MATROC, Vernitron Div., 232 Forbes Rd., Bedford, OH 44146-5478, Tel: 216-232-8600, TWX: 810-427-2274, FAX: 216-232-8731; Empl.: 100; *Sls. Mgr.:* D.W. Bacso ..... **B•1921**

Local Sales Offices & Reps

CA El Toro, Morgan Matroc, Inc. 714-768-8672
IL Des Plaines, Esco Assoc. 312-298-5310

MORRIS, J. I, CO., 372 Elm St, Southbridge, MA 01550, Tel: 508-764-4394, FAX: 508-764-7350; FSC No.: 95548; Empl.: 25

MORRIS ENTERPRISES, 16799 Schoenborn St, Sepulveda, CA 91343, Tel: 818-894-9103, TELEX: 6-74681, TWX: 910-496-1525, FAX: 818-894-5791; FSC No.: 54918; Empl.: 50; *Sls. Mgr.:* J. Dumpert

MORS ASC®

FAX: 617-245-4531

MORS/ASC, 134 Water St., PO Box 544, Wakefield, MA 01880-4444, Tel: 617-246-1007; FSC No.: 54659; Empl.: 35; *Sls. Mgr.:* Mike Palmerino; *Dist. Mgr.:* Mike Palmerino ..... **B•1745**

Local Sales Offices & Reps

CA Arcadia, HMC, Inc. 818-447-0958
CA San Jose, Vernexx 408-972-9072
CO Boulder, Stratford Grp. 303-530-3194
FL Boca Raton, Newell-Hynes 407-392-3186
GA Norcross, Mountain Electro Mktg. 404-448-5594
IL Wheaton, C-S Technical Sls. 708-653-8126
IA Marion, MSB Assocs. 319-377-6261
KS Shawnee Mission, MSB Assocs. 913-432-2131
MA Andover, Crawford Assocs. 508-470-2122
MI Farmington Hills, W. R. Hummon 313-474-0661
MN Golden Valley, Highland Sls. 612-546-2123
MO St. Charles, MSB Assocs. 314-946-5577
NY Fairport, Andres Component Sls. 716-223-2430
NY Patchogue, Optimum Metro Sls. 516-756-0644
OH Willoughby, Nationwide Comps. 216-946-3226
OR Hillsboro, Doran Sls. 503-640-4500
PA Wynnewood, Metz-Benham Assoc. ... 216-896-7300
TX Bedford, El-Tec Sls. 817-268-2896
VA Ashland, Glasscock Assoc. 804-798-2125
WA Redmond, Doran Sls. 206-885-1885
EXP CT/Litchfield, Intrade 203-567-5901

Local Distributors

AL Birmington, Forbes Distbg. 205-251-4104
AZ Phoenix, Arizona Comps. 602-269-5655
AZ Tempe, RCD Inds. 602-838-0979
CA Fremont, KEA Elctrns. 415-651-2600
CA Los Angeles, Elec. Switches 213-660-1310
CA San Jose, Rose Elctrns. 408-943-0200
CA San Jose, Sierra West 408-435-7477
CA Santa Monica, Master Dists. 213-452-1229
CA Sunnyvale, PSC 408-737-1333
CA Tustin, Western Switch & Controls 714-731-4333
CO Denver, CSID 303-292-9594
CO Englewood, Indelco 303-694-9444
CT Bridgeport, Park Dists. 203-366-7200
CT Wallingford, Mid-State Elctrns. 203-265-9900
DE New Castle, Elctrns. Exchange 302-322-5401
FL Boca Raton, Zelcon 407-451-1600
FL Ft. Lauderdale, Brothers Elctrns. 305-561-6700
FL Melbourne, GRS/Rome Elctrns. 407-242-8151
GA Norcross, Dow Elctrns. 404-448-4004
ID Spirit Lake, A-I Elctrns. 208-623-3111
IL Addison, Belford Elctrns. 708-691-1100
IL Chicago, Leeds Elctrns. 312-625-3800
IL Wheeling, Hawk Elctrns. 312-459-4030
IL Wood Dale, Nep Elctrns. 312-595-8500
IN Carmel, Altex Elctrns. 317-848-1323
IN Terre Haute, Midwest Supp. 812-232-0187
IA Cedar Rapids, Iowa Radio Supp. 319-393-4510
IA W. Des Moines, Ramco Co. 515-225-6933
KS Wichita, Radio, Inc. 316-264-2798
MD Beltsville, PSI 301-937-4960
MD Jessup, Treeko Elec. 301-470-3300
MD Kensington, Marine Air Supp. 301-949-9560
MA Marlboro, Hardware Specialties 617-481-8622
MA Westborough, In Stock Prods. 617-870-5750
MA Wilmington, North Star Elec. 617-657-5155
MI Battle Creek, Great Lakes Elctrns. 616-731-4156
MI Grand Rapids, Calder Elctrns. 616-698-7400
MI St. Clair Shores, Spemco 313-771-2700
MN Burnsville, Cassidy Elctrns. 612-895-9026
MN Fridley, Voyager Elctrns. 612-571-7766
MN Minneapolis, Tortec Corp. 612-866-3662
MO St. Louis, Wes-Garde Comps. 314-567-7776
NH Salem, Diamond Elec. 603-894-4420
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ Mt. Laurel, New Jersey Comps. 609-722-7108
NJ Oakland, Relay Specialties 201-337-1000
NM Albuquerque, Harrison/Int'l 505-345-8127
NY Amherst, Std. Elctrns. 716-691-3801
NY Bohemia, Key Comps. 516-567-7500
NY Hempstead, Davis Elect. 516-483-9200
NY Mt. Vernon, QAR/All American 914-699-2224
NY Rome, Rome Elctrns. 315-337-5400
NY Woodside, Switches Unltd. 718-478-5000
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Dayton, Stotts-Friedman 513-298-5555
OH Willoughby, Gateway Megatech 216-953-0333
OR Beaverton, Rose Elctrns. 503-629-9288
PA Norristown, Kimberly James Co. 215-666-7286
PA Philadelphia, Shap Elctrns. 215-969-3300
RI Pawtucket, Major/Edwards 401-725-7400
TX Arlington, Bell Comp. Sls. 817-461-5303
TX Dallas, Wholesale Elctrns. 214-824-3001
TX Ft. Worth, Indl. Elctrns. 817-731-7321
TX Garland, J & S Elctrns. 214-487-8808
UT Salt Lake City, Std. Supp. Co. 801-486-3371
WA Redmond, Kent Elctrns. 206-883-7200
WA Vancouver, Interconnect Sls. 206-256-4085
WV Huntington, Elctrn. Supp. 304-523-6443
WI Mequon, Lake-View Elctrns. 414-377-8250
WI Milwaukee, Progressive Image 414-321-4722
WI New Berlin, Nep Elctrns. 414-785-9100
Can Markham, Ont., Deskin Sls. 416-475-1412
Can Montreal, Que., Versatech Elctrns. 514-481-0196
Can Quebec, A.R. Gray & Assoc. 514-694-6378
Can Surrey, B.C., Memco 604-590-1553

MORS TECHNOLOGIES INC., Mors Group-France, 225 Industrielle, Delson, Quebec, Canada J0L 1G0, Tel: 514-638-4150, FAX: 514-638-2270

MOSAIC SEMICONDUCTOR INC., Implex Inc., 7420 Carroll Rd., San Diego, CA 92121, Tel: 619-271-4565, FAX: 619-271-6058; Empl.: 45; *Sls. Mgr.:* Derek Best, Gary Brown; *Dist. Mgr.:* Derek Best

MOTION ENGINEERING, INC., 520 E. Montecito St., Santa Barbara, CA 93103, Tel: 805-962-5409, FAX: 805-962-8001; Empl.: 6; *Sls. Mgr.:* Matt Cheresh

MOTION SCIENCE INC., 830-6 Jury Ct, San Jose, CA 95112, Tel: 408-993-0300, FAX: 408-993-0123; Empl.: 27

MOTION SENSORS, INC., 12 Park Street, Cranford, NJ 07701, Tel: 908-709-0025, FAX: 908-709-1144; Empl.: 6; *Sls. Mgr.:* Arthur Bergman

MOTOR CAPACITORS, INC., 6655 N. Avondale Ave., Chicago, IL 60631, Tel: 312-631-0713, FAX: 312-774-8778; Empl.: 14

MOTOROLA CERAMIC PRODUCTS, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113, Tel: 505-822-8801; Empl.: 600; *Sls. Mgr.:* Tom Gilder

MOTOROLA INC., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., 4000 Commerical Ave., Northbrook, IL 60062, Tel: 708-205-2867, TELEX: 671-5420 MOT APD; Empl.: 2500

MOTOROLA SEMICONDUCTOR PRODS. SECTOR, 2100 East Elliot, Tempe, AZ 85284, Tel: 602-244-6900, TWX: 910-951-1334; FSC No.: 04713; *Sls. Mgr.:* Ted Jaros; *Dist. Mgr.:* Brian Hilton

MOTOR TECHNOLOGY, INC., 2798 Culver Ave., Dayton, OH 45429, Tel: 513-294-1041, FAX: 513-294-8336; Empl.: 35 ..... **B•1303-1305**

Local Sales Offices & Reps

OH Dayton, Motor Technology, Inc. 513-294-1041

MOTORTEST, INC., PO Box 292633, Columbus, OH 43229, Tel: 614-882-7821, FAX: 614-841-9007

MOTOR-TRONICS, INC., 2142 Industrial Ct., Bldg. 'F', Vista, CA 92083, Tel: 619-727-7430, FAX: 619-727-4436; *Sls. Mgr.:* Bill Linko

MOUSER ELECTRONICS, 11433 Woodside Ave., Santee, CA 92071, Tel: 619-449-2222, TELEX: 619-44; Empl.: 200; *Sls. Mgr.:* C. Degurse; *Dist. Mgr.:* G. Rye

MOUSER ELECTRONICS, 2401 Hwy. 287 North, Mansfield, TX 76063, Tel: 800-346-6873, FAX: 817-483-0931; Empl.: 200; *Dist. Mgr.:* G. Rye

MOXNESS PRODUCTS, INC., Versa Technologies, 1914 Indiana St., Racine, WI 53405, Tel: 414-554-5050, 800-558-5706, FAX: 414-554-2321; Empl.: 250; *Sls. Mgr.:* Ronald M. Buono; *Dist. Mgr.:* Ronald M. Buono

MPB CORP., Miniature Precision Bearings Div., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; FSC No.: 40920; Empl.: 1900; *Sls. Mgr.:* T. A. Rudziensky; *Dist. Mgr.:* R. F. Chartier

M P C, 150 S. Harbor Blvd. Unit J, Santa Ana, CA 92704, Tel: 714-775-0211, FAX: 714-775-1674; Empl.: 25; *Sls. Mgr.:* Sam Granat

MPC, Div. of Consulting Systems, 638 Main St, Danville, NH 03819, Tel: 603-642-5913, FAX: 603-642-5913; *Sls. Mgr.:* W. Morse ..... **D•1911**

Local Distributors

TN	Knoxville, Indl. Elctrns.	615-573-7135

MP/CAPAR, Multi Products International, 250 Lackawanna Ave., P.O. Box 737, West Paterson, NJ 07424, Tel: 201-890-1344, FAX: 201-890-1677; *Sls. Mgr.:* Leroy Gray ..... **A•1107**

Local Sales Offices & Reps

AZ	Phoenix, JBS Assocs.	602-893-2382
CA	Mission Viejo, Jay Mktg. Assoc.	714-768-7519
CA	Santa Clara, Nova-Tronix, Inc.	408-727-0261
CO	Denver, Electrophase	303-296-0443
FL	Indian Rocks Bch., Electronic Mfrs. Agt.	813-596-5053
GA	Lawrenceville, Tek Rep Mktg.	404-963-1600
IL	Des Plaines, ESCO Assocs.	312-298-5310
IN	Frankfort, CS Elctrns. Sls.	317-659-1874
IA	Marion, MSB Assocs	319-377-6261
KS	Shawnee Mission, MSB Assocs.	913-432-2131
MA	Norwood, The MacInnis Co.	617-762-8090
MI	Lathrup Village, RC Nordstrom & Co.	313-559-7373
MN	St. Paul, Proud Inds.	612-646-9428
MO	St Charles, MSB Assocs.	314-967-5577
NY	Farmingdale, BDK Mktg., Inc.	516-694-5500
NY	Rochester, Ontec Elctrn. Mktg.	716-464-8636
OH	Dayton, KW Elctrn. Sls.	513-890-2152
OR	Tigard, Eltech Inc.	503-684-3458
PA	Collegeville, Beacon North	703-478-2480
TX	Irving/Dallas, AID Elctrns	214-790-4761
WA	Bellevue, Eltech Inc.	206-643-4330

Local Distributors

AL	Huntsville, Components Resources	205-533-2862
CA	Chatsworth, Passive Comps.	818-700-8838
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Huntington Beach, Capacitor Specialists	714-843-1815
CA	Irvine, Kelex Inc.	714-863-1230
CA	Sunnyvale, Capsco Sls.	408-734-3020
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
IL	Lisle, Components Inc.	312-852-7707
IN	Carmel, Altex Elctrns.	317-848-1323
MD	Gaithersberg, Axis Elctrns.	301-840-9640
MD	Spencerville, US Elctrns.	301-384-3300
MA	Bellrica, Baldwin Comps.	508-667-6710
MA	Tyngsboro, Port Elctrns.	508-649-4880
MI	Grand Rapids, RM Elctrns. Co.	616-531-9300
MN	New Brighton, Chris Elctrns.	612-631-2647
MN	New Brighton, Parts I	612-633-8079
NJ	Rockaway, Tonar Inds.	201-986-9000
NY	Bohemia, Key Components	516-567-7500
NY	Ronkomkoma, Baldwin Comps.	516-588-5700
OR	Portland, Radar Elec.	503-232-3404
OR	Tualatim, Moore Elctrns.	503-692-5333
PA	York, E C I	717-846-5334
PA	Bristol, Aim Elctrns.	215-785-3510
RI	Pawtucket, Major Edward Elctrns.	401-725-7400
TX	Ft. Worth, Allied Elctrns.	817-336-9168
TX	Richardson, GTT	214-437-4747
WA	Seattle, Radar Elctrns.	206-282-2511
WI	Grafton, Lakeview Elctrns.	414-377-8250
Can	Montreal, Prelco Elctrns.	514-389-8051
Can	St. Laurent, Que., ZEI Elctrns.	514-342-6211

MRL, Missouri Research Labs., 3800 West Clay, St. Charles, MO 63301, Tel: 314-946-6900, 1-800-325-0223, FAX: 314-946-2860; Empl.: 100; *Sls. Mgr.:* Virgil Beer

MSC AUTOMATION, Miller Sales Co., 1111 Old Rand Rd., Wauconda, IL 60084, Tel: 708-526-9200, 800-323-5294, FAX: 708-526-9206; Empl.: 23; *Sls. Mgr.:* Paula Bilinski; *Dist. Mgr.:* Lena Nilsson



FAX: 803-393-4123

MSD, INC., Magnecraft, 700 Orange St., Darlington, SC 29532, Tel: 803-393-5421; Empl.: 210; *Sls. Mgr.:* Bob Forbes ..... **B•1551-1556**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
AZ	Tuscon, Clemick	602-749-4003
CA	Mountain View, Bridge Mktg.	415-965-8045
CA	Torrance, MG Sls.	213-533-1808
CO	Englewood, CSI	303-779-8060
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Orlando, CDM	407-240-3903
GA	Chamblee, BCI	404-455-0405
IL	Downers Grove, Rockford Controls Co.	312-960-2046
KS	Olathe, Advanced Tech Sls.	913-782-8702
MA	Millis, Zaslow Sls.	508-393-8150
MD	Towson, Bresson	301-321-0326
MI	Southfield, L.H. Dickelman Co.	313-353-8210
MN	Edina, Dunlop	612-559-9693
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	West Caldwell, GSA	201-575-9300
NH	Portsmouth, Zaslow	508-393-8150
NY	Buffalo, Zang Agency	716-877-3677
OR	Tigard, Eltech	503-684-3458
OH	Cincinnati, Stegman Blaine	513-729-1969
VA	Moneta, Bresson	804-525-7445
PA	Narberth, Bresson	215-664-6460
TN	Memphis, Lesley Assocs.	901-755-9492
TX	Richardson, Texoma	214-238-8127
WA	Bellevue, Eltech, Inc.	206-643-4330
UT	Midvale, CSI	801-561-5099
WI	Sun Prairie, Rockford Controls	608-837-3350

Local Distributors

AL	Birmingham, M G Elctrns.	205-328-4525
AL	Decatur, M-G Elctrns. & Equip.	205-355-6121
AL	Huntsville, Wyle Lab.	205-837-4411
AL	Montgomery, Southern Controls, Inc.	205-277-5030
AR	Little Rock, Carlton-Bates	901-755-1249
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Hayward, Electro Comps. Inc.	415-783-5800
CA	Hayward, Western Electro Sls.	415-489-2211
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Oakland, Brill Elctrs.	415-834-5888
CA	San Diego, Johnstone Supply	619-298-7168
CA	Santa Ana, Norstan Elctrns. Inc.	714-540-4165
CA	Woodland Hills, Cypress Elctrns., Inc.	818-710-7730
CO	Aurora, Comp. Specialties, Inc.	303-341-0160
CO	Denver, Newark-Denver Elctrns.	303-757-3351
CT	Wallingford, Sager Elec Supp. Co.	203-265-4600
CT	West Hartford, HESCO	203-236-6363
FL	Lakeland, A-A Elec. Inc	813-665-6941
FL	Orlando, T & T Prods., Inc.	407-857-2282
GA	Atlanta, Brownell-Electro, Inc.	404-762-5181
GA	Norcross, A-A Elec. Inc.	404-449-8670
IL	Bensenville, Voyager Elctrns.	312-860-1300
IL	Chicago, Newark Elctrns. Corp.	312-784-5100
IL	Hinsdale, Whiteco,Inc.	312-654-3326
IL	Peoria, Klaus Radio, Inc.	309-691-4840
IN	Ft. Wayne, Bell Inds., Inc.	219-423-3422
IA	Cedar Rapids, The Van Meter Co.	319-366-5301
KS	Kansas City, Kornfeld-Thorp Elec.	913-321-7070
LA	Baton Rouge, Menard Elctrns. Inc.	504-355-0323
MA	Harrahan, M-G Electrns. & Equip. Co.	504-733-0070
LA	Lafayette, Ralph's of Lafayette Inc.	318-233-0105
LA	Shreveport, Ind. Elctr. Supp.	318-222-9459
ME	lakeland Engrg. Equiq.	
MD	Baltimore, Whitney Distrs. Inc.	301-944-8080
MA	Springfield, T.F. Cushing Inc.	413-788-7341
MA	Woburn, Apparatus Svce. Co.	617-933-5999
MI	Battle Creek, Kendall Elec. Supp.	616-963-5585
MI	Oak Park, Newark-Detroit Elctrn.	313-967-0600
MI	Troy, Teal Elec. Co.	313-689-3000
MN	Fridley, Voyager Elctns. Corp.	612-571-7766
MN	Hibbing, Jasper Engnrg. & Equip.	218-262-3421
MO	Maryland Hgts., L Comp. Inc.	314-291-6200
NJ	Audubon, Universal Elctrns. Supp.	800-327-3529
NJ	E. Hanover, State Elctrn. Parts	201-887-2550
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NM	Albuquerque, Summit Elec. Supp.	505-884-4400
NY	Buffalo, L.A. Wooley Co.	716-821-1200
NY	Buffalo, Summit Dists.	716-887-2800
NY	Plainview, A.C.I. Elctrns.	516-293-6630
NY	Rochester, Requa Elec. Co.	716-475-1600
NY	Rome, Rome Elctrns., Inc.	315-337-5400
NY	Woodside, Switches Unlimited	718-478-5000
NC	Goldsboro, Shepherd Elec. Supp.	919-735-1701
OH	Akron, Aesco Elctrns., Inc.	216-762-8818
OH	Cincinnati, Hughes-Peters, Inc.	614-294-5351
OH	Cincinnati, Wesco	513-542-4300
OH	Columbus, E & M Equip.	614-236-0888
OH	Toledo, F.N. Cuthbert, Inc.	419-385-0881
OH	Warren, REM Elctrns.	216-373-1300
OK	Tusla, Radio, Inc.	918-587-9123
OR	Portland, Johnstone Supp., Inc.	503-231-4833
PA	McKean, Advacom Inc.	814-476-7774
PA	McKeesport, Barno Radio Co.	412-751-5966
PA	Murrysville, Wesco	412-733-6800
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	St. Marys, B & R Elec. Co.	814-834-2814
PA	West Chester, West Chester Elec.	215-696-7500
PA	York, E.C.I. Inc.	717-846-5334
SC	Charleston, Cameron & Barkley Co.	803-745-2900
SC	Greenville, Emsco	803-233-4121
TN	Chattanooga, Electr. Motor Sls. & Supp.	615-899-1126
TN	Kingsport, WESCO	615-247-6190
TN	Nashville, Electra Distrbg. Co.	615-256-0800
TX	Dallas, Assocd. Aircraft	214-331-4381
TX	Dallas, Wholesale Elctr. Supp.	214-824-3001
TX	Fort Worth, Allied Elctrs.	817-595-3500
TX	Houston, Lenert Co.	713-225-1465
UT	Salt Lake City, Stuart Elec. Supp.	801-466-8603
WA	Redmond, EIL Insts. Inc.	206-882-3222
WV	Huntington, State Elec. Supp. Co.	304-523-7491
WV	South Charleston, Allied Controls Co.	304-768-7313
WI	Cedarburg, Automation Engrg.	414-377-7500
WI	Milwaukee, Marsh Elctrs.	414-475-6000
IA	Cedar Rapids, Advanced Tech. Sls.	319-393-8280

MSI ELECTRONICS, INC., 34-32 57th St., Woodside, NY 11377, Tel: 718-672-6500, TELEX: 426407, FAX: 718-397-0972; FSC No.: 18518; Empl.: 18; *Sls. Mgr.:* A. Lederman

M. SYSTEM TECHNOLOGY, INC., 15028 Beltway Dr., Dallas, TX 75244, Tel: 800-544-3181, FAX: 214-385-2299; Empl.: 10; *Sls. Mgr.:* Chuck Seifert

MTE CORP., W147 N 9525 Held Dr., Menomonee Falls, WI 53051, Tel: 414-253-8200, FAX: 414-253-8222; FSC No.: 5950; Empl.: 120; *Sls. Mgr.:* John Houdek; *Dist. Mgr.:* John Houdek

M-TEK, 2419 Smallman St., Pittsburgh, PA 15222, Tel: 800-245-5101 , 412-261-9030, TELEX: 812-569, FAX: 412-261-7220; FSC No.: 56452; Empl.: 20; *Sls. Mgr.:* John Hartnett

M-tron

FAX: 605-665-1709

M-TRON INDUSTRIES, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, Tel: 605-665-9321, TWX: 910-668-3603; FSC No.: 23875; Empl.: 150; *Sls. Mgr.:* Larry Barbary; *Dist. Mgr.:* Les Willman ..... **A•1408-1409**

Local Sales Offices & Reps

AL	Huntsville, Group 2000 Sls. Inc.	205-536-2000
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	Mountain View, Bridge Mktg.	415-965-8045
CA	Torrance, Universal Comps. Co.	213-783-0220
CO	Englewood, Comp. Sls; Inc.	303-779-8060
CT	Fairfield, Comptech/NRG Ltd.	203-384-1112
FL	Ft. Lauderdale, QXI of Florida Inc.	305-978-0120
FL	Melbourne, QXI of FL, Inc.	407-723-4384
FL	Orlando, QXI of Florida Inc.	407-872-2321
FL	St. Petersburg, QXI of Florida Inc.	813-894-4556
GA	Norcross, Group 2000 Sls. Inc.	407-729-1889
IL	Arlington Hgts., KMA Sales	708-398-5300
IN	Ft. Wayne, Alpha Tech, Inc.	219-447-0040
MD	Columbia, Robert Electronic Sales	301-995-1900
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MA	Tyngsboro, Comptech, Inc.	508-649-3030
MI	Farmington Hills, Tritech Sales, Inc.	313-553-3370
MN	Edina, OHMS Technology Inc.	612-932-2920
NJ	E. Brunswick, Winch Sales Associates	201-613-1515

NJ Marlton, Naudain Associates, Inc. 609-983-5300
NY Farmingdale, Milgray Int'l 516-420-9800
NY Pittsford, James E. Zimmerman Sales 716-381-3186
NY Plainview, Winch Sales Associates ... 516-681-3163
NC Raleigh, Robert Electronic Sales 919-878-4465
NC Sapphire, Robert Electronics Sales ... 704-877-3280
OH Dayton, Lyons Corporation 513-278-0714
OH Richfield, Lyons Corporation 216-659-9224
OH Westerville, Lyons Corporation 614-895-1447
OR Portland, K-Tek Intl. Inc. 503-624-0315
TX Austin, Ram Electronics Sales, Inc. 512-250-5082
TX Houston, Ram Electronics Sales, Inc. 713-955-0768
TX Plano, Ram Electronic Sales, Inc. 214-424-4455
UT Midvale, Component Sales, Inc. 801-561-5099
WA Lynnwood, Quadra Sales 206-743-2633
WI Milwaukee, KMA Sales 414-259-1771
Can Burnaby, BC., Kaytronics 604-294-2000
Can Concord, Ont., Kaytronics 416-669-2262
Can Kantata, Ont., Kaytronics 613-564-0080
Can Ville St. Laurent, Que., Kaytronics 514-745-5800

Local Distributors

AL Huntsville, Bell Industries 205-837-1074
AL Huntsville, Pioneer Electronics 205-837-9300
AZ Phoenix, Sterling Electronics 602-437-5565
AZ Tempe, Acacia 602-894-2874
AZ Tempe, Bell Industries 602-966-7800
AR Little Rock, Carlton-Bates 501-562-9100
CA Agoura Hills, Bell Industries 818-706-2608
MA Auburn, Dove Electronics 508-832-2730
WI Brookfield, Pioneer 414-784-3480
CA Chatsworth, Sterling Electronics 818-407-8850
CA Cypress, Bell Industries 714-895-7801
CA Fremont, Acacia 415-623-7500
CA Gardena, Bell Industries 213-515-1800
CA Huntington, Wyle Kitting 714-373-9944
CA Irvine, Acacia 714-660-0834
CA Los Angeles, Bell Industries 213-826-6778
CA Rocklin, Bell Industries 916-652-0414
CA San Diego, Acacia 619-597-0577
CA San Diego, Bell Industries 619-268-1277
CA San Diego, Pyramid Electronics/Kent 619-271-5404
CA San Diego, Sterling Electronics 619-271-6555
CA San Jose, All American 403-943-1200
CA San Jose, Compass Components 408-432-7525
CA Santa Clara, Pyramid/Kent Elect. 408-727-9810
CA Sherman Oaks, DLDI 213-283-2058
CA Stanton, Inductive Comp/Crystal 714-828-3420
CA Sunnyvale, Bell Industries 408-745-0400
CA Sunnyvale, Bell Industries 408-734-8570
CA Torrance, All American 213-320-0240
CA Torrance, Pyramid/Kent Electronics .. 714-773-0781
CA Tustin, Sterling Electronics 714-259-0900
CO Englewood, Component Sales, Inc. ... 303-779-8060
CO Englewood, Sterling Electronics 303-792-3939
CO Lakewood, Acacia 303-232-2882
CO Wheatridge, Bell Industries 303-424-1985
CT E. Haven, J.V. Electronics 203-469-2321
CT Norwalk, Pioneer Electronics 203-853-1515
FL Altamonte Springs, Bell Industries 407-339-0078
FL Altamonte Springs, Pioneer 407-834-9090
FL Clearwater, All American 813-536-0445
FL Miami, All American 305-621-8282
CA Santa Fe Springs, Bell Industries 213-921-3611
GA Norcross, Bell Industries 404-662-0923
GA Norcross, Pioneer Electronics 404-623-1003
IL Addison, Pioneer Electronics 708-495-9680
IL Elk Grove Vl., Bell Industries 312-640-1910
IL Rosemont, Advent Electronics 708-297-6200
IL Schaumburg, Sterling Electronics 707-303-9900
IN Ft. Wayne, Bell Industries 219-423-3422
IN Indianapolis, Advent Electronics 317-872-4910
IN Indianapolis, Bell Industries 317-875-8200
IN Indianapolis, Pioneer Electronics 317-573-0880
IA Cedar Rapids, Advent Electronics 319-363-0221
IA Cedar Rapids, Bell Industries 319-395-0730
CA San Jose, Pioneer Technologies 408-954-9100
FL Sunrise, All American 305-572-7999
MD Baltimore, Resco Baltimore 301-931-8200
MD Beltsville, Resco/Washington 301-937-9100
MD Gaithersburg, Pioneer Electronics 301-921-0660
MA Andover, Bell Industries 508-474-8880
MA Billerica, A. W. Mayer Co. Inc. 508-229-2255
FL Clearwater, Pioneer/Tampa 813-536-0445
MA Lexington, Pioneer Electronics 617-861-9200
MD Rockville, All American 301-251-1205
MA Wakefield, All American 617-246-2300
MA Wilmington, J.V. Electronics 508-833-0700
MA Winchester, Bell Industries 617-729-5800
MI Ann Arbor, Bell Industries 313-347-6633
MI Farmington Hills, Advent Industries ... 313-477-1650
MI Grand Rapids, Pioneer Electronics 616-698-1800
MI Livonia, Pioneer Electronics 313-525-1800
MN Eden Prairie, All American 612-944-2151
MN Eden Prairie, Pioneer 612-944-3355
MN Hibbing, Minntech Electronics 218-262-5228
NJ Hopeland, Dove Electronics 201-324-7830
MN Minneapolis, Stark Electronics 612-332-1325
MO St Louis, Ric-tronics 314-997-0747
MO St. Louis, Pioneer Electronics 314-432-4350
NH Hudson, Bell Industries 603-882-1133
NH Nashua, Brevan Electronics 603-889-7230
NJ Fairfield, Pioneer Electronics 201-575-3510
NJ W. Berlin, GCI 609-768-6767
NM Albuquerque, Bell Industries 505-292-2700
NM Albuquerque, Sterling Electronics 505-884-1900
NJ Berlin, P.A.C. Electronics 609-768-5180
NY Binghamton, Pioneer Electronics 607-722-9300
NY Bohemia, Key Components Inc. 516-567-7500
NY Fairport/Rochester, Pioneer 716-381-7070
NY Farmingdale, Bell Industries 516-752-9303
NY Ronkonkoma, All American 516-981-3935
NY Ronkonoma, M-tron Components 516-467-5100
NY Stony Brook, Dove Electronics 516-689-7733
NY Woodbury, Pioneer Electronics 516-921-8700
NC Charlotte, Pioneer Electronics 704-527-8188
NC Durham, Pioneer Electronics 919-544-5400
NC Raleigh, Century Electronics 919-782-2116
NC Raleigh, Sterling 804-226-2190
OH Cleveland, Pioneer Electronics 216-587-3600
OH Dayton, Bell Inds. (Industrial) 513-435-8660
OH Dayton, Bell Inds. (Military) 513-434-8231
OH Dayton, Pioneer Electronics 513-236-9900
OK Oklahoma City, Radio Inc. 405-789-0741
OK Tulsa, Altair 918-252-5781
OK Tulsa, Radio Inc. 918-587-9123
OR Beaverton, Acacia 503-646-3377
OR Lake Oswego, Bell Industries 503-635-6500
NM Betatron, Albuquerque 505-821-1122
PA Horsham, Pioneer Electronics 215-674-4000
PA Norristown, Century Electronics 215-631-5400
PA Pittsburgh, Pioneer Electronics 412-782-2300
TX Austin, Altair 512-837-4970
TX Austin, Pioneer Electronics 512-835-4000
TX Dallas, Pioneer Electronics 214-386-7300
TX Ft. Worth, Carlton Bates 800-456-0314
TX Houston, Altair 713-462-3029
TX Houston, Pioneer Electronics 713-495-4700
TX Houston, Pyramid/Kent 713-978-5896
TX Houston, Sterling 713-627-9800
TX Richardson, Altair 214-231-5166
TX Richardson, Bell Industries 214-690-0466
UT Midvale, Bell Industries 801-255-9611
UT Salt Lake City, Standard Supply 801-486-3371
UT Salt Lake City, Sterling Electronics 801-972-5444
VA Herndon, Sterling Electronics 703-742-8400
VA Richmond, Sterling Electronics 804-226-2190
WA Redmond, Bell Industries 206-885-9963
WA Redmond, Priebe Electronics 206-881-2363
WA Redmond, Pyramid/Kent Electronics 206-883-7200
WA Redwood, Acacia 206-881-5566
WI Brookfield, Pioneer 414-784-3480
WI Milwaukee, Marsh Electronics 414-475-6000
TX Richardson, All American 214-231-5300
WI Waukesha, Bell Industries 414-547-8879
Can Burnaby, BC, ITT/R-A-E Ltd. 604-291-8866
Can Calgary, Alb., Electrosonic 403-255-9550
Can Calgary, AB, Cardinal Electronics Ltd. 306-934-3443
Can Calgary, AB, Zentronics 403-295-8838
Can Concord, Ont., ITT/R-A-E Ltd. 416-736-1144
Can Dartmouth, NS, ITT/R-A-E Ltd. 902-465-2350
Can Don Mills, Ont., Saynor Varah 416-445-0723
Can Edmonton, Alb., Zentronics 403-484-1669
Can Edmonton, ALB., Cardinal Electronics 403-483-6266
Can Mississauga, Ont., Zentronics 416-564-9600
Can Moncton, NB, ITT/R-A-E Ltd. 506-857-8011
Can Nepean, Ont., ITT/R-A-E Ltd. 613-596-6980
Can Nepean, Ont., Zentronics 613-226-8840
Can Ottawa, Ont., Electrosonic Inc. 613-728-8333
Can Richmond, B.C., Zentronics 604-273-5575
Can Richmond, BC, Electrosonic Inc. 604-273-2911
Can Saskatoon, SK, Cardinal Electronics Ltd. 306-934-3443
Can St. Foy,Que., Zentronics 418-654-1077
Can St. Laurent, Que., Zentronics 514-437-9700
Can St. Laurent, QB, ITT/R-A-E Ltd. 514-335-7697
Can Willowdale, Ont., Electrosonic Inc. 416-494-1666
Can Winnepeg, Man., Zentronics 204-694-1957
Can Winnipeg, Electrosonic Inc. 204-783-3105
Can Winnipeg, MN, ITT/R-A-E Ltd. 204-786-8401

MTS SYSTEMS, Box 24012, Minneapolis, MN 55424, Tel: 612-937-4000, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 1300; *Sls. Mgr.:* Ted Beaudoin

MUELLER ELEC. CO., 1583 E. 31st St., Cleveland, OH 44114, Tel: 216-771-5225, FAX: 216-771-3068; Empl.: 156; *Sls. Mgr.:* J. E. Wisneski

MULTI-AMP CORP., TBG, 4271 Bronze Way, Dallas, TX 75237, Tel: 214-333-3201, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 350; *Sls. Mgr.:* Hermann Michaeli

MULTICOMP., INC., 3005 S.W. 154th No. 3, Beaverton, OR 97006, Tel: 503-626-4200, FAX: 503-643-4889; Empl.: 150 ..... **A•1108, 2307**

Local Sales Offices & Reps

OR Portland, Intertech Sls. 503-775-7885

MULTI-CONTACT USA, 610 Davis St., Santa Rosa, CA 95401, Tel: 707-575-7575, FAX: 707-575-7573; *Sls. Mgr.:* Walter Roberts, Gen. Mgr.; *Dist. Mgr.:* Walter Roberts ..... **C•1475-1477**

Local Sales Offices & Reps

IL Chicago, Multi-Contact 312-286-1666

MULTICORE SOLDERS, 1751 Jay Ell Drive, Richardson, TX 75081, Tel: 214-238-1214; Empl.: 1000

MULTICORE SOLDERS, 400 Post Ave. Ste., 306, Westbury, NY 11590, Tel: 516-334-7997, FAX: 516-334-7098

MULTIPOWER, INC., Spectrum Electronics Corp., 3005 S.W. 154th Terrace No. 1, Beaverton, OR 97006, Tel: 503-646-4700, FAX: 503-643-4889; FSC No.: 75498; Empl.: 33 ..... **D•1912**

Local Sales Offices & Reps

OR Beaverton, MultiPower, Inc. 503-646-4700

MULTI PRODUCTS INTERNATIONAL, 250 Lackawanna Ave., West Paterson, NJ 07424, Tel: 201-890-1344, TELEX: 219289, FAX: 201-890-1677; Empl.: 28; *Sls. Mgr.:* LeRoy Gray ..... **A•2309; D•1913**

Local Sales Offices & Reps

AZ Phoenix, JBS Assocs. 602-893-2382
CA Mission Viejo, Jay Mktg. 714-768-7519
CA Santa Clara, Nova Tronix 408-727-9530
CA Westminster, West Elctrn. Sls. 714-898-0120,
CO Denver, Electrophase 303-296-0443
FL Longwood, Elctrn. Mfgs. Agt. 305-682-1202,
GA Lawrenceville, Tek Rep Mktg. 404-963-1600
IL Des Plaines, Esco Assocs. 312-298-5310
IN Frankfort, C-S Elctrns. Sls. 317-659-1874
KS Shawnee Mission, MSB Assocs. 913-432-2131
MD Sterling, Beacon North 703-478-2480
MA Norwood, Mac Innis Co. 617-762-8090
MI Lathrup Vl, R. C. Nordstrom & Co. 313-559-7373
MN St. Paul, Proud Inds. 612-646-9428
MO St. Charles, MSB Assocs. 314-967-5577
NJ Cedar Grove, Legtonics Assocs. 201-239-4098
NY Rochester, Ontec Elctrns. 714-464-8636
OH Dayton, K.W. Elctrn. 513-890-2150
PA Langhorne, Beacon North 703-478-2480
PA Pittsburgh, KW Elctrns. 412-366-9396
TX Dallas, AID Elctrns. 214-790-4761
WA Bellevue, Eltech 206-643-4330
Can Lachine, Bytewide Mktg. 514-636-4121

MULTISENS INC, 2633 Blv. Le Corbusier, Laval, Que., Canada H7S 2E8, Tel: 514-629-5646, FAX: 514-629-6801; Empl.: 20; *Sls. Mgr.:* Jean-Franqois Olivier

MULTI-TECH SYSTEMS, INC., 2205 Woodale Dr., Mounds View, MN 55112, Tel: 612-785-3500, 800-328-9717, FAX: 612-785-9874; Empl.: 210; *Sls. Mgr.:* Thomas Heimerman; *Dist. Mgr.:* Peter Hanlon/Jan Hubbard/Jim Stacklie

MUPAC CORP., Carlo Gavazzi Co., 10 Mupac Dr., Brockton, MA 02401, Tel: 508-588-6110, FAX: 508-588-0498; Empl.: 180; *Sls. Mgr.:* James L. Gallagher

muRata ERIE

FAX: 404-436-3030

MURATA ERIE NORTH AMERICA, INC., 2200 Lake Park Dr., Smyrna, GA 30080, Tel: 404-436-1300, TELEX: 54-2329, TWX: 810-766-1531; Empl.: 1800; *Sls. Mgr.:* Jack Driscoll; *Dist. Mgr.:* Kenneth O'Connor ..... **A•1109-1113, 1213, 1410-1415, 1696-1698, 1736-1738, 1820, 1957, 2058-2060; B•1323, 1853, 1922-1923; D•1045-1047**

Local Sales Offices & Reps

AL Madison, Jack Harvey & Assoc., Inc. .. 205-461-8591
AZ Scottsdale, Thom Luke Sls. 602-941-1901
CA Chatsworth, Murata Erie 818-701-9702
CA Fountain Valley, Bager Elctrns.;Inc. 714-957-3367
CA Los Altos, Recht Assocs. 415-964-6321
CA San Diego, CK Assocs. 619-279-0420
CA Tustin, Murata Erie 714-832-9972

CA Woodland Hills, Bager Elctrns., Inc. ... 818-712-0011
CO Boulder, Promotional Technlg. Corp. .. 303-447-2474
FL Deerfield Besch, Glen White Assocs. ... 305-570-8545
FL Maitland, Murata Erie ... 407-644-0954
FL Satellite Beach, Glen White Assoc. ... 407-773-3514
FL Tarpon Springs, Glen White Assoc. ... 813-938-7557
GA Norcross, Jack Harvey & Assocs. ... 404-449-4643
IL Park Ridge, Metcom Assoc. Corp. ... 708-696-1490
IN Carmel, Jack Harvey & Assocs., Inc. .. 317-575-4900
IN Kokomo, Jack Harvey & Assoc., Inc. .. 317-453-4260
IA Cedar Rapids, Stan Clothier Co., Inc. .. 319-393-1576
KS Olathe, Stan Clothier Co., Inc. ... 913-829-0073
KY Prospect, Jack Harvey & Assoc., Inc. .. 502-228-4100
NY Ithaca, Technlg. Sls., Inc. ... 607-257-7070
MD Towson, Glen White Assoc. ... 301-321-7235
MD Towson, Murata Erie ... 301-494-0405
MA Wakefield, Murata Erie ... 617-245-7880
MI W. Bloomfield, Jack Harvey & Assoc., Inc. ... 313-737-9122
MN Eden Prairie, Stan Clothier Co., Inc. ... 612-944-3456
MO St. Charles, Stan Clothier Co., Inc. ... 314-928-8078
NJ Springfield, Radix, Inc. ... 201-467-4970
NY Fairport, Technology Sls., Inc. ... 716-223-7500
NY Ithaca, Technlg. Sls., Inc. ... 607-257-7070
NC Raleigh, Glen White Assoc. ... 919-848-1931
OH Dayton, KW Electrn. Sls., Inc. ... 513-890-2150
OH Shaker Hgts., KW Elctrn. Sls., Inc. ... 216-491-9177
OR Beaverton, Murata Erie ... 503-646-4973
OR Beaverton, Westmark Elec., Inc. ... 503-641-8780
PA Pittsburg, KW Elctrn. Sls., Inc. ... 412-366-9396
TN Knoxville, Jack Harvey & Assoc., Inc. ... 615-694-7541
TX Austin, RAM Elec. Sls., Inc. ... 512-345-2982
TX Houston, RAM Elec. Sls., Inc. ... 713-955-0768
TX Plano, RAM Elec. Sls., Inc. ... 214-424-4455
UT Midvale, Promotional Technlg. Corp. .. 801-566-8919
VA Lynchburg, Glen White Assocs. ... 804-385-6110
WA Bellevue, Westmark Elect., Inc. ... 206-454-1944
WI West Allis, Metcom Assoc. Corp. ... 414-476-1300
PR Hato Rey, Semtronic Assocs., Inc. ... 809-766-0700
Can Mississauga, Ont., Gidden Morton Assocs. ... 416-671-8111
Can Richmond, Ont., Gidden Morton Assocs. ... 613-838-4480
Can St. Laurent, Que., Gidden Morton Assocs. ... 514-335-9572

Local Distributors

AL Huntsville, Future Elctrns. ... 205-830-2322
AZ Phoenix, Future Elctrns. ... 602-968-7140
AZ Phoenix, Sterling Elctrns. ... 602-437-5565
AZ Tempe, Acacia Sls./Deanco ... 602-894-2874, 602-882-9054
AZ Tempe, Time Elctrns. ... 602-967-2000
CA Agoura Hills, Time Elctrns. ... 818-707-2890
CA Camarillo, Milgray Elctrns. ... 805-484-4055
CA Chatsworth, Future Elctrns. ... 818-772-6240
CA Chatsworth, Passive Technlg. ... 818-882-2277
CA Chatsworth, Sterling Elctrns. ... 818-407-8850
CA Chatsworth, Time Elctrns. ... 818-998-7200
CA Compton, Harper Sid ... 213-979-5090
CA Fremont, Acacia/Deanco ... 415-623-7500
CA Garden Grove, Natl. Elctrns. Corp. ... 800-854-2451
CA Inglewood, Newark Elctrns., Inc. ... 213-671-7377
CA Irvine, Acacia Sls./Deanco ... 213-971-2428, 714-660-0834
CA Irvine, Future Elctrns. ... 714-250-4141
CA San Diego, Acacia Sls./Deanco ... 619-565-4365
CA San Diego, Future Elctrns. ... 619-278-5020
CA San Diego, Sterling Elctrns. ... 619-271-6555
CA San Diego, Time Elctrns. ... 619-586-1331
CA San Jose, Future Elctrns. ... 408-434-1122
CA San Jose, Future Elctrns. ... 408-434-1114
CA San Jose, Passive Technlg. ... 408-435-5566
CA Sunnyvale, Capsco Sls., Inc. ... 408-734-3020
CA Sunnyvale, Time Elctrns. ... 408-734-9888
CA Torrance, Time Elctrns. ... 213-320-0880
CA Tustin, Sterling Elctrns. ... 714-259-0900
CA Tustin, Time Elctrns. ... 714-669-0100
CO Denver, Newark Elctrns. ... 303-757-3351
CO Englewood, Sterling Elctrns. ... 303-792-3939
CO Englewood, Time Elctrns. ... 303-799-8851
CO Lakewood, Acacia Sls./Deanco ... 303-232-2882
CO Westminister, Future Elctrns. ... 303-421-0123
CT Bethel, Future Elctrns. ... 203-743-9594
CT Milford, Milgray Elctrns. ... 203-878-5538
CT Wallingford, Cronin Elctrns. ... 203-265-3134
CT Wallingford, Sterling Elctrns. ... 203-265-9535
FL Altamonte Springs, Future Elctrns. ... 407-767-8414
FL Clear Water, Future Elctrns. ... 813-578-2770
FL Orlando, Time Elctrns. ... 407-841-6565
FL Winter Park, Milgray Elctrns. ... 407-647-5747
GA Augusta, Dixie Elctrns. ... 404-722-2055
GA Concord, Dixie Elctrns. ... 404-495-5916
GA Norcross, Future Elctrns. ... 404-441-7676
GA Norcross, Milgray Elctrns. ... 404-446-9777
GA Norcross, Time Elctrns. ... 404-448-4448
IL Arlington Hgts., Milgray Elctrns. ... 708-253-1212
IL Bensenville, Goold Elctrns. Corp. ... 708-860-7171
IL Chicago, Newark Elctrns. ... 312-784-5100
IL Rosemont, Advent Elctrns., Inc. ... 708-297-6200
IL Schaumburg, Future Elctrns. ... 708-882-1255
IL Schaumburg, Time Elctrns. ... 708-303-3000
IN Indianapolis, Advent Elctrns., Inc. ... 317-872-4910
IA Cedar Rapids, Advent Elctrns., Inc. ... 319-363-0221
KS Lenexa, Sterling Elctrns. ... 913-492-5406
KS Overland Park, Milgray Elctrns. ... 913-236-8800
MD Baltimore, Resco(Baltimore) ... 301-981-8200
MD Beltsville, Resco(Washington) ... 301-937-9100
MD Columbia, Future Elctrns. ... 301-290-0600
MD Columbia, Milgray Elctrns. ... 301-621-8169
MD Columbia, Sterling Elctrns. ... 301-290-3800
MD Columbia, Time Elctrns. ... 301-964-3090
MA Hopkinton, Interface Elctrns. Corp. ... 508-435-6858
MA Needham, Cronin Elctrns. ... 617-449-5000
MA Peabody, Time Elctrns. ... 508-532-9900
MA Westborough, Future Elctrns. ... 508-366-2400
MA Wilmington, Milgray Elctrns. ... 508-657-5900
MA Woburn, Sterling Elctrns. ... 617-938-6200
MI Farmington Hills, Advent Elctrns., Inc. ... 313-477-1650
MI Livonia, Future Elctrns. ... 313-261-5270
MI Oak Park, Newark Elctrns. ... 313-967-0600
MN Eden Prairie, Future Elctrns. ... 612-944-2200
MN Edina, Time Elctrns. ... 612-835-1250
MN Minneapolis, Aero Space Computer Supp. ... 612-884-4725
MN Minneapolis, Newark Elctrns. ... 612-331-6350
MN Minneapolis, Sterling Elctrns. ... 612-831-2666
MO St. Louis, Future Elctrns. ... 314-469-6805
MO St. Louis, Time Elctrns. ... 314-391-6444
NH Manchester, Cronin Elctrns. ... 603-624-0105
NJ Edison, Sterling Elctrns. ... 908-417-1000
NJ Maritan, Time Elctrns. ... 609-596-6700
NJ Mariton, Milgray Elctrns. ... 609-983-5010
NJ Mt. Laurel, Future Elctrns. ... 609-778-7600
NJ Parsippany, Future Elctrns. ... 201-299-0400
NJ Parsippany, Milgray Elctrns. ... 201-335-1766
NJ Pine Brook, Time Elctrns. ... 201-882-4611
NJ Rockaway, Tonar Inds. ... 201-586-9000
NM Albuquerque, Sterling Elctrns. ... 505-884-1900
NY E. Syracuse, Time Elctrns. ... 315-432-0355
NY Farmingdale, Milgray Elctrns. ... 516-420-9800
NY Hauppauge, Future Elctrns. ... 516-234-4000
NY Hauppauge, Time Elctrns. ... 516-273-0100
NY Liverpool, Future Elctrns. ... 315-451-2371
NY Rochester, Future Elctrns. ... 716-272-1120
NC Charlotte, Dixie Elctrns. ... 704-377-4338
NC Charlotte, Elctrn. Mktg. Corp. ... 704-394-6195
NC Charlotte, Time Elctrns. ... 704-522-7600
NC Oxford, Time Elctrns. ... 919-693-5166
NC Raleigh, Future Elctrns. ... 919-790-7111
NC Raleigh, Milgray Elctrns. ... 800-562-3118, 919-790-8094
OH Cleveland, Milgray Elctrns. ... 216-447-1520
OH Columbus, Elctrn. Mktg. Corp. ... 614-299-4161
OH Dublin, Time Elctrns. ... 614-761-1100
OH Highland Hgts., Elctrn. Mktg. Corp. ... 216-442-3441
OH Kettering, Elctrn. Mktg. Corp. ... 513-439-4711
OH Valleyview, Newark Elctrns. ... 216-447-8860
OK Tulsa, Sterling Elctrns. ... 918-663-2410
OR Beaverton, Acacia Sls./Deanco ... 503-646-3377
OR Beaverton, Future Elctrns. ... 503-645-9454
OR Portland, Time Elctrns. ... 503-684-3780
OR Tualatin, Moore Elctrns. ... 503-692-5333
PA Malvern, Interface Elctrns. ... 215-889-2060
SC Columbia, Dixie Elctrns. ... 803-779-5332
SC Greenville, Dixie Elctrns. ... 803-297-1430
SC N. Charleston, Dixie Elctrns. ... 803-552-2671
TN Gray, Dixie Elctrns. ... 615-477-2131
TN Oak Ridge, Dixie Elctrns. ... 615-481-3393
TX Austin, Sterling Elctrns. ... 512-836-1341
TX Austin, Time Elctrns. ... 512-339-3051
TX Carrollton, Sterling Elctrns. ... 214-243-1600
TX Dallas, Milgray Elctrns. ... 214-248-1603
TX Garland, Newark Elctrns. ... 214-487-8144
TX Houston, Newark Elctrns. ... 713-270-4800
TX Houston, Sterling Elctrns. ... 713-623-6600
TX Irving, Harper Sid ... 214-621-0500
TX Richardson, Future Elctrns. ... 214-437-2437
TX Richardson, Time Elctrns. ... 214-644-4644
UT Salt Lake City, Future Elctrns. ... 801-972-8489
UT Salt Lake City, Milgray Elctrns. ... 801-272-4999
UT Salt Lake City, Sterling Elctrns. ... 801-972-5444
UT Salt Lake City, Time Elctrns. ... 801-973-8181
VA Richmond, Sterling Elctrns. ... 804-226-2190
WA Redmond, Acacia/Deanco ... 206-881-5566
WA Redmond, Future Elctrns. ... 206-881-8199
WA Redmond, Time Elctrns. ... 206-882-1600
WI Mequon, Taylor Elec. Co., Inc. ... 414-241-4321
WI Yaukesha, Future Elctrns. ... 414-786-1884
Can Alberta, AB Calgary, Zentronics ... 403-295-8838
Can Downsview, Ont., Future Elctrns. ... 416-638-4771
Can Edmonton, AB, Zentronics ... 403-484-1669
Can Manitoba-Winnipeg, MB, Zentronics ... 204-694-1957
Can Mississauga, Ont., Time Elctrns. ... 416-672-5300
Can Mississauga, Ont., Zentronics ... 416-564-9600
Can Montreal,PA, Future Elctrns. ... 514-694-7710
Can Nepean, Ont., Carsten ... 613-726-9250
Can Nepean, Ont., Zentronics ... 613-226-8840
Can Ottawa, Ont., Future Elctrns. ... 613-820-8313
Can Scarborough, Ont., Carsten ... 416-495-9999
Can St. Foy, Que., Zentronics ... 418-654-1077
Can St. Laurent, Zentronics ... 514-737-9700
Can St. Laurent, PQ, Carsten ... 514-334-8321
Can St. Laurent, PQ, Toner Industries ... 514-286-4061
Can Vancouver, BC, Future Elctrns. ... 604-294-1166
Can Vancouver, BC, Zentronics ... 604-273-5575
Can Willowdale, Ont., Milgray Elctrns./Toronto ... 416-756-4481

MURATA MANUFACTURING CO., LTD., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan 617, Tel: 075-951-9111, TELEX: J64270, FAX: 075-955-6526; Empl.: 21,561; *Sls. Mgr.:* O. Otaka

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FAX: 603-666-4013

THE MUSHIELD CO. INC., P.O. Box 439, 5 Springfield Rd., Goffstown, NH 03045, Tel: 603-666-4433, TELEX: 95-5439; FSC No.: 57284; Empl.: 8 ... **C•1700**

MUTUAL INDUSTRIES, INC., 707 West Grange Street, Philadelphia, PA 19120, Tel: 215-927-6000, FAX: 215-927-3388

MWS Wire Industries

FAX: 818-706-0911

MWS WIRE INDUSTRIES, 31200 Cedar Valley Dr., Westlake Village, CA 91362, Tel: 818-991-8553; FSC No.: 51668; Empl.: 65; *Sls. Mgr.:* Greg Fancon ... **C•1772-1775**

H. WM. MYERS & ASSOCS., 361 Virginia St., Crystal Lake, IL 60014, Tel: 815-459-0100; Empl.: 5; *Sls. Mgr.:* L. Peter Baenziger

NAMCO CONTROLS, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060, Tel: 216-946-9900, TELEX: 24-1566, FAX: 216-946-1228; Empl.: 200; *Sls. Mgr.:* Jon Slayburgh, Pres., Gen. Mgr.

NAMIKI, Precision of America, Inc., 201 West Passaic St., Rochelle Park, NJ 07662, Tel: 201-368-0123, FAX: 201-368-2244; FSC No.: 201-343-3172

NANO PULSE INDUSTRIES, 440 Nibus St., Brea, CA 92670, Tel: 714-529-2600, FAX: 714-671-7919; FSC No.: 57222; Empl.: 250; *Sls. Mgr.:* Michael J. Schubert

NATEL

FAX: 805-584-4357

NATEL ENGINEERING CO., INC., 4550 Runway St., Simi Valley, CA 93063-3449, Tel: 805-581-3950, TWX: 910-494-1959; Empl.: 170; *Sls. Mgr.:* Tom Guerriere ... **D•1186-1187**

Local Sales Offices & Reps

AL Huntsville, Saber Assocs. ... 800-327-0853
CA Solana Bch., Cerco ... 619-792-5555
CO Parker, Howard Assocs. ... 303-841-5755
IL Itasco, Beta Technlg. Sls., Inc. ... 708-250-9586
IA Cedar Rapids, Midwest Tech. Sls., Inc. ... 319-393-5115
KS Goddard, Midwest Tech. Sls., Inc. ... 316-794-8565
KS Lenexa, Midwest Tech. Sls., Inc. ... 913-888-5100
MD Eldersburg, Natel Engrg. Co., Inc. ... 301-795-1115
MA Topsfield, Natel Engrg. Co., Inc. ... 508-887-7939
MO Earth City, Midwest Tech. Sls., Inc. ... 314-298-8787
NY Bohemia, Natel Engrg. Co., Inc. ... 516-563-4911

OH Dayton, Rixan Assocs., Inc. 513-222-0011
OH Stow, Rixan Assocs., Inc. 216-686-2909
TX Houston, Lear Assocs. 713-488-7893
TX Richardson, Lear Assocs. 214-231-5388
WA Mercer Island, Eagle Entprs., Inc. 206-232-7401
WI Milwaukee, Beta Technlg. Sls., Inc. 414-543-6609

NATIONAL ELECTRONICS CORP., 11731 Markon Dr., Garden Grove, CA 92641, Tel: 714-892-7749, 800-854-2451, FAX: 714-898-6769; Empl.: 50

NATIONAL CONTROLS CORP., 1725 Western Dr., W. Chicago, IL 60185, Tel: 312-231-5900, FAX: 312-231-1377; Empl.: 250; *Dist. Mgr.:* Cy Pfeifer

NATIONAL INFORMATION SYSTEMS, INC., 4040 Moorpark Ave., San Jose, CA 95117-1852, Tel: 408-985-7100, 800-441-5758, FAX: 408-246-3127; Empl.: 50

NATIONAL INSTRUMENTS®
The Software is the Instrument™

FAX: 512-794-8411

NATIONAL INSTRUMENTS CORP., 6504 Bridge Point Pkwy., Austin, TX 78730-5039, Tel: 512-794-0100, TELEX: 756737 Nat Inst Aus; Empl.: 3000; *Sls. Mgr.:* Melodie Summersett, Natl. Sls. Mgr. ..... **D•1124, 1188-1189, 1296-1297**

Local Sales Offices & Reps

CA Milpitas, Natl. Instrs. 408-453-3120
CO Colorado Springs, Natl. Instrs. 719-542-2815
GA Marietta, Natl. Instrs. 404-499-0505
IL Oak Brook, Natl. Instrs. 708-574-0050
MA Boston, Natl. Instrs. 617-938-8508
MA Norwell, Natl. Instrs. 617-659-9444
MN Shoreview, Natl. Instrs. 612-482-9930
NJ Rutherford, Natl. Instrs. 201-460-7883
NY Levittown, Natl. Instrs. 516-822-3074
OH Mogadore, Natl. Instrs. 216-325-3156
TX Richardson, Natl. Instrs. 214-699-7474
VA Herndon, Natl. Instrs. 703-709-9874

Local Distributors

CA Riverside, Innovation Products., Inc. ... 714-682-8506
WA Woodenville, Team, Inc. 206-485-1111
Can Mississauga, Ont., Allan Crawford Assocs. 416-890-2010

NATIONAL LAMINATION CO., National Material Ltd., 555 Santa Rosa Dr., Des Plaines, IL 60018, Tel: 708-298-7676, FAX: 708-635-8624; Empl.: 210

NATIONAL MANUFACTURING CO., INC., 12 River Rd., Chatham, NJ 07928, Tel: 201-635-8846, FAX: 201-635-7810; Empl.: 150; *Sls. Mgr.:* Otto Stahl, Jr.

NATIONAL MICRONETICS, 71 Smith Ave., Kingston, NY 12401, Tel: 914-338-0333, TWX: 510-247-8046, FAX: 914-338-0377; Empl.: 700; *Sls. Mgr.:* Richard Carlton

NATIONAL POWER TECHNLG., See Intelligence Power Technology

NATIONAL SEMICONDUCTOR, 2900 Semiconductor Dr., Santa Clara, CA 95052, Tel: 408-721-2641, FAX: 408-245-9655; Empl.: 30,000

NATIONAL SEMICONDUCTORS, LTD., See Silonex Inc.

NATIONAL-STANDARD CO., 1618 Terminal Rd., Niles, MI 49120, Tel: 616-683-8100, TELEX: 295187, FAX: 616-683-6249; Empl.: 2800; *Sls. Mgr.:* A. Osos; *Dist. Mgr.:* D. M. Wedsworth

NATIONAL TELEPHONE & ELECTRONICS INC., 2350 N.W. 96 Avenue, Miami, FL 33172, Tel: 305-592-0551, FAX: 305-599-0948; Empl.: 50

FAX: 213-225-4630

NATIONAL WIRE & CABLE CORP., 136 San Fernando Rd., Los Angeles, CA 90031-1780, Tel: 213-225-5611, TELEX: 181409, TWX: 910-321-4155; FSC No.: 04569; Empl.: 225 ..... **C•1704, 1776-1797**

Local Sales Offices & Reps

AZ Mesa, System Sls. 602-464-9989
AR Cotter, P.M.I. Sls. Co. 501-430-5525
CA San Diego, C.K. Sales 619-279-0420
CA Santa Clara, Ross Mktg. 408-988-8111
CO Arvada, Arrowhead/CSI Sls. 303-423-5597
FL Altamonte Springs, Gugel Assocs. 407-788-0845
GA Lawrenceville, Tek-Rep Mktg. 404-963-1600
HI Hilo, Kirco Corp. 808-959-3888
IL Northfield, H. S. Tollaksen 708-441-6644
MD Glen Burnie, Faion Lott 301-744-4611
MA Norwood, Tom Maguire Assocs., Inc. .. 617-551-0500
MI Farmington Hills, Luebbe Sls. 313-489-8828
MN Minnetonka, Producton Automation ... 612-935-1414
MO St. Louis, P.M.I. Sls. Co. 314-963-0001
NJ Wayne, GT Assoc. 201-694-6040
NY Sodus, S.W. Woolard 315-655-8145
OH Cincinnati, Luebbe Sls. 513-530-0600
OH Dayton, Luebbe Sls. 513-294-0426
OH Westlake, Luebbe Sls. 216-899-0071
PA Hatboro, Jacobsen Assocs. 215-674-2937
PA Pittsburgh, Luebbe Sls. Co. 412-364-0490
TX Ft. Worth, Tesco, Inc. 214-553-1200
WA Redmond, Halbar Assocs. 206-882-0990

NATIONWIDE ELECTRONIC SYSTEMS, See Weschler/NES Instruments

NAUGLER ENGINEERING, INC., Off Dunham Rd., Beverly, MA 01915, Tel: 617-922-5634, FAX: 617-468-1272; FSC No.: 05222; Empl.: 10; *Sls. Mgr.:* Kristen N. Bonnette

NAVAN CORPORATION, 20 West Front Street, Media, PA 19063, Tel: 215-543-8066, FAX: 215-543-2151; FSC No.: 6695; Empl.: 6; *Sls. Mgr.:* Howland St. Clair

NAZ-DAR/K.C., Thrall Enterprises, 1087 N. Branch St., Chicago, IL 60622, Tel: 312-943-8338, FAX: 312-943-8215; Empl.: 53; *Sls. Mgr.:* Kent Schnese; *Dist. Mgr.:* Kent Schnese

NCE:NATIONAL CUSTOM ENTERPRISES, INC., 400 Gateway Blvd., Burnsville, MN 55337-2559, Tel: 612-890-1360, FAX: 612-890-1014; FSC No.: 1FS75; Empl.: 25; *Sls. Mgr.:* J. A. Carlson

NCGI/STRUTHERS-DUNN, INC., INDUSTRIAL/COMMERICAL RELAYS, See MSD, Div. of Magnecraft

NCI, 6438 University Drive, Huntsville, AL 35806, Tel: 205-837-6667, FAX: 205-837-5221; Empl.: 8; *Sls. Mgr.:* Hal Newcomb; *Dist. Mgr.:* David Newcomb

NCR COMTEN, INC., NCR Corp., 2700 Snelling Avenue N., St. Paul, MN 55113, Tel: 612-638-7777, TELEX: 6879018 Comten, FAX: 612-638-8573; FSC No.: 7025-0010; Empl.: 1000; *Sls. Mgr.:* Gerry Fisher; *Dist. Mgr.:* Gerry Fisher

NCR POWER SYSTEMS, 3200 Lake Emma Rd., Lake Mary, FL 32746, Tel: 407-323-9250, FAX: 407-333-8312; Empl.: 156; *Sls. Mgr.:* Rick Ullinger

NDK

FAX: 415-623-6590

NDK AMERICA, INC., 47671 Westinghouse Dr., Fremont, CA 94539, Tel: 415-623-6500; Empl.: 28; *Sls. Mgr.:* Mike Kurihara, VP ..... **A•1416-1423**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Mktg. Assoc. 205-880-8050
AZ Scottsdale, Carefree 602-951-9121
TX Dallas, SW Tech. 214-369-0977
CA Irvine, Quad-Rep South, Inc. 714-727-4222
CA Orangevalle, I Square, Inc. 916-989-0843
CA San Diego, Quad-Rep. 619-560-8330
CA Santa Clara, I Square, Inc. 408-988-3400
CO Englewood, CSI 303-779-8060
CT Woodbury, Anacon 203-266-0707
DE Medford, Jack McCoy 609-953-0770
GA Atlanta, Elctrn. Mktg. Assoc. 404-448-1215
ID Boise, Intermountain Tech. 208-888-6071
IL Chicago, M. Gottlieb & Assocs. 312-775-1151
IN Carmel, Fred A. Dorsey & Assocs. 317-844-4842
IA Davenport, Rush & West Assocs. 319-388-9494
KS Olathe, Rush & West Assocs. 913-764-2700
MD Annapolis, E.E.S Assoc. 301-269-4234
MA Burlington, Anacon Sls. Assocs., Inc. .. 617-272-9080
MI Grand Rapids, Miltimore Sls. 616-942-9721
MI Novi, Miltimore Sls. 313-349-0260
MO St. Louis, Rush & West Assocs. 314-965-3322
MT Boise, Inter-Mtn. Tech. 208-888-6071
NE Davenport, Rush & West 319-388-9494
NV Santa Clara, I Squared 408-988-3400
NY Syracuse, Rep Tech., Inc. 315-437-2845
NJ Fairfield, Tech. Applications & Mktg. ... 201-575-4130
NJ Medford, Jack McCoy, Inc. 609-953-0770
NM Albuquerque, Nelco Elctrns. 503-293-1399
NY Fairfield, TAM 201-575-4130
NC Raleigh, Elctrn. Mktg. Assoc. 919-847-8800
OH Cincinnati, Makin Assocs. 513-871-2424
OH Columbus, Makin Assocs. 614-848-5424
OH Solon, Makin Assocs. 216-248-7370
OR Tigard, Comps. West 503-684-1671
PA Medford, Jack McCoy, Inc. 609-953-0770
PA Solon, Makin Assocs. 216-248-7370
SC Greenville, Elctrn. Mktg. Assoc. 803-233-4637
TX Austin, Southwestern Tech. Sls. 512-440-0499
TX Dallas, Southwestern Tech. Sls. 214-369-0977
TX Houston, Southwestern Tech. Sls. 713-440-9200
UT Boise, Inter-Mtn Tech. 208-888-6071
VT Wilmington, Anacon 617-270-3712
WA Redmond, Comps. West 206-885-5880
WI Chicago, M. Gottlieb Assocs. 312-775-1151

Local Distributors

AL Huntsville, Lex Elec. 205-895-0480
AL Huntsville, Time Elctrns. 214-721-1134
AZ Tempe, Lex Elec. 602-431-0030
AZ Tempe, Time Elctrns. 602-967-2000
CA Calabassas, Lex Elec. 818-880-9686
CA Chatsworth, Time Elctrns. 818-988-7200
CA Irvine, Lex Elec. 714-987-0404
CA San Diego, Time Elctrns. 619-986-0129
CA San Jose, Lex Elec. 408-432-7171
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CO Englewood, Lex Elec. 303-799-0258
CO Englewood, Time Elctrns. 303-721-8882
CT Danbury, Lex Elec. 203-264-4700
FL Deerfield, Lex Elec. 305-977-7511
FL Ft. Lauderdale, Time Elctrns. 305-484-7778
GA Norcross, Lex Elec. 404-449-9170
GA Norcross, Time Elctrns. 404-448-4488
IL Schaumburg, Lex Elec. 708-330-2888
IL Wood Dale, Time Elctrns. 312-350-0610
KS Overland Pk., Lex Elec. 913-492-2922
MD Columbia, Lex Elec. 301-996-7800
MD Columbia, Time Elctrns. 301-964-3090
MA Peabody, Time Elctrns. 508-532-9900
MA Wilmington, Lex Elec. 508-694-0962
MI Livonia, Lex Elec. 313-525-8100
MN Eden Prairie, Lex Elec. 612-941-5280
MN Edina, Time Elctrns. 612-943-2433
MO Manchester, Lex Elec. 314-391-6444
MO St. Louis, Time Elctrns. 314-391-6444
NH Manchester, Lex Elec. 603-625-2250
NJ Marlton, Time Elctrns. 609-996-6700
NJ Pinebrook, Lex Elec. 201-227-7880
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Hauppauge, Lex Elec. 516-231-2900
NY Hauppauge, Time Elctrns. 516-434-3344
NY Rochester, Lex Elec. 716-424-2222
NY Westbury, Lex Elec. 516-876-4000
NC Raleigh, Lex Elec. 919-876-0000
NC Raleigh, Time Elctrns. 919-847-9650
OH Beachwood, Lex Elec. 216-464-2970
OH Columbus, Time Elctrns. 614-794-3309
OH Dayton, Lex Elec. 513-439-1800
OK Tulsa, Lex Elec. 918-622-8000
OR Portland, Time Elctrns. 503-684-3782
PA Pittsburgh, Lex Elec. 412-963-6804
TX Austin, Lex Elec. 512-339-3051
TX Austin, Time Elctrns. 512-346-7346
TX Dallas, Lex Elec. 214-247-6300
TX Houston, Lex Elec. 713-784-3600
UT West Valley City, Time Elctrns. 801-973-8494
WA Kirkland, Time Elctrns. 206-820-1525
WI New Berlin, Lex Elec. 414-784-9451
Can Ontario, Time Elctrns. 416-672-5300

NEC

FAX: 415-965-6272

NEC ELECTRONICS, INC., 401 Ellis Street, P.O. Box 7241, Mountain View, CA 94039, Tel: 415-960-6000, TWX: 910-379-6985; Empl.: 1200; *Sls. Mgr.:* Mike Despotes, Sls. V.P.; *Dist. Mgr.:* Michael Kelly ..... **A•1115-1119; B•1100-1102, 1324-1332, 1558-1564**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999
AZ	Phoenix, Oasis Sls., Inc.	602-277-2714
CA	Cardiff, Mission Technlg.	619-753-5092
CA	Mtn. View, NEC Elctrns.	415-965-6000
CA	San Jose, Exis	408-456-1650
CA	Santa Ana, NEC Elctrns.	714-546-0501
CO	Aurora, NEC Elctrns.	303-755-6353
CO	Boulder, Promotional Technlg.	303-447-2474
CO	Parker, Promotional Technlg.	303-841-4664
CT	Cheshire, Datatrack Engrg., Inc.	203-271-1311
FL	Altamonte Springs, V.G. Sls., Inc.	407-831-8688
FL	Ft. Lauderdale, V.G. Sls. Inc.	305-938-4333
FL	Largo, V.G. Sls. Co., Inc.	813-536-7787
FL	Maitland, NEC Elctrns.	407-875-1145
GA	Norcross, NEC Elctrns.	404-447-4409
GA	Norcross, 20th Century Mktg. Inc.	404-446-1999
IL	Arlington Hgts., NEC Elctrns.	312-577-9090
IL	Schaumburg, Martan Inc.	312-303-5660
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IA	Cedar Rapids, Stan Clothier Co.	319-393-1576
KS	Overland Pk., AME Sls.	913-492-3971
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Glen Burnie, TRI-MARK Inc.	301-761-6000
MA	Natick, NEC Elctrns.	508-650-4100
MA	Woburn, Compass Technlg.	617-933-3336
MI	Grand Rapids, Miltimore Sls.	616-942-9721
MI	Novi, Miltimore Sls.	313-349-0260
MI	Troy, NEC Elctrns.	313-680-0506
MN	Bloomington, NEC Elctrns.	612-854-4443
MN	Minneapolis, Stan Clothier Co.	612-944-3456
MO	St. Charles, AME Sls.	314-928-2599
NJ	Bellmawr, TAI Corp.	609-778-5353
NJ	Saddle Brook, Metro Logic Corp.	201-575-5585
NY	Fishkill, NEC Elctrns.	914-897-2101
NY	Melville, NEC Elctrns.	516-753-7526
NY	Pittsford, Elcom Sls.	716-385-1400
NY	Skaneateles, Elcom Sls.	315-685-8245
NC	Charlotte, Quantum Mktg. Inc.	704-523-8822
NC	Durham, NEC Elctrns.	919-544-4132
NC	Raleigh, Quantum Mktg. Inc.	919-846-5728
OH	Columbus, NEC Elctrns.	614-436-1778
OH	Pepper Pike, NEC Elctrns.	216-831-0067
OR	Portland, Venture Elctrns.	503-624-0617
OR	Tigard, NEC Elctrns.	503-671-0177
PA	Allentown, NEC Elctrns.	215-391-9094
TX	Austin, TL Mktg., Inc.	512-837-7272
TX	Dallas, NEC Elctrns.	214-931-0641
TX	Dallas, TL Mktg., Inc.	214-484-6800
TX	Houston, NEC Elctrns.	713-955-2191
TX	Houston, TL Mktg., Inc.	713-589-2763
UT	Midvale, Promotional Technlg. Corp.	801-566-8919
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Mequon, Martan Inc.	414-241-4955
PR	Mayaguez, V. G. Sls. Co., Inc.	809-831-4150
Can	Concord, Ont., Kaytronics	416-669-2262
Can	Kanata, Ont., Kaytronics	613-592-6606
Can	Surrey, BC, Kaytronics Western	604-294-2000
Can	Ville St.-Laurent, Que., Kaytronics	514-745-5800

NEARFIELD SYSTEMS, INC., 1330 E. 223rd St. 524, Carson, CA 90745, Tel: 213-518-4277, FAX: 213-518-4279; Empl.: 6

NECOA, INC., Nittoku Engineering Group, 9321A Philadelphia Rd., Baltimore, MD 21237, Tel: 301-574-4960, FAX: 301-574-7083; *Sls. Mgr.:* Larry Whyte

NEC TECHNOLOGIES, INC., 1414 Massachusetts Ave., Boxborough, MA 01719, Tel: 508-264-8000, TELEX: 910-997-0594; Empl.: 2700; *Sls. Mgr.:* Richard Gilbert/Jim Gregg

NEDAP N.V., P.O. Box 6, Groenlo, Holland 7140 AA, Tel: ò31-5440-71111, TELEX: 44253, FAX: ò31.5440.62745; Empl.: 420; *Sls. Mgr.:* W. Bonnemeier

NEDCO ELECTRONICS, INC., 8246 LeHigh, Morton Grove, IL 60053, Tel: 312-967-0500, FAX: 312-967-0505; Empl.: 10

NEEDHAM'S ELECTRONICS, 4539 Orange Grove Ave., Sacto, CA 95841, Tel: 916-924-8037, FAX: 916-972-9960; Empl.: 5

NEFF INSTR., 700 S. Myrtle Ave., Monrovia, CA 91016, Tel: 818-357-2281, TWX: 910-585-1833, FAX: 818-303-2286; Empl.: 125; *Sls. Mgr.:* Louis P. Lang

NEL FREQUENCY CONTROLS, INC., 357 Beloit St., Burlington, WI 53105, Tel: 414-763-3591, FAX: 414-763-2881; FSC No.: 00815; Empl.: 160; *Sls. Mgr.:* Dick Griebel, VP Sls. & Mktg.; *Dist. Mgr.:* Boyd Recknagel ... **A•1425**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999
FL	Valrico, Richmar Elctrns.	813-654-8032
CA	Burlingame, Wm. J. Purdy Co.	415-347-7701
CA	Westlake Vlg., Elkin & Assoc.	818-597-1075
CO	Parker, A5 Co.	303-841-3651
FL	Orlando, Richmar Elctrns.	407-352-3755
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Downers Grove, Richmar Elctrns.	708-968-0118
IN	Indianapolis, Richmar Elctrns.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
MI	Adrian, Elctrn. Salesmasters	517-263-2500
MI	Wixom, Elctrn. Salesmasters	313-669-0015
NH	Nashua, Bell Controls	603-882-6984
NY	Glen Cove, DynoRep	516-676-1598
NJ	Medford, Champion Elctrn. Sls. Assoc.	609-983-0932
NJ	Somerville, DynoRep	201-874-4670
NY	Attica, PSR Co.	716-591-1219
NY	Auburn, PSR Co.	315-253-4109
NY	Endicott, PSR Co.	607-754-7846
NY	Port Jefferson Sta., DynoRep	516-928-5135
NC	Raleigh, 20th Century Mktg.	919-790-9383
OH	Beechwood, Elctrn. Salesmasters	216-831-9555
OR	Tigard, RTS, Inc.	503-244-4123
TX	Plano, Richmar Elctrns.	214-424-8388
TX	Round Rock, Richmar Elctrns.	512-255-2551
WA	Edmonds, RTS Inc.	206-745-5445
WA	Vashon, RTS, Inc.	206-285-1363
WI	Butler, Richmar Elctrns.	414-781-1730
EXP	San Juan, Puerto Rico, Elctrn. Tech. Sls.	809-798-1300

Local Distributors

AZ	Tempe, Time Elctrns.	602-967-2000
CA	Chatsworth, Time Elctrns.	818-998-7200
MA	Auburn, Dove Elctrns.	508-832-2730
CA	Canoga Pk., Tim-Co Sls.	818-992-5040
CA	Irvine, Integrated Elctrns.	714-837-9960
NH	Manchester, Glynn Elctrns.	603-622-8131
CA	Milpitas, Sierra West	408-945-1050
MN	New Brighton, Chris Elctrns.	800-356-6599
CA	Sacramento, Integrated Elctrns.	916-363-6030
CA	San Jose, All American	408-943-1200
CA	San Jose, Integrated Elctrns.	408-435-1000
CA	Sunnyvale, Target	408-733-0384
CA	Torrance, All American	800-669-8300
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Time Elctrns.	714-669-0100
CA	Van Nuys, C. W. Swift	818-989-1133
CA	Westlake Village, Sertek	818-707-2872
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Yalesville, Glynn	203-265-2498
FL	Miami, All American	305-621-8282
FL	Sunrise, All American	800-327-6237
IL	Hoffman Estates, Integrated Elctrns.	708-843-2040
IL	Lisle, Components Inc.	312-852-7707
IL	Northbrook, Classic Comps.	708-272-9650
IL	Rosemont, Advent	800-323-1270
IN	Indianapolis, Advent	317-872-4910
IA	Cedar Rapids, Advent	319-363-0221
MD	Jessup, Treeko Elctrns.	301-792-0112
MD	Rockville, All American	800-426-0420
MA	Billerica, Mayer Elctrns.	617-229-2255
MA	Middleboro, Glynn Elctrns.	800-225-8684
MA	Wakefield, All American	800-874-2834
MI	Farmington Hills, Advent	313-477-1650
MN	Eden Prairie, All American	612-944-2151
MN	Minneapolis, Bergquist	612-835-2322
NJ	Hopelawn, Dove Elctrns.	908-324-7830
NY	Buffalo, Genesee Indl.	716-873-9661
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Ronkonkoma, All American	800-874-2830
NY	Stony Brook, Dove Elctrns.	516-689-7733
OH	Englewood, Argent	513-836-8633
OH	Solon, Repco Elctrns.	216-248-8900
OK	Tulsa, Altair	918-252-5781
OR	Beaverton, Integrated Elctrns.	503-641-1690
TX	Austin, Altair Co.	512-837-4970
TX	Dallas, Off The Shelf	214-247-0052
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, All American	800-541-1435
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Off The Shelf	214-238-0808
UT	Salt Lake City, Integrated Elctrns.	801-977-9750
WA	Bellevue, Integrated Elctrns.	206-455-2727
WI	Mequon, Taylor Elec.	800-242-8914
WI	New Berlin, Classic Comps.	800-242-7408
Can	Calgary, Alberta, Memco	403-258-3399
Can	Surrey, B.C., Memco	604-590-1553

NEMETH ENGINEERING ASSOCIATES, INC., 5901 West Highway 22, Crestwood, KY 40014, Tel: 502-241-1502, FAX: 502-241-5907; Empl.: 36

NEPENTHE, INC., 2479 E. Bayshore Rd. 800, Palo Alto, CA 94303, Tel: 415-496-6666, FAX: 415-856-8650; FSC No.: 415.856 8650; Empl.: 50; *Sls. Mgr.:* Kirk Feyerabend

NESCO BATTERY SYSTEMS, National Electro-Sales Corp., 7110 Gerald Ave., Van Nuys, CA 91406-7840, Tel: 818-781-0505, 1-800-423-2664, FAX: 818-786-2758

NESHAMINY TRANSFORMER CORP., Edison-Furlong Road, Furlong, PA 18925, Tel: 215-794-7411, FAX: 215-794-3894; Empl.: 70; *Sls. Mgr.:* Tom Linton

NES, INC.(NATIONWIDE ELECTRONIC SYSTEMS), See Weschler Instruments

N.E.S., INC., 502 Union St., Box 29, W. Springfield, MA 01090, Tel: 413-734-6491; FSC No.: 3439; Empl.: 10; *Sls. Mgr.:* Sandy Saffer

NETCOM, INC, 3000 Commerical Ave.,P.O.Box 3025, Northbrook, IL 60065-3025, Tel: 708-564-5100, FAX: 708-564-2279; FSC No.: 57193; Empl.: 105; *Sls. Mgr.:* Wayne Roeder

NETWORKS INTERNATIONAL CORPORATION, 13924 W. 108th St., Lenexa, KS 66215, Tel: 913-469-6494, FAX: 913-469-6495; Empl.: 20; *Sls. Mgr.:* Abhay Bisarya; *Dist. Mgr.:* Abhay Bisarya

NETWORK SOFTWARE ASSOCIATES, INC., 39 Argonaut, Laguna Hills, CA 92656, Tel: 714-768-4013, FAX: 714-768-5049; Empl.: 50; *Sls. Mgr.:* Raymond Chan; *Dist. Mgr.:* Raymond Chan

NETWORK TECHNOLOGIES INC., 7322 Pettibone Rd., Chagrin Falls, OH 44022, Tel: 216-543-1646, FAX: 216-543-5423

NEURAL SYSTEMS INC., 2827 West 43rd Ave., Vancouver, BC, Canada V6N 3H9, Tel: 604-263-3667, FAX: 604-263-3667; Empl.: 2; *Sls. Mgr.:* Gary Josin

NEURON ELECTRONICS, INC., 3914 Del Amo Blvd., Ste. 902, Torrance, CA 90503, Tel: 213-793-1300, 1-800-FON-4-NEI, FAX: 213-793-1304; Empl.: 4; *Sls. Mgr.:* Steve Stone

NEUTRIK PRODUCTS, See Kulka Smith

NEW ENGLAND KEYBOARD INC., 191 Cleghorn St., Fitchburg, MA 01420, Tel: 508-345-8332, FAX: 508-345-4329; Empl.: 16; *Sls. Mgr.:* Mark A. Yates ..... **B•1825**

NEW HAMPSHIRE BALL BEARING, INC., Corp. Hdqtrs & Hitech Div., Rte. 202, Peterborough, NH 03458, Tel: 603-924-3311, FAX: 603-924-6632; Empl.: 1200; *Dist. Mgr.:* Alan Paynter

NEW HAMPSHIRE BALL BEARINGS, INC., 9727 DeSoto Ave., Chatsworth, CA 91311, Tel: 818-407-9300, FAX: 818-407-5020; FSC No.: 50294; Empl.: 245; *Sls. Mgr.:* Paul M. Spencer; *Dist. Mgr.:* Alan H. Paynter

NEWMAN, M. M., CORP., Heli-Tube Div., P.O. Box 615, Marblehead, MA 01945, Tel: 617-631-7100, FAX: 617-631-8887; FSC No.: 09106; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel ..... **C•1798**

NEW MEDIA GRAPHICS CORP., 780 Boston Rd., Billerica, MA 01821, Tel: 508-663-0666, FAX: 508-663-6678; Empl.: 50



FAX: 714-546-3022

NEWPORT ELECTRONICS, 2229 S.Yale St., Santa Ana, CA 92704-4426, Tel: 714-540-4914, 800-NEWPORT, TWX: 910-595-1787; Empl.: 120; *Sls. Mgr.:* Chris Salzer; *Dist. Mgr.:* Chris Salzer ..... **D•1363-1364, 1366**

Local Sales Offices & Reps

AL	Birmingham, Richardson Co.	205-823-2200
CO	Denver, AKI Entprs.	303-388-4488
IA	Davenport, H & H Vega Sls. Assocs.	319-326-5664
KS	Shawnee Mission, H & H Vega Sls.	913-432-6363
MD	Joppa, Electra-Tech	301-877-0344
MI	Livonia, Amtech Reps.	313-474-8300
MN	Eden Prairie, Rockmore Sls. Corp.	612-941-1390
NJ	Parlin, JMR Sls.	201-525-8000
NY	Albany, Expert Indl. Sys.	518-869-3355
NY	Wading River, JMR Sls., Inc.	516-929-5756
NC	Charlotte, SPK Instrmn.	704-535-2345

PA Valley Forge, J. E. Cuesta & Co., Inc. .. 215-935-0400
TN Memphis, Southeastern Marketing 901-794-1230
TX Richardson, ADI Instrs., Inc. 214-680-2222
VA Dumfries, Electra-Tech 703-670-6962

Local Distributors

AL Birmingham, Brownell Instrs. 205-332-3374
AZ Tempe, Metermaster 602-431-0880
AR Little Rock, Brownell Instrs. 501-562-2061
CA Costa Mesa, FLW, Inc 714-751-7512
CA Foster City, Therm-X 415-571-1166
CA Fremont, FLW, Inc. 415-651-6511
CA Hayward, Coast Instr. 415-786-9300
CA Los Angeles, EIL Instrs., Inc. 213-685-7020
CA S. San Francisco, Steven Engrg. 415-588-9200
CA Yorba Linda, Metermaster 714-921-2101
CO Denver, Brownell 303-333-3541
CT Middletown, EIL Instrs., Inc. 203-346-6646
FL Orlando, FLW, Inc. 407-894-9671
GA Atlanta, Inotek/Sesco, Inc. 404-458-6423
GA Atlanta (Hapeville), Brownell Electro .. 404-362-9009
GA Marietta, FLW Southeast 404-424-1731
HI Kailua, FLW, Inc. 808-262-0818
IL Chicago, Data Elctrns. Co. 708-283-0300
IL Countryside, Inotek 708-352-3500
IL Glendale Heights, Crompton Metermaster 708-351-4554
IN Evansville, Electro-Lab Svcs. 812-423-5211
IA Davenport, Interstate Indl. 319-355-5959
KS Kansas City, Process Measurement .. 913-384-2064
KY Louisville, EIL Instrs. 502-454-3420
LA Baton Rouge, SIA, Inc. 504-756-4631
MD Sparks, EIL Instr. 301-771-4800
MA Waltham, Calibron Instrs. 617-894-6440
MI Royal Oak, George Instr. 313-280-1111
MN Minneapolis, Instrmn. Svcs. 612-544-8916
MN Minneapolis, Process Meas. 612-544-4035
MO Kansas City, ISL Corp. 816-587-5400
MO St. Louis, Universal Precision Inst. 314-394-4693
NE Omaha, Interstate Indl. 402-331-3535
NJ Edison, Brownell 201-287-2030
NJ Newfoundland, Hosica Labs. 201-697-6111
NY Buffalo, EIL 716-634-8500
NY Buffalo, KOM Lamb 716-874-3530
NY Hauppauge, Brownell Electro 516-234-8600
NC Charlotte, EIL 704-376-2237
OH Cincinnati, Schlemmer 513-522-8340
OH Cleveland, Pioneer Instr. 216-248-8710
OH Cleveland, Weschler Elec. 216-238-2550
OH Dayton, Pioneer Instr. 513-236-9900
PA Philadelphia, Shelby-Jones 215-446-6600
OK Tulsa, Inotek 918-627-1500
OR Portland, Branom 503-283-2555
OR Portland, Westcon 503-283-0132
PA Philadelphia, Sunshine Scientific 215-673-5600
PA York, Trola Inds. 717-848-3700
SC Columbia, Brownell Instrs. 803-772-6111
TN Knoxville, Brownell 615-966-3441
TX Dallas, EIL Instrs. 214-357-0297
TX Dallas, Inotek 214-243-7000
TX Houston, American Analog 713-941-7265
UT N. Salt Lake, Western Controls 801-292-5900
VA Richmond, Metermetrics 804-275-1431
WA Redmond, EIL Instruments 201-882-3222
WA Seattle, Branom Instrs. 206-762-6050
WI Milwaukee, E-M Instrs. 414-272-7799

NEW WAVE INSTRUMENTS, 128 W 3100 N., Provo, UT 84604, Tel: 801-373-4909, FAX: 801-373-4909; *Sls. Mgr.:* Larry Christensen

THE J. M. NEY COMPANY, Ney Industrial Park, Bloomfield, CT 06002, Tel: 203-242-2281, TELEX: 9-9238, FAX: 203-242-5688; *Sls. Mgr.:* Terrence P. Dunn

NF ELECTRONIC INSTRUMENTS, 3303 Harbor Blvd., Ste.G-14, Costa Mesa, CA 92626, Tel: 714-557-1684, FAX: 714-549-9742; Empl.: 250; *Sls. Mgr.:* Jeff Dwyer; *Dist. Mgr.:* Jeff Dwyer

NH RESEARCH

FAX: 714-474-7062

NH RESEARCH, INCORPORATED INSTRUMENTATION PRODUCTS DIVISION, 16601 Hale Ave., Irvine, CA 92714, Tel: 714-474-3900, TELEX: 67-8377; Empl.: 120; *Sls. Mgr.:* Fred Sabatine ..... **D•1299**

Local Sales Offices & Reps

FL Treasure Island, NH Research 813-367-5101

NH RESEARCH, 16601 Hale Avenue, Irvine, CA 92714, Tel: 714-474-3900, TELEX: 67-8377, FAX: 714-474-7062; FSC No.: 24862; Empl.: 125; *Sls. Mgr.:* Gary Pollard ..... **D•1299**

Local Sales Offices & Reps

CA Irvine, NH Research, Inc. 714-474-3900
IL Naperville, NH Research, Inc. 312-355-5991
NJ Totowa, NH Research, Inc. 201-785-2261

NIC COMPONENTS CORP., 6000 New Horizons Blvd., N. Amityville, NY 11701, Tel: 516-226-7500, TELEX: 221-228, FAX: 516-226-6262; Empl.: 50; *Sls. Mgr.:* Robert Schatz; *Dist. Mgr.:* Nancy Lamendola

NICHICON (AMERICA) CORP., 927 E. State Pkwy., Schaumburg, IL 60173, Tel: 708-843-7500, TELEX: 20-6577, FAX: 312-843-2798/7125; *Sls. Mgr.:* Russ Edwards; *Dist. Mgr.:* Buddy Black

NICHIFU AMERICA, INC., 60 Robinson St, Pottstown, PA 19464, Tel: 215-323-7120, FAX: 215-970-2096; *Sls. Mgr.:* Roy Allen

NICOLET INSTRUMENT CORP., Test Instrument Division, 5225 Verona Rd., Madison, WI 53711, Tel: 608-271-3333, TELEX: 608-273-5061, TWX: 910-286-2737; Empl.: 700; *Sls. Mgr.:* Robert Terrio

NICOLET COMPUTER GRAPHICS DIV., See Bruning Computer Graphics

NIDEC CORPORATION, 318 Industrial Lane, Torrington, CT 06790, Tel: 203-482-4422, FAX: 203-489-7201; Empl.: 350; *Sls. Mgr.:* John Mills; *Dist. Mgr.:* Richard Bagg

NIEC-BASISTA, 3401 Brecksville Rd 110, Richfield, OH 44286, Tel: 216-659-9287, FAX: 216-659-3580; Empl.: (NIEC-Japan) 1200 230M Sales

NIEC, See QMI/NIEC

NISSEI DENKI AMERICA, INC., 7873 S.W. Nimbus Ave., Beaverton, OR 97005, Tel: 503-646-1434, FAX: 503-641-9594; Empl.: 6; *Sls. Mgr.:* T. Watanabe

Nissei Electronics

FAX: 415-961-7259

NISSEI ELECTRONICS, 460 E. Middlefield Rd., Mountain View, CA 94043, Tel: 415-969-1100 ..... **B•1103-1105**

NITTANY PIEZO CERAMICS, See Piezo Kinetics, Inc.

NJE CORPORATION, 329 Culver Rd, P.O. Box 669, Dayton, NJ 08810-0669, Tel: 201-329-4611, TWX: 710-480-5674, FAX: 201-329-6185; FSC No.: 98380; Empl.: 105; *Sls. Mgr.:* John Slavik

nkk switches OF AMERICA INC

FAX: 602-998-1435

NKK SWITCHES OF AMERICA, INC., 7850 E. Gelding Dr., Scottsdale, AZ 85260, Tel: 602-991-0942; FSC No.: 63426; Empl.: 459; *Sls. Mgr.:* Joseph Nessim; *Dist. Mgr.:* Joseph Nessim ..... **B•1638, 1746-1752**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Phoenix, C.T. Carlberg & Assocs. 602-468-0750
AZ Scottsdale, NKK Switches 602-991-0942
CA Cupertino, Getsales 408-725-8384
CA Torrance, Universal Comps. 213-783-0220
CO Wheat Ridge, Cluff & Assocs. Inc. 303-425-6604
FL Altamonte Springs, Over & Over, Inc. 407-332-1222
FL Coral Springs, Over & Over Inc. 305-753-7050
FL Tampa, Over & Over Inc. 813-626-9100
GA Norcross, Over & Over, Inc. 404-449-6205
IL Mt. Prospect, The Dombrow Co., Inc. .. 708-253-3326
IN Carmel, Frank E. Kahsar Sls. 317-844-9353
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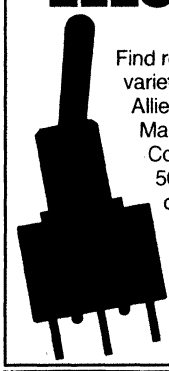

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PA Montgomeryville, Pyttronic Inds. 215-643-2850
PA Pittsburgh, CAM-RPC Elctrns. 412-782-3770
PA Reading, Barbey Elctrns. 215-376-6116
SC Greenville, Hammond Elctrns. 803-233-4121
TX Austin, Sterling Elctrns. 512-836-1341
TX Dallas, Sterling Elctrns. 214-243-1600
TX El Paso, International Elctrns. 915-598-3406
TX Grapevine, Mechatronics 817-488-6634
TX Houston, Newark Elctrns. 713-270-4800
TX Houston, Sterling Elctrns. 713-623-6600
TX Richardson, Bell Inds. 214-690-0466
UT Midvale, Bell Inds. 801-255-9611
UT Salt Lake City, Sterling Elctrns. 801-972-5444
UT West Valley City, Denver Beta Wintronic Co. 801-966-0378
VA Herndon, Sterling Elctrns. 703-742-8400
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Newark Elctrns. 206-641-9800
WA Mercer Island, Mechatronics SAB, Inc. 206-232-4800
WA Redmond, Bell Inds. 206-885-9963
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Classic Comps. 414-786-5300
WI Waukesha, Bell Inds. 414-547-8879
Can Pointe Claire, Que., Future Elctrns. 514-694-7710

NMC FASTENING SYSTEMS, Nylon Molding Corp., 1617 S. California, Monrovia, CA 91016, Tel: 818-357-0901, FAX: 818-303-6085; Empl.: 45; *Sls. Mgr.:* Gary Fraze

NOBLE U.S.A., INC., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008, Tel: 708-364-6038, TELEX: 206745, FAX: 1-708-364-6045; *Sls. Mgr.:* Robert K. Burdick ..... **A•2061**

Local Sales Offices & Reps

AL Huntsville, Electro Mech Sls. 205-880-0592
AZ Phoenix, RF Mayo Assoc. 602-945-9363
AZ Scottsdale, RF Mayo Assoc. 602-953-1295
CA Los Gatos, Stewart-Fullerton Assocs. 408-376-0368
CA Mtn. View, Stewart-Fullerton Assocs. .. 415-964-7870
CA Napa, Stewart-Fullerton Assoc. 707-258-1160
CO Boulder, RF Mayo Assoc. 303-442-2155
FL Plantation, Gallagher & Assocs. 305-473-2101
GA Norcross, Electro Mech Sls. 404-447-6478
IL Chicago, BNI Elctrns. 312-775-1717
IN Carmel, Fred A. Dorsey Assoc. 317-844-4842
KY Jamestown, Fred A. Dorsey Assoc. ... 502-343-4624
MA Randolph, Hatch Assoc. 617-963-3306
MI Plymouth, M Rep 313-420-2233
MN Minneapolis, Holmgren Assoc. 612-574-9983
MO St. Louis, R.E.P.S. 314-429-3111
NY Hilton, ST Sls. 716-392-9242
NY Rochester, CAM/RPC Elctrns. 716-427-9999
NC Raleigh, Electro Mech Sls. 919-790-9300
OH Akron, Tim Nachtigal 216-745-8890
OH Cincinnati, PMR - Privett Mfr's. 513-825-0022
OH Powell, Lee Gier 614-548-5143
OK Bethany, Design Mktg. 405-789-5911
OR Beaverton, Quest Mktg. 503-641-7377
PA Flourtown, C.G.M. Inc. 215-233-0333
TN Greenville, Lamons, Sls. Co. 615-639-8711
TX Austin, Design Mktg. 512-263-9151
TX Dallas, Design Mktg. 214-480-8151
TX Houston, Design Mktg. 713-550-3318
WA Bellevue, Quest Mktg. 206-747-9424
Can Edmonton,Alberta, Deskin Sls. 403-466-2106
Can Markham, Ont., Deskin Sls. 416-475-1412
Can Nepean, Ont., Deskin Sls. 613-228-1201
Can St. Laurent,P.Q., Deskin Sls. 514-331-2860
Can Transcona, Man., Deskin Sls. 403-466-2106
Can Vancouver,B.C., Deskin Sls. 604-324-8343

Local Distributors

CA Irvine, ITT Multicomps. 714-727-4001
CA San Jose, ITT Multicomps. 408-453-1404
CO Westminster, ITT Multicomps. 303-451-8740
IL Addison, Belford Elctrns. 708-691-1100
IL Addison, Belford Elctrns. 708-691-1118
MA Billerica, Baldwin Comps. 508-667-6710
MO St. Louis, Franklin Elctrns. 314-429-3111
NY Ronkonkoma, Baldwin Comps. 516-588-5700
OH Cleveland, CAM/RPC Elctrns. 216-461-4700

NOHAU CORPORATION, 51 E. Campbell Ave, Campbell, CA 95008, Tel: 408-866-1820, 408-866-4493, FAX: 408-378-7869 ..... **D•1300-1303**

Local Sales Offices & Reps

CA San Diego, Microware Technlg. Inc. ... 619-693-4280
CT Old Saybrook, AD Elctrns. 203-388-2204
NY Suffern, Information Automation 914-357-7575
NY White Plains, Information Automation 914-948-4300
PA Hatboro, Delta Tech. Sls. 215-957-0600
TX Austin, Techtools 512-454-9027
WA Bothell, Exectronics 206-947-2115
Can Laval,Que., Techmation Instrs. 514-689-5889

NOISE COM INC., E. 49 Midland Ave., Paramus, NJ 07652, Tel: 201-261-8797, FAX: 201-261-8339; FSC No.: 65185; Empl.: 18; *Sls. Mgr.:* Gary Simonyan ..... **A•1821; D•1304-1305**

Local Sales Offices & Reps

CA Los Angeles, McDougall/Mc Laughlin 213-477-8556
CA San Jose, Allis Assocs., Inc. 408-252-2883
FL Clearwater, Beacon Microwave 813-796-2378
MD Columbia, Creative Mktg. Assoc. 301-880-4161
MA Reading, Geder Assoc. 617-944-3105
MN Minneapolis, Baltz Assocs. 612-546-8520
NY Plainview, Bertram D Aaron & Co. 516-349-7399
OH Centerville, Extensive Entprs. 513-434-5078
WA Kirkland, Allis Northwest 206-828-0444
EXP Palo Alto, Ca, Radar Systems 415-322-7448
Can Ottawa, Giga-Tron Assocs. Ltd. 613-225-4084

NOLATRON, P.O. Box 4042, Harrisburg, PA 17111, Tel: 717-564-3398, FAX: 717-939-5831; Empl.: 5

NOLL, J. A. CO., P.O. Box 312, Monroeville, PA 15146, Tel: 412-856-7566; *Sls. Mgr.:* P. Carson; *Dist. Mgr.:* P. Carson

NON-LINEAR SYSTEMS/DIV. OF KAYPRO CORP., 4174 Sorrento Valley Blvd., San Diego, CA 92121, Tel: 619-535-2155, FAX: 619-535-2169; FSC No.: 03626; Empl.: 55; *Sls. Mgr.:* Jeanne Simmons; *Dist. Mgr.:* Jeanne Simmons

NORDION INTERNATIONAL, 447 March Rd., Kanata, Ontario, Canada K2K 1X8, Tel: 613-592-2790, TELEX: 053-4162, FAX: 613-592-6937

NORELCOM INDS., 63 Marine St., Farmingdale, NY 11735, Tel: 516-249-7245, FAX: 516-249-3745; Empl.: 30

NOREN PRODUCTS INC., 1010 O'Brien Drive, Menlo Pk., CA 94025, Tel: 415-322-9500, TELEX: 17-1410 Noren MNPK, FAX: 415-324-1348; *Sls. Mgr.:* Jim Blair

NORGREN, 5400 South Delaware, Littleton, CO 80120-1663, Tel: 303-794-2611, TELEX: 45541; Empl.: 661; *Sls. Mgr.:* Mark Shellenbarge

NORITAKE CO., INC., Noritake Co., Limited (Japan), 23820 Hawthorne Blvd., Ste. 100, Torrance, CA 90505, Tel: 213-373-6704; FSC No.: 213-772-3918; Empl.: 7; *Sls. Mgr.:* Y. Tatsuta

NORMA MESSTECHNIK OPTIK, Elektronik GmbH., Eumigweg 7, Wr. Neudorf, Austria 2351, Tel: 02236 61530, TELEX: 79316, FAX: 02236 63080; Empl.: 250; *Sls. Mgr.:* Hr. Weber; *Dist. Mgr.:* Hr. Kohlhauser

NORPLEX OAK INC., P.O. Box 1448, La Crosse, WI 54602-1448, Tel: 608-784-6070, TELEX: 59-2257; Empl.: 2,200

NORTH AMERICAN PHILIPS CONTROLS CORP., See Airpax Corporation, Cheshire Div.

NORTH AMERICAN PHILIPS LIGHTING, 200 Franklin Sq. Dr., Somerset, NJ 08875, Tel: 201-563-3000, TWX: 510-685-5651; Empl.: 600; *Sls. Mgr.:* C. J. Lehmann

NORTH ATLANTIC INDUSTRIES, 60 Plant Ave., Hauppauge, NY 11788, Tel: 516-582-6500, TWX: 510-227-9660, FAX: 516-582-8079; FSC No.: 07342; Empl.: 320; *Sls. Mgr.:* Ken Salz ..... **D•1306**

Local Sales Offices & Reps

AL Huntsville, Teqspec, Inc. 205-883-6699
FL Cape Canaveral, TeqSpec 407-783-3444
FL Palm Harbor, Teqspec 813-942-6006
GA Snellville, Teqspec 404-972-7955
IL Chicago, Pat Lind Elctrns. 312-726-3513
IN Indianapolis, Pat Lind Elctrns. 317-632-7444
IA Cedar Rapids, Palatine Engrg. 319-365-8071
MA Burlington, Intersell 617-273-3844
MI Madison Heights, WKM Assoc. 313-588-2300
MN Circle Pines, Pat Lind Elctrns. 612-786-5770
MO Florissant, Palatine Engrg. 314-839-0800
NY Saugerties, Beckpep, Inc. 914-246-3031
NC Winston-Salem, Teqspec III 919-765-5553
OH Dayton, WKM Assoc. 513-434-7500
OR Wilsonville, Syntek 503-682-2750

PA Horsham, Pennsylvania Sci. Dvcs. 215-956-0700
TX Houston, Scientific Sls. 713-645-6218
TX Richardson, Scientific Sls. 214-231-6541
WI Milwaukee, Pat Lind Elctrns. 414-224-0146

NORTHEAST INNOVATIONS, INC., PO Box 1214, Concord, NH 03302, Tel: 603-736-8260, FAX: 603-736-4506; Empl.: 10; *Sls. Mgr.:* Ryan Irving

NORTHERN AMPOWER CORP., 47087 Grand River, Novi, MI 48374, Tel: 313-349-4860, FAX: 313-349-5692; Empl.: 30; *Sls. Mgr.:* Ronald Kirsch .... **D•1914**

NORTHERN MAGNETICS INC., 16124 Wyandotte, Van Nuys, CA 91406, Tel: 818-997-8675, FAX: 818-997-3935; Empl.: 12

NORTHERN PRECISION LABS., 11 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-4800, FAX: 201-575-5973; Empl.: 95; *Sls. Mgr.:* P. Pytal

NORTHERN TECHNOLOGIES CORP., 35 Rivera Dr., Unit No. 5, Markham, Ont., CAN L3R 8N4, Tel: 416-475-9320, 1-800-456-1875, FAX: 416-475-5719; Empl.: 30; *Sls. Mgr.:* Alan Pett

North Hills
A Porta Systems Company

FAX: 516-759-3327

NORTH HILLS ELECTRONICS, 1 Alexander Pl., Glen Cove, NY 11542, Tel: 516-671-5700, TELEX: 46-6886; FSC No.: 98821; Empl.: 100; *Sls. Mgr.:* Steve Muth .... **A•2310-2313**

Local Sales Offices & Reps
AZ Phoenix, Mercury Eng. Sls. 602-265-0344
CA Campbell, Sedillo Co., Inc. 408-374-5222
CA North Palo Alto, Tri-Rep 415-965-1822
CA Palo Alto, Tri Rep 415-965-1822
CA South El Toro, Par Mktg. 714-768-6021
CO Littleton, Mercier & Assoc. 303-770-0666
CT Wethersfield, Underwood Sls. Corp. 203-563-3046
FL Clearwater, Brennan Assocs. 813-446-5006
MD Baltimore, Stemler Assocs. Inc. 301-944-4840
IL Wheaton, Vine Tech. Sls. 913-642-7220
MD Laurel, CSDS 301-953-7884
MA Hingham, Northeast Rep. 617-749-8700
MA Lowell, Underwood Sls. Corp. 617-256-8191
MN Eden Prairie, COM-TEK Sls. 612-941-7181
MN Minneapolis, Hei-Lite Sls. 612-861-6051
MO St. Louis, Alpha Tech. Sls. 314-537-2647
MO St. Louis, Thunderbird Tech. Sls. 314-298-8984
NY Whitney Point, T.A.E. Reps 607-692-3705
NY Albertson, DOL Engrg. 516-747-3944
OH Dayton, Mid-Con Elctrns. 513-837-2643
OR Portland, Evergreen Mktg. Grp. 503-643-8020
TX Dallas, Milestek, Inc. 817-455-7444
TX Houston, Milestek, Inc. 713-376-6776
WA Seattle, Evergreen Mktg. Grp. 206-633-3160
WI Genoa City, Vine Tech. Sls. 414-279-3871
Can Montreal, Componetics Ltd. 514-331-9930

Local Distributors
MD Laurel, Rayma 1-800-447-2962
TX Argyle, Miles Tek, Inc. 817-455-7444

NORTH HILLS ELECTRONICS INC., Power Products Div., 1 Alexander Place, Glen Cove, NY 11542-3796, Tel: 516-671-5700, TELEX: 46-6886 NOHILL CI, FAX: 516-759-3327; Empl.: 135; *Sls. Mgr.:* Jay M. Mohr

NORTHLAKE ENGINEERING, INC., 999 Anita Ave., Antioch, IL 60002, Tel: 708-395-5710, FAX: 708-395-9101; FSC No.: 50638; Empl.: 120; *Sls. Mgr.:* W. A. Hardt

NORTHWEST ANALYTICAL INC., 520 N. W. Davis St., Portland, OR 97209, Tel: 503-224-7727, FAX: 503-224-5236; Empl.: 14

NORTHWEST MICROCIRCUITS, INC., 211 S. 9th - P.O. Box 1199, Philomath, OR 97370, Tel: 503-929-6424, FAX: 503-929-6428; Empl.: 15; *Sls. Mgr.:* Matt Granam

NORTON ASSOCIATES, INC., 557 Oak St., Copiague, NY 11726, Tel: 516-842-4666, FAX: 516-842-4667; FSC No.: 08739

NORWESCO, INC., See Norwesco Interconnect Devices

NORWESCO INTERCONNECT DEVICES, 2633 Plastics Drive, Gastonia, NC 28053, Tel: 704-868-3581, FAX: 704-867-0577; Empl.: 80; *Sls. Mgr.:* Frank Pellatt

NOVA ELECTRIC CORP., Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07652, Tel: 201-385-0500, FAX: 201-385-0702; FSC No.: 29019; Empl.: 50; *Sls. Mgr.:* Kenneth Niovitch .... **D•2214-2215**

Local Sales Offices & Reps
AZ Phoenix, CPS Assoc. 602-246-1097
CA Flintridge, Synertek Mktg. 818-915-1439
CA Los Altos, Jay Stone Assoc. 415-948-4563
CO Englewood, Odyssey 1 303-773-8176
CT W. Hartford, Power Factor Assoc. 203-233-0600
FL Orlando, Truex Assoc. 407-859-2160
KS Kansas City, Harris-Hansen Co. 816-763-6200
MD Rockville, Marktron 301-251-8990
MA Whitinsville, Power Factor Assoc. 508-234-6415
MI Detroit, Comtel 313-358-2505
MN Minneapolis, White Sls. Co. 612-553-1818
MO St. Louis, Harris-Hansen Co. 314-432-3611
NJ Westfield, Metro-Mics 201-233-6116
NM Albuquerque, Fry-Gates Assoc. 505-262-1525
NY Hauppauge, Metro-Mics 516-361-6134
OH Cleveland, Comtel Assoc. 216-442-8080
TN Knoxville, Southern Automation Sls. .. 615-690-8488
TX Dallas, Carey McMahill Assoc. 214-681-1414
UT Odyssey 1. 801-485-4728
WA Bellevue, Topp 206-747-5400
Can Ottawa, Ont., Subtec 613-723-7720

NOVATEK CORPORATION, 3700 NW 124th Ave., Coral Springs, FL 33065, Tel: 305-341-7700, TELEX: 522600 AAA EXECT, FAX: 305-345-9334; Empl.: 15; *Sls. Mgr.:* Joe DiBrigida

NOVA TRAN CORPORATION, Union Carbide Corporation, 100 Deposition Dr., Clear Lake, WI 54005, Tel: 715-263-2333, FAX: 715-263-3189; Empl.: 85; *Sls. Mgr.:* Bill Henry

NOVATRONICS INC., 677 Erie St., P.O. Box 610, Stratford, Ontario, Canada N5A 6V6, Tel: 519-271-3880, TELEX: 06-955394, FAX: 519-271-9781; Empl.: 100; *Sls. Mgr.:* Laraine Murray

NOVOTECHNIK U.S., INC., 237 Cedar Hill St., Marlborough, MA 01752, Tel: 508-485-2244, FAX: 508-485-2430; FSC No.: MULTIPLE; Empl.: 8

NRD INC., Subsidiary of Mark IV Inds., Inc., 2937 Alt Blvd. N., Grand Island, NY 14072, Tel: 716-773-7634, TELEX: 91578 NRD GRDI, FAX: 716-773-7744; Empl.: 100; *Sls. Mgr.:* James Curtis; *Dist. Mgr.:* Larry Keating .... **D•2238**

Local Sales Offices & Reps
AZ Tempe, Frank Steinmetz & Assoc. 602-829-0654
CA Santa Clara, Tech-Ser, Inc. 408-496-1004
CA Torrance, Tech-Ser, Inc. 213-370-7200
FL St. Cloud, Kurt Whitlock Assoc., Inc. 407-892-9876
IL Chicago, MGA Kokomo 312-775-1151
FL Kokomo, MGA Kokomo 317-455-0444
KS Lenexa, MIDTEC Assoc., Inc. 913-541-0505
MA Salem, Alpha-Stat 508-744-1100
MI Southfield, M. Gottlieb Assoc.,Inc. 313-358-4151
MN Edina, Omni-Tec 612-881-4447
MO St. Louis, Midtec Assoc., Inc. 314-275-8666
NY Fairport, Rod Patterson Assocs. 716-425-2738
NC Charlotte, Electro-Rep Assocs. 704-527-2530
PA Feasterville, ARC Assocs. 215-364-1050
TX Dallas, Scalon, Hughes & Assocs. 214-739-2888

NTE ELECTRONICS, INC., 44 Farrand St., Bloomfield, NJ 07003, Tel: 201-748-5089, FAX: 201-748-6224; FSC No.: 7T184; Empl.: 60; *Sls. Mgr.:* Cindy Habick; *Dist. Mgr.:* Mary Damiano

NTK

FAX: 708-390-6482

NTK TECHNICAL CERAMICS, NGK Spark Plugs (USA), 1200 Business Ctr. Dr., Suite 300, Mt. Prospect, IL 60056, Tel: 708-824-1133; FSC No.: 95-246-1286; *Sls. Mgr.:* Mark Ota; *Dist. Mgr.:* Chuck Ito .... **A•1699-1704, 1822**

Local Sales Offices & Reps
AZ Mesa, NTK Tech. Ceramic 602-820-4900
CA San Jose, NTK Tech. Ceramic 408-727-5180
FL Longwood, D-Assocs. 407-321-9594
FL Maitland, D. J. Ellis & Assocs., Inc. 305-645-1101
GA Atlanta, L&D Inc. 404-455-3483
IL Mt. Prospect, NTK Tech. Ceramic 708-824-1133
IN Ft. Wayne, T.X. Sls. 219-489-4447
IA Chanhassen, Barnes Sls. Assocs. 612-934-2907
MA Farmingham, NTK Tech. Ceramic 508-820-0220
MI Ann Arbor, Jordan-Elliott Sls. Inc. 313-662-4087
MI Jackson, Jordan-Elliottt Inc. 517-788-8353
MN Chanhassen, Barnes Sales Assocs. 612-934-2907
NJ Springfield, NTK Tech. Ceramic 201-376-6070
TX Dallas, NTK Tech. Ceramic 214-404-1173
Can Ontario, NGK Spark Plugs Canada 416-291-9746
Can Scarborough, Ont., NGK Spark Plugs Canada Ltd. 416-291-1927

NUCLEAR RESEARCH CORP., 125 Titus Ave., Box H, Warrington, PA 18976, Tel: 215-343-5900, TELEX: 510-665-8525 NRC WNTN, FAX: 215-343-4670; FSC No.: 96696; Empl.: 130; *Sls. Mgr.:* Tom O'Malley; *Dist. Mgr.:* Tom O'Malley

NUCLEONIC PRODS., See Thomson-CSF Comps. Corp., Passive Comps. Div.

NU-CONCEPT SYSTEMS, 2725 Advance La.,P. O. Box 587, Colmar, PA 18915, Tel: 215-822-8400, FAX: 215-822-1427; FSC No.: 58561; Empl.: 10; *Sls. Mgr.:* Robert F. Scheuerle

NU DATA, INC., 32 Fairview Ave., Little Silver, NJ 07739, Tel: 908-842-5757, TELEX: 271139, FAX: 908-842-5757; Empl.: 20; *Sls. Mgr.:* Richard A. Previte; *Dist. Mgr.:* George Serbe

NUMERIX CORP., 20 Ossipee Rd., Newton, MA 02164, Tel: 617-964-2500, TELEX: 948032, FAX: 617-969-4380

NWL CAPACITORS, NWL Transformers, 1 Industrial Drive, Snow Hill, NC 28580, Tel: 919-747-5943; Empl.: 55 .... **A•1120-1122**

Local Sales Offices & Reps
NJ Haddonfield, M&S Mesa Inc. 609-429-7055
NM Albuquerque, Westfahl & Assocs. 505-268-1433
NY Canandaigua, Jones/Sudder 716-384-2628
NY Nassau, Dave Jones(Jones/Sudder) 518-766-9575
OH Maineville, George Barnet 513-677-0922
VT White River Junction, Gary Jones(Jones/Sudder) 802-295-5260

NWL TRANSFORMERS, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, Tel: 609-298-7300, FAX: 609-298-1982; Empl.: 225; *Sls. Mgr.:* Helmut Herder .... **A•1120-1121, 2314-2315; D•1915**

WILLIAM F. NYE, INC., P.O. Box G-927, New Bedford, MA 02742-0927, Tel: 508-996-6721, TELEX: 940807, FAX: 508-997-5285; Empl.: 27; *Sls. Mgr.:* Donald R. Fairbanks .... **C•1146**

Local Sales Offices & Reps
MI Pleasant Ridge, Brian C. Holley 313-542-2720

NY GLASS PLASTICS, Calnetics Corp., 7314 E. Madison St., Paramount, CA 90723, Tel: 213-636-1035, FAX: 213-531-0693; Empl.: 60; *Sls. Mgr.:* Chris Ward

NYTRON INDUCTORS, INC., 700 Orange St., Darlington, SC 29532, Tel: 803-393-5421, TWX: 810-665-2182, FAX: 803-393-4123; FSC No.: 83125; Empl.: 450; *Sls. Mgr.:* John Elliot .... **A•1214-1235; B•1023**

OAKGRIGSBY

FAX: 708-556-4216

OAKGRIGSBY INC., 88 N. Dugan Rd., Sugar Grove, IL 60554, Tel: 708-556-4200; FSC No.: 76854; Empl.: 300 .... **B•1633, 1754-1759**

Local Sales Offices & Reps
AL Huntsville, Electramark, Inc. 205-830-4400
AZ Scottsdale, Carefree Elctrns. Sls. 602-951-9121
CA Laguna Hills, Fitch Assocs. 714-951-0196
CA Los Gatos, Stewart/Fullerton 408-376-0368
CA Mountain View, Stewart/Fullerton 415-964-7870
CA Napa, Stewart Fullerton & Assoc. 707-258-1160
CO Englewood, Krebill Comp. Sls. 303-771-0955
CO Grand Junction, Krebill Comp. Sls. 303-243-8220
FL Altamonte Springs, Electramark FL 407-830-0844
GA Norcross, Electramark, Inc. 404-446-7915

IL Cary, Golbeck/Milota 708-639-3424
IL Crystal Lake, Oak Switch Sys. Inc. 815-459-5000
IA Cedar Rapids, Pattison Sls. 319-395-9866
KS Parker, S.W. Wollard Assocs. 913-898-6552
MA Acton, Boston Elctrns. Assocs. 508-264-4456
MI White Pigeon, Jim Wells & Assoc. 616-483-7179
MN Bloomington, Murnco & Assocs. 612-854-4161
FL Boca Raton, Electramark FL 407-392-1763
NV Henderson, Carefree Elctrns. Sls. 702-386-8858
NJ Mountainside, Henry G. Richter 201-233-4615
NJ Mt. Laurel, Eastern Elctrns. 609-778-3106
FL Tampa, Electramark FL 813-889-7775
NY Pittsford, A.C.S. 716-381-3818
NC Raleigh, Eastern Elctrns. 919-876-7591
OH Cincinnati, JMK Elctrns. 513-271-3860
OH Middlebury Heights, JMK Elctrns. 216-234-1202
OR Tigard, Rep-West 503-639-0325
PA Phoenixville, Henry G. Richter 215-495-6176
TX Dallas, Dal/Tex Rep., Inc. 214-991-7799
WA Seattle, Rep-West 206-283-8351
Can Mississauga. Ont., GMA (Toronto) 416-671-8111
Can Richmond, Ont., GMA(Ottowa) 613-838-4480
Can St. Laurent, Que., GMA (Montreal) 514-335-9572

Local Distributors

AL Huntsville, Component Distr. 205-883-7501
AZ Scottsdale, Harper SID 800-442-7737
CA Compton, Harper SID 213-979-5090
CA San Diego, Harper SID 619-578-2500
CA San Jose, Harper SID 408-943-9490
CO Denver, CSID 303-292-9594
CO Englewood, Component Distrs. 303-799-4916
FL Melbourne, Component Distr. 407-724-9910
FL W. Palm Bch., Wings Electro Sls. Co. 407-798-6606
GA Norcross, Component Distr. 404-441-3320
IL Crystal Lake, Sub-Sem, Inc. 815-459-4139
IL Rosemont, Advent Elctrns. 708-297-6200
IA Cedar Rapids, Advent Elctrns. 319-363-0221
IN Indianapolis, Advent Elctrns. 317-872-4910
MA Canton, Impact Sls. 617-821-1500
MA Westborough, In-Stock Prods. 508-870-5750
MA Westwood, Semad 617-329-7373
MA Wilmington, North Star Elctrns. 508-657-5155
MI Farmington Hills, Advent Elctrns. 313-477-1650
MN Minneapolis, Berquist 800-328-3882
NY Hauppauge, Fairmont Elec. 516-231-3313
NY Jamaica, Calson Co. 718-525-5900
NY Northport, Coke-el Aerospace Co. 516-754-2233
NC Raleigh, Component Distr. 919-787-7311
OH Centerville, IPD 513-435-2086
TX Dallas, Component Distr. 214-644-0373
TX Irving, Harper S. I. D. 214-621-0500
WI Milwaukee, Progressive Image, Inc. 414-321-4722
Can Burnaby, B.C., Semad Elctrn. Dist. 604-420-9889
Can Calgary, Alberta, Semad Elctrn. Dist. .. 403-252-5664
Can Concord, Ontario, Westburne Elec. Supp. 416-660-3545
Can Markham, Ont., Semad Elctrn. Dist. 416-475-3922
Can Ottawa, Ont., Semad Elctrn. Dist. 613-727-8325
Can Pointe Claire,Quebec, Semad Elctrn. Dist. 514-694-0860
AZ Tucson, Carefree Elctrns. Sls. 602-882-8642

OAK SWITCH SYSTEMS, See OakGrigsby, Inc.

OAKTRON CORPORATION, Mtx, 704 30th St., Monroe, WI 53566, Tel: 608-328-5560, FAX: 608-328-5575; FSC No.: 07109; Empl.: 100; *Sls. Mgr.:* J. F. Disch

OAL ASSOCIATES, INC., P.O. Box J, Escondido, CA 92033, Tel: 619-743-7143, FAX: 619-743-2460; Empl.: 18; *Sls. Mgr.:* Mark Lohkemper

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OCEAN MOTIONS CO., P.O. Box 130, Barrington, RI 02806, Tel: 401-246-1394, FAX: 401-246-0075; FSC No.: 64654 ..... **B•1924**

Local Sales Offices & Reps

CO Denver, Control Agcy., Inc. 303-694-9214
UT Salt Lake City, Control Agcy. 801-268-9880, FAX:801-268-9924

OCEAN STATE THERMOTICS, INC., 27 Thurber Blvd., Smithfield, RI 02917, Tel: 401-231-4640, FAX: 401-231-4641; Empl.: 50; *Sls. Mgr.:* Stephen R. Hecht; *Dist. Mgr.:* Stephen R. Hecht

OCE' GRAPHICS, 385 Ravendale Dr., Mountain View, CA 94039, Tel: 415-964-7900, FAX: 415-961-6152; *Sls. Mgr.:* Bill Manos; *Dist. Mgr.:* Bill Manos

OCTAGON SYSTEMS, 6510 W. 91st Ave., Westminster, CO 80030, Tel: 303-430-1500, FAX: 303-426-8126

OCULAR INC., 610 Presidential, Ste. 100, Richardson, TX 75081, Tel: 214-437-2561, FAX: 214-437-2562; Empl.: 110; *Sls. Mgr.:* Ben Kwong ..... **B•1106-1107**

Local Sales Offices & Reps

CA San Dimas, A-F Sls. Engrg. 714-599-4412
CO Arvada, Arrowhead Sls. 303-423-5556
FL Hollywood, Advantage Comps. 305-962-2255
IL Arlington Hgts., Coombs & Assocs. ... 708-439-9810
IN Fort Wayne, Menze Sls. 219-747-5616
MA Swansen, Wm. Poisson & Assocs. 508-677-3655
MN Corcoran, Mktg. Assocs. 612-420-2506
MO Kansas City, EPI, Inc. 816-523-8911
NJ Wayne, Paul Breen Assocs. 201-696-8683
NC Durham, Advantage Comps. 919-383-0933
PA Newton, Indl. Sls. Assoc. 215-860-2076
TX Dallas, Component Technlg. 214-783-8831
WA Renton, K.R. Jensen Sls. Co. 206-277-2772
WI Milwaukee, Coombs & Assocs. 414-351-6123

ODU-USA, INC., ODU-KONTAKT GmbH, 4620 Calle Quetzal, Camarillo, CA 93012, Tel: 805-484-0981, FAX: 805-484-7458; Empl.: 1; *Sls. Mgr.:* Ralf Eberlein

OECO CORP., 4607 S.E. International Way, Milwaukie, OR 97222, Tel: 503-659-7932, TELEX: 36-0350, FAX: 503-653-6310; FSC No.: 95266; Empl.: 700; *Sls. Mgr.:* Dave Fuller, VP Sls.

OGALLALA ELCTRNS., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153, Tel: 308-284-4093, FAX: 308-284-4740; Empl.: 41; *Sls. Mgr.:* H. L. Harrington

OGDEN MANUFACTURING CO., 48 W. Seegers Road, Arlington Heights, IL 60005, Tel: 708-593-8050, FAX: 708-593-8062; Empl.: 250; *Dist. Mgr.:* Gordon D. Hollander

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FAX: 614-486-0743

OHIO SEMITRONICS, INC., 1205 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-9561; FSC No.: 12066; Empl.: 47; *Sls. Mgr.:* G. Clagett ..... **B•1925-1944**

Local Sales Offices & Reps

AL Huntsville, Datarep Inc. 205-881-0361
AZ Tucson, Sheldon Equip. 602-722-1452
CA Arcadia, Van Gott & Assocs. 818-445-9728
CA Fremont, FLW, Inc. 415-651-6511
CO Denver, MC Squared Inc. 303-286-1414
DC Dumfries, Electra-Tech 703-670-6962
FL Margate, Datarep 305-968-6568
FL Orlando, Datarep 407-843-5224
GA Marietta, FLW 404-424-1731
IL Columbia, R.L. Weisheimer & Assocs. 314-487-7328
IL Park Ridge, Elctrn. Instr. Assocs. 708-298-2290
IN Indianapolis, Electronic Instr. Assocs. 317-257-7231
KS Kansas City, R.L. Weisheimer & Assocs. 816-561-1711
MD Edgewood, Electra-Tech, Inc. 301-676-2254
MI Milford, TMS 313-360-1514
MN Minneapolis, The Mark Co. 612-933-3026
NJ Garwood, E.R. Mertz, Inc. 201-232-4643
NJ Haddonfield, G.L. Williams & Assoc. 609-428-6060
NM Albuquerque, MC Squared Inc. 505-293-9090
NY Latham, L-Tron Corp. 518-489-7810
NC Charlotte, Zelco Assocs. 704-541-6122
OH Columbus, Ohio Semitronics Inc. 614-486-9561
OH Dayton, Mohawk Intronics 513-434-8873
OH No. Ridgeville, TMS, Inc. 216-327-3527
OK Stillwater, Acudata Inc. 405-743-1886
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Pittsburg, TMS 412-221-2338
RI Narragansett, Pat Assocs. 401-783-9598
TX Austin, Acudata Inc. 214-424-3561
TX Houston, Acudata Inc. 713-580-2451
TX Plano, Acudata Inc. 512-478-1018
UT Salt Lake City, MC Squared, Inc. 801-298-3388
VA Waverly, Electra-Tech 804-834-2417
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
Can Brossard, Ont., CTH Industrial Controls. 514-671-2181
Can Edmonton, Alb., CTH Instrs. 403-466-2900
Can Sarnia, Ont., Armatek Controls 519-332-0100
Can Toronto, Ont., Armatek Controls 416-251-3111

FAX: 708-675-1505

OHMITE MANUFACTURING CO., 3601 W. Howard St., Skokie, IL 60076, Tel: 708-675-2600, TELEX: 72-4433; FSC No.: 44655; *Sls. Mgr.:* Kim Youngblood; *Dist. Mgr.:* Ed Kason ..... **A•1958-1964**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Tempe, Elctrn. Dev. Sls. 602-438-1547
CA Los Angeles, Wiley Co. 213-666-1611
CA Santa Clara, Ross Mktg. 408-492-0197
CO Wheat Ridge, Cluff & Assocs. 303-425-6604
FL Altamonte Spgs., Over & Over 407-332-1222
GA Norcross, Over & Over 404-449-6205
IL Mt. Prospect, Dombrow Co. 708-253-3326
IN Indianapolis, Leslie M. DeVoe Co. 317-842-3245
IA Cedar Rapids, Spectrum Sls. 319-366-0576
KS Overland Pk., Spectrum Sls. 913-648-6811
MA Norwood, MacInnis Co. 617-762-8090
MI Farmington Hills, R.C. Merchant Co. 313-476-4600
MN Minneapolis, Elec. Comp. Sls. 612-933-2594
MO Florissant, Spectrum Sls. 314-921-1313
NJ Englewood Cliffs, Ed Glass Assocs. 201-592-0200
NY Victor, Net Sls. 716-924-1844
NC Charlotte, Over & Over 704-542-9111
NC Raleigh, Over & Over 919-876-7338
OH Westlake, Baehr Greenleaf & Assoc. .. 216-892-1770
OR Beaverton, Eclipse Mktg. 503-642-1661
PA Narbeth, Bresson Assocs. 215-664-6460
PA Warrendale, Baehr Greenleaf & Assoc. 412-934-3088
TX Richardson, Pro-Comp Sls. 214-669-1500
WA Redmond, Eclipse Mktg. 206-885-6991
EXP Skokie, IL, Ohmite Mfg. Co. 708-675-2600
Can Pickering, Ont., A.C. Simmonds & Sons 416-839-8041

Local Distributors

AR Ft. Smith, Carlton Bates 501-646-8201
CA El Monte, Kimball & Stark 818-444-2594
CA Fountain Valley, Component Ctr. 800-879-3550
CA Oakland, Brill Elctrns. 415-834-5888
FL Orlando, Hammond Elctrns. 407-849-6060
IL Chicago, Newark Elctrns. 312-784-5100
IL Palatine, Ohm Elctrns. 708-359-5500
IN Indianapolis, Bell Inds. 317-875-8200
MA Hingham, Sager Elctrns. 617-749-6700
MI Livonia, RS Elctrns. 313-525-1155
MN St. Paul, Gopher Elctrns. 612-490-4900
NJ Camden, GRS Elctrns. 609-964-8560
NY Buffalo, Summit Distrs. 716-887-2800
NY Lynbrook, Peerless Radio Corp. 516-593-2121
NY Rome, Rome Elctrns. 315-337-5400
OH Akron, AESCO Elctrns. 216-762-8818
OH Dayton, Stotts-Friedman Co. 513-298-5555
OH Warren, REM Elctrns. Supp. 216-373-1300
SC Columbia, Dixie Elctrns. 803-779-5332
TX Richardson, Altair Co. 214-231-5166
TX Stafford, Harrison Equip. 713-879-2600
WA Richland, Radar Elec. 509-943-8336
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Don Mills, Ont., Saynor Varah 416-445-2340
Can Willowdale, Ont., Electro-Sonic 416-494-1666

OHMTEK INC., Vishay, 2160 Liberty Dr., Niagara Falls, NY 14304, Tel: 716-283-4025, FAX: 716-283-5932; FSC No.: 57489; Empl.: 205; *Sls. Mgr.:* William Cuviello ..... **A•1965-1967**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs. 205-883-1712
AZ Chandler, Mission Mktg. Grp. 602-786-0804

AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	Glendale, Mission Mktg. Grp.	818-247-9110
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, V.E.C.	619-690-5112
CA	Tustin, V.E.C.-Los Angeles	714-544-7024
CO	Loveland, V.E.C.-Rocky Mtn.	303-667-7500
CT	Wallingford, Comp Rep Assoc., Inc.	203-269-1145
FL	Altamonte Springs, Semtronic Assoc., Inc.	407-831-8233
FL	Clearwater, Semtronic Assoc., Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assoc., Inc.	305-731-2484
GA	Roswell, JWL Assocs.	404-993-0100
IL	Skokie, IRI-Illinois	312-967-8430
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
KS	Olathe, Tech. Sls. Assoc., Inc.	913-829-2800
MD	Lutherville, J.A. Dougherty Sls., Inc.	301-321-7890
MA	Sterling, Compatable Comps. Inc.	508-422-7641
MA	Westwood, Comp. Rep. Assoc., Inc.	617-329-3454
MI	Plymouth, Jay Mktg. Assoc.	313-459-1200
MN	Bloomington, IRI of MN.	612-854-8027
MN	Edina, Dunlop Consultants	612-933-9070
MN	Minneapolis, Dunlop Consits.	612-544-1070
MO	St. Louis, Tech. Sls. Assoc., Inc.	314-521-2044
NJ	Flanders, K & R Eng. Sls., Inc.	201-584-5235
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	Rochester, L-Mar Assocs.	716-381-9100
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Aurora, EMA, Inc.	216-562-6104
OH	Centerville, EMA, Inc.	513-433-2800
OH	Worthington, EMA, Inc.	614-436-9452
OR	Beaverton, N.R. Schultz Co.	503-643-1644
PA	Horsham, TMI, Inc.	215-441-4300
TX	Dallas, Edward F. Avmond Co.	214-826-7620
TX	Houston, Edward F. Avmond Co.	713-943-3149
WA	Bellevue, UniComp	206-868-5124
WI	Milwaukee, IRI-Wisconsin	414-789-9393
PR	Caguas, Comp. Rep. Assoc., Inc.	809-746-6550
Can	Concord, Ont., Kaytronics, Inc.	416-669-2262
Can	Kanata, Ont., Kaytronics, Inc.	613-564-0080
Can	Ville St. Laurent, Que., Kaytronics, Inc.	514-745-5800

OK INDUSTRIES, INC., 4 Executive Plaza, Yonkers, NY 10701, Tel: 914-969-6800, TELEX: 12-5091, FAX: 914-969-6650; Empl.: 200; *Sls. Mgr.:* John Malboeuf

OLEKTRON CORP., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570, Tel: 508-943-7440, FAX: 508-949-1804; FSC No.: 32252; Empl.: 160; *Sls. Mgr.:* Michael Smith

OLFLEX WIRE & CABLE, INC., 30 Plymouth Street, Fairfield, NJ 07004, Tel: 201-575-1101, FAX: 201-575-7178; Empl.: 25; *Sls. Mgr.:* Peter Deschner

OLIVER ADVANCED ENGINEERING, 320 W. Arden St., Glendale, CA 91203, Tel: 818-240-0080, FAX: 818-240-6131; Empl.: 28

OLYMPIC WIRE & CABLE, 1 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-7996, FAX: 201-227-1606; FSC No.: 63830; Empl.: 35; *Dist. Mgr.:* Yvette Archer

OLYMPUS CORPORATION, Industrial Fiberoptics Division, 4 Nevada Dr., Lake Success, NY 11042-1179, Tel: 516-488-3880, FAX: 516-488-3973

OMATION INC., 801 Presidental Dr., Richardson, TX 75081, Tel: 214-231-5167, 800-553-9119, FAX: 214-783-9072; Empl.: 15; *Sls. Mgr.:* Nancy James

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OMEGA ENGINEERING, Box 4047, Stamford, CT 06907, Tel: 800-826-6342; Empl.: 500; *Sls. Mgr.:* Peter Casiraghi & Nelson Hart ..... **B•1760, 1854-1855, 1945-1946; C•1799; D•1013, 1101, 1142, 1191, 1307, 1368-1369, 1422**

OMICRON ELECTRONIC, Ang-Kauffmann-Str. 8, Hohenems, Austria A-6845, Tel: ò/5576/4010-0, FAX: ò/5576/5153; Empl.: 10; *Sls. Mgr.:* Marc Andreas Vogg; *Dist. Mgr.:* Marc Andreas Vogg

OMNICOMP GRAPHICS CORP., 1734 W. Sam Houston Pkwy N., Houston, TX 77043, Tel: 713-464-2990, TELEX: 285801, FAX: 713-827-7540; Empl.: 40; *Sls. Mgr.:* Richard A. Jones

OMNIBYTE CORP., 245 W. Roosevelt Rd., Bldg. 1-5, W. Chicago, IL 60185, Tel: 708-231-6880, FAX: 708-231-7042; Empl.: 30; *Sls. Mgr.:* Peter Czuchra

OMNIPrint

FAX: 408-747-0358

OMNIPRINT, INC., 1188 Elko Drive, Sunnyvale, CA 94089, Tel: 408-745-6400; Empl.: 12 ..... **D•1102-1105**

Local Sales Offices & Reps

CA	Irvine, OBI Distrs.	714-250-9003
IL	Arlington Heights, Coombs Assoc., Inc.	312-439-9810
NJ	Fords, Marlin Data	201-738-7200

OMNI SWITCH USA, INC., 21630 N. 19th Ave., Ste. B-16, Phoenix, AZ 85027, Tel: 602-582-0629, FAX: 602-582-0665; Empl.: 100; *Sls. Mgr.:* Peggy Ann Wenzel, V.P.

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FAX: 708-893-9991

OMNI VISION INC., 168 N. Brandon Dr., Glendale Heights, IL 60139, Tel: 708-893-1720; *Sls. Mgr.:* Walt Kowalski ..... **B•1109**

OMRON ELECTRONICS, INC., Control Components Division, 1 East Commerce Dr., Schaumburg, IL 60173, Tel: 708-843-7900, FAX: 708-843-8081; Empl.: 300; *Dist. Mgr.:* Mac Rowell

OMRON ELECTRONICS, INC., F A Systems Div., One E. Commerce Dr., Schaumburg, IL 60173, Tel: 708-843-7900, FAX: 708-843-7787; Empl.: 300; *Sls. Mgr.:* Sal Scafidi

OMUTEC, Odetics, Inc., 1515 S. Manchester Ave., Anaheim, CA 92802, Tel: 714-758-0200, TWX: 910-594-1461; *Sls. Mgr.:* Robert Asher

ONAN POWER/ELECTRONICS, 9713 Valley View Rd., Minneapolis, MN 55344, Tel: 612-943-4600, FAX: 612-943-4627; FSC No.: 3Z577; Empl.: 500; *Sls. Mgr.:* Jim Vogt

ONEAC CORPORATION, 27944 N. Bradley Rd., Libertyville, IL 60048, Tel: 708-816-6000,800-327-8801, TWX: 757024 ONEAC USA; Empl.: 250; *Sls. Mgr.:* John Jeter; *Dist. Mgr.:* Herb Goldstein

ONSET COMPUTER CORP., 199 Main St., PO Box 1030, N. Falmouth, MA 02556, Tel: 508-563-9000, FAX: 508-563-9477; Empl.: 10; *Sls. Mgr.:* Lon Hocker

ONSHORE TECHNOLOGY, 1917 W. 3rd St., Tempe, AZ 85281, Tel: 602-921-3000

ONTRACK DATA RECOVERY, INC., Ontrack Computer Systems, Inc., 6321 Bury Drive, Ste.15-19, Eden Prairie, MN 55346, Tel: 800-872-2599, FAX: 612-937-5750

OPAMP LABS, INC., 1033 N. Sycamore Ave., Los Angeles, CA 90038, Tel: 213-934-3566, FAX: 213-462-6490; FSC No.: 24699; Empl.: 18 ..... **D•1014**

OPHIR TECHNOLOGY INC., 4001 Via Oro Ave., Long Beach, CA 90810, Tel: 213-834-0202, FAX: 213-834-7730; Empl.: 26

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OPTEK TECHNOLOGY INC., 1215 West Crosby Rd., Carrollton, TX 75006, Tel: 214-323-2200; Empl.: 2000; *Sls. Mgr.:* Larry Newman; *Dist. Mgr.:* Kas Kunz ..... **B•1333**

Local Sales Offices & Reps

AZ	Scottsdale, Pinnacle Comp. Sls.	602-994-0441
CA	Torrance, Detomas;& Grupp Inc.	213-618-8898
AZ	Tucson, Pinnacle Comp. Sls.	602-886-1726
CA	Escondido, Uni Rep Co.	619-746-5131
CA	Mission Hills, Detomas; & Grupp Inc.	818-365-5300
CA	Mountain View, Marcon	415-964-8046
CO	Wheat Ridge, Waugaman Assoc.	303-423-1020
CT	Stratford, VISTAssociates	203-375-5456
FL	Boca Raton, S. Atlantic Comp. Sls.	407-391-1034
FL	Orlando, South Atlantic Comp. Sls.	407-857-3650
FL	Winter Haven, S. Atlantic Comp. Sls.	813-423-0953
GA	Norcross, South Atlantic Comp. Sls.	404-447-6154
IL	Arlington Heights, KMA Sls. Co.	708-398-5300
IN	Indianapolis, Elctrns Sls. & Engrg.	317-849-4260
KS	Parker, S.W. Assoc.	913-898-6552
IA	Cedar Rapids, C.H. Horn & Assoc.	319-393-8703
MA	Marlborough, VISTAssociates	617-481-9277
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Bloomington, Tecteam	612-854-6616
MO	St. Louis, John G. Macke	314-432-2830
NJ	West Caldwell, Technical Mktg. Grp.	201-226-3300
NM	Albuquerque, S.W. Sls.	505-899-9005
NY	Clark Mills, KLM Garner	315-853-6126
NY	Melville, Technical Mktg. Grp.	516-351-8833
NY	Pittsford, KLM Garner	716-381-8350
NC	Raleigh, South Atlantic Comp. Sls.	919-852-4676
OH	Dayton, Midwest Mktg. Assocs.	513-433-2511
OR	Beaverton, Earl & Brown Co. Inc.	503-643-5500
PA	Broomall, L.D. Lowery Inc.	215-356-5300
TX	Austin, Ion	512-331-7251
TX	Grand Prairie, Ion	214-647-8225
TX	Houston, Ion	713-537-7717
UT	Salt Lake City, Waugaman	801-261-0802
WA	Redmond, Earl & Brown Co. Inc.	206-885-5064
WI	Milwaukee, KMA	414-259-1771
Can	Richmond, Ont., Renmark Elctrns. Ltd.	416-881-8844

Local Distributors

CA	Compton, Harper-S.I.D.	213-979-5090
CA	Culver City, Hamilton-Avnet	213-558-2000
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Tustin, Added Value	714-259-8258
CA	Tustin, AVED	714-259-8258
FL	Orlando, Chip Supp.	407-298-7100
IL	Chicago, Newark Elctrns.	312-784-5100
MD	Gaithersburg, Pioneer-Technlg.	301-921-0660
MA	Norwood, Gerber Elctrns.	617-769-6000

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OPTELECOM, INC., 15930 Luanne Dr., Gaithersburg, MD 20877, Tel: 301-840-2121; FSC No.: 59338; Empl.: 50; *Sls. Mgr.:* Pam Imes ..... **B•1227-1229**

OPTICAL & CONDUCTIVE COATINGS, Meridian Inds., Inc., 428 N. Buchanan Cir., 68, Pacheco, CA 94553, Tel: 415-798-6066, FAX: 415-798-4789; FSC No.: 9U775; Empl.: 8; *Sls. Mgr.:* Glenn G. Grupe

OPTICAL CABLE CORP., P.O. Box 11967, Roanoke, VA 24022-1967, Tel: 1-800-622-7711, TELEX: 705-290, FAX: 703-265-0724; FSC No.: 6Y528; Empl.: 50; *Sls. Mgr.:* Luke J. Huybrechts, VP/Sls.; *Dist. Mgr.:* Chuck Surat, Natl. Accts. Exec.

OPTICS FOR RESEARCH, INC., P.O. Box 82, Caldwell, NJ 07006, Tel: 201-228-4480, TELEX: 497-4643, FAX: 201-228-0915; Empl.: 27; *Sls. Mgr.:* Donald K. Wilson

OPTIMA ELECTRONIC PACKAGING SYSTEMS, 2166 Mountain Industrial Blvd, Tucker, GA 30084-5088, Tel: 404-496-4000, FAX: 404-496-4041; FSC No.: 10110; Empl.: 150; *Sls. Mgr.:* Don Southwell ..... **C•1064-1069**

Local Sales Offices & Reps

AZ Scottsdale, Arcom Sls., Inc. 602-947-5745
CA Garden Grove, Elsco Elctrns., Inc. 714-891-4621
CA Santa Clara, Nova-Tronix 408-727-9530
CO Denver, Promotech, Inc. 303-692-8484
FL Oviedo, Conley & Assocs., Inc. 407-365-3283
GA Roswell, Acurep Associates, Inc. 404-998-5008
GA Tucker, Optima Elctrn. Packaging 404-496-4000
IL Arlington Heights, Berndt Assocs., Inc. 708-632-0900
MA Millis, Selmark Assocs., Inc. 508-376-2914
MI Madison Hgts., DEM Electronic Sls., Inc. 313-583-1500
MN Minneapolis, Holmgren Assocs., Inc. .. 612-574-9983
MO Bridgeton, BC Elctrn. Sls. 314-739-6683
NJ Berkeley Heights, Cambridge Allen & Assocs. 908-464-0203
NC Raleigh, Godwin Assocs. 919-878-8000
OH Cleveland, C.A. Robinson Co., Inc. 216-473-6044
UT Salt Lake City, Sierra Technical Sales 801-566-9719
VA Sterling, Beacon North, Inc. 703-478-2480
WA Bellevue, El Tech 206-746-7780

OPTIMA PRECISION, INC., 775 SW Long Farm Rd., West Linn, OR 97068, Tel: 800-544-4118, 503-638-2525, FAX: 503-638-4545; Empl.: 6

OPTIMATION, See Julie Research Labs

OPTIMIZED DEVICES, INC., 220 Marble Ave., Pleasantville, NY 10570, Tel: 914-769-6100, FAX: 914-741-0729; Empl.: 30

OPTIMUM APPLIED SYSTEMS, 145 Palisade St., Dobbs Ferry, NY 10522-1696, Tel: 914-693-9001; Empl.: 30; *Sls. Mgr.:* H. Joseph Brakl

OPT INDUSTRIES, INC., 300 Red School Lane, Phillipsburg, NJ 08865, Tel: 908-454-2600, FAX: 908-454-3742; Empl.: 290; *Dist. Mgr.:* Sandra Keefe

OPTIVISION, INC., 1477 Drew Ave., Suite 102, Davis, CA 95616, Tel: 916-756-4429, 800-562-8934, FAX: 916-756-1309; Empl.: 19; *Sls. Mgr.:* Kathy Ernest

OPTO DIODE CORP., 750 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-499-0335, FAX: 805-499-8108; FSC No.: 67109; Empl.: 12; *Sls. Mgr.:* Russell Dahl

OPTOELECTRONICS, INC., 5821 N.E. 14th Ave., Ft. Lauderdale, FL 33334, Tel: 305-771-2050, FAX: 305-771-2052; Empl.: 25; *Sls. Mgr.:* L. R. Hufft; *Dist. Mgr.:* L. R. Hufft

OPTOELECTRONICS/TEXTRON, 1309 Dynamic St., Petaluma, CA 94975-0039, Tel: 707-763-5900, FAX: 707-762-7383; Empl.: 125

OPTO PLUS o INC., 23382 Madero, Unit A, Mission Viejo, California, CA 92691, Tel: 714-380-8654, 800-486-6786, FAX: 714-380-0761; Empl.: 7

OPTO TECHNOLOGY, INC., 562 Chaddick Dr., Wheeling, IL 60090, Tel: 708-537-4277, FAX: 708-537-4785; Empl.: 25; *Sls. Mgr.:* Thomas W. Hegberg, Sls. Mgr.

OPTO 22, 15461 Springdale St., Huntington Bch., CA 92649, Tel: 714-891-5861, FAX: 714-893-0867; Empl.: 140

OPTREX

FAX: 213-214-1721

OPTREX/SATORI, 3830 Del Amo Blvd. Ste. 101, Torrance, CA 90503, Tel: 213-214-1791; Empl.: 12; *Sls. Mgr.:* Ken Yoshikawa; *Dist. Mgr.:* Ken Yoshikawa ..... **B•1110-1111**

Local Sales Offices & Reps

AZ Scottsdale, JKA Associates 602-990-8804
CA Santa Clara, Nova-Tronix 408-727-9530
CA Torrance, Satori Elec. 213-378-9478
CO Denver, Aki Entprs. 303-388-4488
CO Denver, AKI Entprs. 303-388-4488
GA Atlanta, Satori Elec. 404-320-8482
OR Portland, Venture Elctrns. 503-624-0617
OR Portland, Venture Elex 503-624-0617
WA Seattle, Venture Elctrns. 206-454-4594
TX Dallas, Satori Elec. 214-518-1946
WA Bellevue, Venture Elex. 206-454-4594
WA Bellvue, Venture Elex 206-454-4594

Local Distributors

CA Buena Park, Cypress Elctrns. 213-744-0355
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Jose, Sierra West 408-435-7477
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Englewood, Cypress Elctrns. 303-792-5829
OR Beaverton, Cypress Elctrns. 503-641-2233
OR Beaverton, I E C 503-641-1690
OR Beaverton, IEC 503-641-1690
WA Bellevue, I.E.C. 206-455-2727
WA Bothell, Cypress Elctrns. 206-483-1144
WA Bothwell, Cypress Elctrns. 206-483-1144

ORAM
High Voltage

FAX: 409-258-5555

ORAM HIGH VOLTAGE, Klemp Road, P.O. Box 1176, Dayton, TX 77535, Tel: 409-258-5553; Empl.: 27; *Sls. Mgr.:* M. Su ..... **D•1916-1917**

ORBIT INDUSTRIES, Countis Industries, 2670 Lockheed Way, Carson City, NV 89706, Tel: 702-882-6123; Empl.: 11; *Sls. Mgr.:* James T. Countis

ORBIT INSTRUMENT CORP., 80 Cabot Ct., Hauppauge, NY 11788, Tel: 516-435-8300, TWX: 510-221-2122, FAX: 516-435-8458; FSC No.: 11263; *Sls. Mgr.:* Jeanne Szabodas

RUGGEDIZED SWITCH PANEL DESIGNS
ORBIT INSTRUMENT CORP.

FAX: 714-527-7552

ORBIT INSTRUMENT OF CAL., Orbit Instrument Corp., 5606 Corporate Ave., Cypress, CA 90630, Tel: 714-527-0561, TWX: 510-221-2122; FSC No.: 11263; *Sls. Mgr.:* Graham Vernon ..... **B•1826; D•1143**

Local Sales Offices & Reps

CA San Diego, D. Cary 619-222-8839
MA Tewksbury, Delcon Sls. 617-851-9911

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FAX: 503-690-9891

ORCAD, 3175 N.W. Aloclek Dr., Hillsboro, OR 97124, Tel: 503-690-9881; Empl.: 60; *Sls. Mgr.:* Scott Gustaff; *Dist. Mgr.:* Kevin O'Lane ..... **D•1125**

Local Distributors

AZ Scottsdale, Tusar 602-988-3688
CA Garden Grove, Advanced Digital Grp. 714-897-0319
CA Santa Clara, Elcor Assocs. 408-980-8868
GA Snellville, Electro-Cadd 404-552-8613
KS Overland Park, Walker Engrg., Inc. 913-888-0089
MA Wilmington, DGA Assocs., Inc. 617-935-3001
MI Bloomfield Hills, MacKellar Assocs. ... 313-335-4440
NJ Manalapan, Beta Lambda, Inc. 201-446-1100
NC Raleigh, Tingen Techn. Sls., Inc. 919-870-6670
OR Portland, AVCOM EDA 408-980-8868
TX Houston, Abcor, Inc. 713-486-9251

ORCUS, Box 16022, Kansas City, MO 64112, Tel: 913-897-5128, TELEX: 4994037, FAX: 913-897-5468; *Sls. Mgr.:* Manford Eaton

OREGON MICRO SYSTEMS, INC., 1800 N.W. 169th Pl., A400, Beaverton, OR 97006, Tel: 503-644-4999, FAX: 503-629-0688; Empl.: 8; *Sls. Mgr.:* Wayne Hunter

ORIEL CORP., 250 Long Beach Blvd., Stratford, CT 06497-0872, Tel: 203-377-8282, TWX: 710-453-8719, FAX: 203-378-2457; Empl.: 149; *Sls. Mgr.:* Thom. Connolly

ORIENTAL MOTOR U.S.A. CORPORATION, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503, Tel: 213-515-2264, TELEX: 664231 ORIENTAL TRNC, FAX: 213-515-2879; Empl.: 45; *Sls. Mgr.:* Don Stephens

ORIENTAL MOTOR USA CORP., Super Vexta, 2580 W. 237th Street, Torrance, CA 90505-5217, Tel: 213-515-2264, TELEX: 664231, FAX: 213-515-2879; Empl.: 4

ORIENTATION INC., 101 Coolidge St., Hudson, MA 01749, Tel: 508-568-0509, FAX: 508-562-3789; *Sls. Mgr.:* Mark Johnson

ORIGINAL ELECTRIC MFG. CO., INC., 123 Lincoln Blvd., Middlesex, NJ 08846, Tel: 201-271-5770, FAX: 201-271-5774

ORION INSTRUMENTS

FAX: 415-327-9881

ORION INSTRUMENTS, INC., 180 Independence Dr., Menlo Park, CA 94025, Tel: 415-327-8800, 800-767-4666, TELEX: 530942; *Sls. Mgr.:* Joe Murdica, VP Sls. ..... **D•1308-1309**

Local Sales Offices & Reps

AL Huntsville, Shivers Instrs. 205-881-7617
AZ Tempe, Aztec Entprs. 602-431-8401
CA Belmont, WDI, Inc. 415-591-6535
CA Redondo Beach, Ward/Davis Assocs. 213-643-6977
CO Denver, Aztec Entprs. 303-779-5285
FL Seminole, Hartek Corp. 813-584-0190
IL Chicago, MacKellar Assocs. 312-243-1400
MD Ellicott City, Technology Sls. 301-461-7802
MI Bloomfield Hills, MacKellar Assocs. ... 313-335-4440
MI Grand Rapids, MacKellar Assocs. 616-956-1177
MO St. Louis, HSES, Inc. 314-567-7565
NH Nashua, MJT Assocs. 603-889-5373
NJ E. Hanover, General Calibration 201-428-2880
NM Albuquerque, Aztec Entprs. 505-262-1688
NY Frankfort, Kapital Instrs. 315-894-4245
NC Apex, Miller Technlgs. 919-362-7587
OH Columbus, MacKellar Assocs. 614-848-3552
OK Tulsa, Scientific Dvcs. SW 918-665-8899
TX Houston, Scientific Devices SW 713-645-4100
TX Richardson, Scientific Dvcs., SW 214-231-8106
UT Salt Lake City, Aztec Entpr. 801-467-4675

Local Distributors

Can Scarborough, Ont., Multitest Elctrns. ... 416-609-8396

ORMEC SYSTEMS CORP., 19 Linden Park, Rochester, NY 14625, Tel: 716-385-3520, FAX: 716-385-5999; Empl.: 50; *Sls. Mgr.:* Gregory Woods

ORTEL CORP., 2015 W. Chestnut St, Alhambra, CA 91803, Tel: 818-281-3636, TELEX: 752434, FAX: 818-281-8231; *Sls. Mgr.:* Bill Moore, V.P. of Sls.

OSBORNE TRANSFORMER, 19636 Derby St., Detroit, MI 48203, Tel: 313-468-9410, FAX: 313-468-4828; Empl.: 20; *Sls. Mgr.:* J. R. Osborne

OSCILLATEK

FAX: 913-829-3505

OSCILLATEK, A Dover Technology Company, 620 North Lindenwood Dr., Olathe, KS 66062, Tel: 913-829-1777; FSC No.: 57693; Empl.: 80; *Sls. Mgr.:* John S. Passiglia ..... **A•1426-1430**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Scottsdale, Thorson Desert States	602-998-2444
CA	Long Beach, L & M Engrg.	714-770-2067
CA	Los Angeles, L & M Engrg.	213-417-3044
CA	San Diego, L & M Engrg.	619-486-1246
CA	San Fernando, L & M Engrg.	805-493-0262
CO	Aurora, Thorson Desert States	303-671-7344
FL	Boca Raton, Beacon Elctrns.	305-997-4518
FL	Clearwater, Beacon Elctrns.	813-796-2378
FL	Longwood, Beacon Elctrns.	305-332-1940
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Barrington, R-Tek	312-382-4600
IN	Ft. Wayne, R-Tek	219-432-8783
IA	Cedar Rapids, Midwest Tech. Sls.	319-365-4011
KS	Gooddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, Addelco Corp.	617-444-4754
NM	Albuquerque, Thorson Desert States	505-293-8555
NY	Fairport, bbd Elctrns., Inc.	716-425-1112
NY	Hartsdale, Spectrum Sls.	914-472-8600
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Miamisburg (Dayton), Elctrn. Comps. Inc.	513-866-3340
OR	Beaverton, Thorson Co. Northwest	503-644-5900
PA	Southampton, Eastern Instrmn. of PA	215-355-7700
TX	Dallas, McDonald Assocs.	214-239-7236
WA	Bellevue, Thorson Co. Northwest	206-455-9180

OSCILLOQUARTZ, B & J Marketing, 17074 Dearborn St., Northridge, CA 91325, Tel: 818-993-0048, TELEX: 650 2068183, FAX: 818-993-5758; Empl.: 125; *Sls. Mgr.:* Alain Jendly

OSHINO LAMPS LIMITED, 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, Japan, Tel: 03-3471-8548, TELEX: 0242-2117, FAX: 03-3450-3939; Empl.: 300; *Sls. Mgr.:* T. Koyama ..... **B•1180-1181**

OSLO CONTROLS, 328 Industrial Ave., Cheshire, CT 06410-1511, Tel: 203-272-2794, FAX: 203-272-3492; *Sls. Mgr.:* J. J. Martinez ..... **B•1761**

Local Sales Offices & Reps

AZ	Phoenix, Western Automation	602-973-2384
CA	Laguna Hills, Western Automation	714-859-6988
CA	Mountain View, Frauman Assoc.	415-964-9464
CO	Englewood, CompuTech Mktg.	303-773-3981
CT	Glastonbury, Pace Assocs.	203-659-2266
FL	Boca Raton, Newell-Hynes	407-392-3186
FL	Deerfield Beach, Newelt Hynes	305-429-3207
GA	Lawrenceville, R.L. Panyik & Assoc.	404-923-3703
IL	Lisle, W-G Controls	708-963-5954
IA	Anamosa, WG Controls	319-462-3456
MN	St. Pauls, Kentronics	612-645-7717
MO	Creve Coeur, Hill & Co.	314-432-1136
NJ	Englewood, Gray Assocs.	201-894-0894
NY	Syracuse, Canavan-Scanlon Assocs., Inc.	315-437-1271
OH	Cincinnati, O. H. Bromberg & Assocs.	513-771-9333
PA	West Chester, All Tech. Mktg.	215-344-0134
TX	Dallas, Glidden Electro Equip.	214-341-0610
WA	Bellevue, MC Assocs.	206-746-7780
Can	Scarborough, Ont., Banke Elctrns.	416-292-5152

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Tempe, LComp., Inc.	602-730-1633
CA	Anaheim, Deco Elctrns., Inc.	714-630-8252
CA	Gardena, California Switch & Signal	1-800-421-2471
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Redwood City, HdB	415-368-1388
CA	San Diego, Deco Elctrns., Inc.	619-693-1595
CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Tustin, Western Switches & Controls, Inc.	714-259-8144
CA	Van Nuys, Wes Garde Components	213-873-4802
CO	Aurora, Jet Elctrn. Supp., Co., Inc.	303-364-1000
CT	Fair Haven, Control Comps.	203-865-0300
CT	Waterbury, Century Elec. Supps., Inc.	203-755-0405
CT	West Hartford, Wes Garde Components	203-527-7705
FL	Lakeland, A A Elec.	800-237-8274
FL	Lakeland, Wes Garde Components	813-644-7564
IL	Addison, LComp., Inc.	312-628-1400
IL	Carol Stream, Wes Garde Components	1-800-323-9431
IL	Crystal Lake, Sub Sem	815-459-4139
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
KS	Overland Park, Wes-Garde	913-262-2718
KS	Wichita, LComp.,Inc.	316-265-5100
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Canton, Impact Sls. Co., Inc.	617-821-1500
MA	Marlboro, Hardware Specialties	508-481-8622
MI	St. Clair Shores, SPEMCO, Inc.	313-771-2700
MN	Minneapolis, Dot Elctrns.	612-861-4561
MN	Minneapolis, Elctrn. Center, Inc.	612-371-5200
MO	Maryland Hgts., LCOMP, Inc.	800-325-1393
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NJ	Mt. Laurel, Wes Garde Components	609-778-8190
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NY	Bohemia, Key Comps.	516-567-7500
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Woodside, Switches Unltd., Inc.	718-478-5000
OH	Shandon, Cartessa Corp.	513-738-4477
OH	Westerville, Wes Garde Components	614-885-0319
TX	Dallas, GEECO Sls. Co.	214-341-0610
TX	Dallas, Wes Garde Components	214-357-1768
WI	Grafton, Lakeview Elctrns.	414-377-8250
WI	Mequon, Taylor Elec.	414-241-4321
Can	Downsview, Ont., Westburne Elctrns.	416-635-2950

OSTBY-BARTON TEST PROBES, 487 Jefferson Blvd., Warwick, RI 02886, Tel: 401-739-7310, TELEX: 927573, TWX: 401-732-4937; Empl.: 75; *Sls. Mgr.:* Joe Burns

OTTO CONTROLS, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, Tel: 708-428-7171, FAX: 708-428-1956; FSC No.: 21649: Empl.: 200; *Sls. Mgr.:* R. E. Sparks ..... **B•1762-1763**

Local Sales Offices & Reps

CO	Denver, Advent Comps. Corp.	303-455-1985
AZ	Scottsdale, Advent Comps. Corp.	602-481-0044
CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	San Jose, Westron Assocs.	408-997-7332
CT	Gulliford, Norris & Assocs.	203-453-1613
GA	Norcross, South Atlantic Comp.	404-447-6154
IL	Itasca, LTD Technlgs., Inc.	708-773-2900
IN	Ft. Wayne, Menze Sls.	219-747-5616
MD	Gaithersburg, Naudain Assocs. Southern, Inc.	301-258-5040
MI	Madison Heights, Pine Sls., Inc.	313-589-0350
MN	Roseville, Vector Comp. Sls.	612-631-1334
MO	Florissant, Spectrum Sls.	314-921-1313
KS	Overland Pk., Spectrum Sls.	913-648-6811
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300
NJ	Hackensack, Coakley, Boyd & Abbett	201-440-4114
NC	Raleigh, S. Atlantic Comp. Sls.	919-859-9970
FL	Orlando, S. Atlantic Comp. Sls.	407-857-3650
TX	Dallas, Control Comps. Corp.	214-458-8877
WA	Bellevue, James Findlay Co.	206-455-9597
WI	Mequon, Badgerep, Inc.	414-241-9200
Can	Toronto, Ont., Wilson Entprs.	416-766-0510

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Tempe, LCOMP	602-730-1633
CA	Gardena, Cal Switch	213-770-2330
CA	Los Angeles, Electric Switches, Inc.	213-660-1310
CA	Santa Ana, Norstan Elctrns.	714-540-4163
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
FL	Orlando, Sager Elctrns.	407-240-3114
FL	Pompano Beach, Peerless Radio Corp.	305-973-4141
IL	Addison, LCOMP	708-628-1400
IL	Carol Stream, Wes-Garde Comps. Grp.	708-653-1460
MD	Columbia, Sager Elctrns.	301-995-6580
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Hingham, Sager Elec. Supp.	617-749-6700
MI	Grand Rapids, RM Elctrns.	616-531-9300
MO	Kansas City, LCOMP	816-241-0111
MO	Maryland Heights, LCOMP	314-291-6200
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NC	Raleigh, Sager Elctrns.	919-850-9550
NC	Winston, Kirkman Elctrns.	919-722-9131
PA	Trevose, Sager Elctrns.	215-638-7491
TX	Dallas, Associated Aircraft Supp.	214-331-4381

OUPIIN AMERICA, INC., 65 W. Easy Street 201, Simi Valley, CA 93065, Tel: 805-520-0862, FAX: 805-520-0864; *Sls. Mgr.:* Randy Ryan

OUTLAND TECHNOLOGY INC., 2144 S. Glencove Ln., Gretna, LA 70056, Tel: 504-394-4354, FAX: 504-394-4354; Empl.: 4; *Sls. Mgr.:* George J. Mayfield; *Dist. Mgr.:* George J. Mayfield

OUTLOOK TECHNOLOGY, INC., 200 E. Hacienda Ave., Campbell, CA 95008, Tel: 408-374-2990, TELEX: 350479, FAX: 408-374-9273; *Sls. Mgr.:* Walter A. Klees

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Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	EL toro, Marktronix	714-858-0632
CA	Los Angeles, Martronix	213-782-7826
CA	San Mateo, Melvin Sls.	415-349-7445
DC	Towson, Dickison Sales Co.	301-823-0923
FL	Longwood, D. Assocs.	407-830-8976
FL	Maitland, Ellis & Assocs.	407-645-11-1
GA	Atlanta, L & D Inc.	404-395-7079
KS	Lexena, MIDTEC Associates	913-541-0505
MD	Towson, Dickison Sls. Co.	301-823-0923
MA	Milton, Naton Assocs.	617-698-0670
NJ	Paramus, Eltech Sls.	201-967-1309
NY	Buffalo, Quality Comps.	716-837-5430
NC	Greensboro, L & D, Inc.	919-292-3201
NC	Raleigh, L&D Inc.	919-876-5301
TN	Bristol, L&D Inc.	615-878-2266
TX	Euless, W. Pat Fralia Co.	817-354-1144
WA	Seattle, Eltech, Inc.	206-643-4330
Can	Mississauga, Vitel Electronics	416-676-9720

OVEN INDUSTRIES, 207 Hempt Rd., P.O. Box 290, Mechanicsburg, PA 17055, Tel: 717-766-0721, FAX: 717-766-4786; FSC No.: 21302; Empl.: 60; *Sls. Mgr.:* T. M. Nolan

OXLEY INC., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, Tel: 203-488-1033, FAX: 203-481-6971; FSC No.: 3R006; *Sls. Mgr.:* Carol Carr .... **A•1705; B•1025, 1179, 1335; C•1479**

Local Sales Offices & Reps

CA	Irvine, Balzer Wolf Assocs.	714-261-6877
CA	Sunny Vale, Stout Inds.	408-746-0470
MN	St. Paul, Hanks	612-484-8531
PA	Paoli, Stitzer Co. Inc.	215-644-5500
TX	Richardson, Eagle Marketing	214-238-5383

PACCOM, 3928 148th NE, Redmond, WA 98052, Tel: 206-883-9200, 800-426-6254, TWX: 910-449-2973, FAX: 206-881-0508; Empl.: 20; *Sls. Mgr.:* B. Rudd

PACE INC., 9893 Brewers Ct., Laurel, MD 20723-1990, Tel: 301-490-9860, TELEX: 198296, FAX: 301-498-3252; *Sls. Mgr.:* James K. Bausell

PACER INDUSTRIES, INC., 1450 First Ave., Chippewa Falls, WI 54729, Tel: 715-723-1141, TELEX: 284755, FAX: 715-723-7890; FSC No.: 60162; Empl.: 13; *Sls. Mgr.:* Patrick Brennan; *Dist. Mgr.:* Patrick Brennan

PACER SYSTEMS, INC., 900 Technology Park Dr., Billercia, MA 01821, Tel: 508-667-8800, FAX: 508-663-5155; Empl.: 325; *Sls. Mgr.:* E. Childress

PACIFIC ATLANTIC ELCTRNS., Patronix, Inc., Box 754, El Cerrito, CA 94530, Tel: 415-237-5837, FAX: 415-524-9267; Empl.: 4; *Sls. Mgr.:* P. Yen; *Dist. Mgr.:* P. Yen

PACIFIC COAST CIRCUITS, INC., 189 Granada Dr., San Luis Obispo, CA 93401, Tel: 805-544-4881, FAX: 805-544-6475; FSC No.: 66107; Empl.: 18; *Sls. Mgr.:* Chris Cofer

PACIFIC COIL CO., Inductor Supp., Inc., 430 E. 19th St., Bakersfield, CA 93305-5495, Tel: 805-323-7714, 800-332-COIL, FAX: 805-325-9732; Empl.: 23

PACIFIC COMMUNICATIONS, 2041 S. Grand Ave., Santa Ana, CA 92705, Tel: 714-546-0147, FAX: 714-546-0084; Empl.: 60

PACIFIC ELECTRICORD, 747 W. Redondo Bch. Blvd., Gardena, CA 90247, Tel: 213-532-6600, TWX: 910-346-7619, FAX: 213-532-5044; Empl.: 1000; *Sls. Mgr.:* Alan Manzo; *Dist. Mgr.:* Alan Manzo

PACIFIC ELECTRO DYNAMICS, INC., 11465 Willows Rd. N.E., Redmond, WA 98073-9745, Tel: 206-881-1700, TWX: 901-449-29-77; Empl.: 420

PACIFIC INDUSTRIAL COMPONENTS CORP., See Altair Exchange Corp.

PACIFIC INDUSTRIAL COMPONENTS CORP., 19201 Parthenia St. No.E, Northridge, CA 91324, Tel: 818-775-1007, FAX: 818-701-5508; *Sls. Mgr.:* Ray Pross ..... **B•1036**

Local Sales Offices & Reps

IL	Elk Grove Village, Pacific Comps.	708-228-0030

PACIFIC INSTRUMENTS INC., 215 Mason Circle, Concord, CA 94520, Tel: 415-827-9010, FAX: 415-827-9023; Empl.: 40

PACIFIC MAGNETICS CORP., 2602 Transportation Ave., Ste. G, National City, CA 92050, Tel: 619-474-8216, FAX: 619-474-3979; *Sls. Mgr.:* Mary Hill

PACIFIC MICROCOMPUTERS, Signal Technology, 5855 Oberlin Dr. Ste. B, San Diego, CA 92121, Tel: 619-453-8649; Empl.: 15; *Sls. Mgr.:* Guy Halac

PACIFIC
POWER SOURCE CORP

FAX: 714-891-1928

PACIFIC POWER SOURCE CORP., 15122 Bolsa Chica St., Huntington Bch., CA 92649, Tel: 714-898-2691, 800-854-2433; FSC No.: 57148; Empl.: 50; *Sls. Mgr.:* Russ Engle ..... **D•2216-2221**

Local Sales Offices & Reps

AL	Huntsville, W A Brown Instrs.	205-830-9224
CA	San Jose, Amasco Corp.	408-262-1500
CA	Torrance, Amasco Corp.	213-781-9494
CO	Denver, Aztec Entprs.	303-779-5285
AZ	Tempe, Aztec Entprs.	602-431-8401
FL	Ft. Lauderdale, W. A. Brown Instrs.	305-581-6444
FL	Melbourne, W.A. Instrs.	407-723-0766
FL	Orlando, W.A. Brown Instrs.	407-648-9660
GA	Norcross, W.A. Brown Instrs.	404-449-7160
IL	Arlington Hgts., Comtel Midwest	708-392-4040
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest Co.	913-268-0762
MA	Hopkinton, Eastern Sys. Inc.	508-435-2151
MI	Plymouth, EQS Sys.	313-455-7920
MO	St. Louis, Comtel Midwest Co.	314-227-7220
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Liverpool, Northern Tech. Sls. Assocs., Inc.	315-451-1091
NY	Wantagh, Bytec Reps.	516-781-7400
NC	Cary, W.A. Brown Instrs.	919-460-1120
OH	Chesterland, EQS Sys.	216-729-2222
OH	Dayton, EQS Sys.	513-236-7676
OR	Portland, Westcon	503-283-0132
NJ	Fairfax, Sci. Reps.,Inc.	609-662-5222
PA	Huntingdon Valley, Sci-Rep Inc.	215-322-6500
PA	Pittsburgh, EQS Sys.	800-729-8084
TX	El Paso, Aztec Entprs.	505-262-1688
VA	Fairfax, Sci-Rep, Inc.	703-385-0600
WA	Kent, Westcon, Inc.	206-824-8922
Can	Ottawa, Ont., Multitest Midwest Elctrns.	613-727-0848
UT	Salt Lake City, Aztec Entprs., Inc.	801-467-4675
WI	New Berlin, Comtel Midwest Co.	414-544-6042
Can	Scarborough, Ont., Multitest Elctrns.	416-609-8396
Can	St. Laurent, PQ, Multitest Elctrns.	514-337-0723

PACIFIC RESISTOR CO., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, FAX: 818-345-1507; FSC No.: 06416; *Sls. Mgr.:* Douglas Trewhitt ... **A•1968-1970**

Local Sales Offices & Reps

CA	San Jose, Comtech Mktg.	408-294-5448

Local Distributors

CA	San Jose, Comtech Mktg.	408-294-5448

PACIFIC SCIENTIFIC CO., 4301 Kishwaukee, Rockford, IL 61109, Tel: 815-226-3100, TELEX: 386743, FAX: 815-226-3122; Empl.: 400; *Dist. Mgr.:* Steve Earley

PACIFIC SCIENTIFIC, Electro Kinetics Division, 402 E. Gutierrez St., Santa Barbara, CA 93101, Tel: 805-963-2055, TWX: 910-334-1177; Empl.: 220; *Sls. Mgr.:* Robert E. Lynch

PACIFIC TRANSDUCER CORP., 2301 Federal, Los Angeles, CA 90064-1482, Tel: 213-478-1134, FAX: 213-312-0826; Empl.: 22; *Sls. Mgr.:* Laura Barba

PACIFIC TRANSFORMER CORP., 4750 Wesley Dr., Anaheim, CA 92807, Tel: 1-800-325-0501, FAX: 714-779-0718; Empl.: 75

PACITEC®
Division of LaFrance Corp

FAX: 215-365-4420

PACTEC, LaFrance Corp., Enterprise & Executive Avenues, Philadelphia, PA 19153, Tel: 215-365-8400; Empl.: 503; *Sls. Mgr.:* J. Singer .... **C•1002, 1070-1076**

Local Sales Offices & Reps

AL	Huntsville, Scott Ray	205-883-2159
CA	Anaheim, Jonathan Winters	714-779-8092
CA	San Jose, Michael Bennett	408-943-0360
FL	Palm Harbor, Roger Hauck	813-784-7895
IL	Lisle, Jim McCloskey	708-969-8821
MA	Burlington, Jim Craig	617-221-4824
EXP	Philadelphia, PA, PacTec Export Sls. Dept.	215-365-8400
NJ	Merchantville, Bill Boucot	609-488-9086
NC	Thomasville, Keith Pierce	919-472-2030
OH	Perrysburg, Bruce Brown	419-874-1110
TX	Dallas, Craig LaDue	214-340-6288
WA	Seattle, Mike Werttemberger	206-363-9899
WI	Appleton, Ed Sabish	414-731-7212

Local Distributors

AL	Birmingham, American Elctrns. Supp.	205-942-4656
AZ	Tempe, Circut Specialists, Inc.	602-966-0764
CA	Anaheim, R&D Elctrns.	714-773-0240
CA	Burbank, Electronic City	213-842-5275
CA	Canoga Park, Sandy's Elctrns. Supp.	213-346-8353
CA	Carpenteria, Electronic Resources	805-684-5439
CA	Costa Mesa, Marvac	714-540-3280
CA	El Segundo, Force Elctrns.	213-772-1324
CA	El Toro, R-Vac	714-586-1210
CA	Gardena, California Switch & Signal	213-538-9830
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Diego, Southland Comps.	619-673-3800
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Rose Elctrns.	408-943-0200
CA	Santa Clara, Force Elctrns.	408-435-1324
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CA	Vallejo, Zackit (Vallejo)	707-644-6676
CO	Aurora, Jet Elctrn. Supp.	303-364-1000
CO	Littleton, Display's Plus	303-730-7333
CT	Wallingford, Midstate Elctrns.	203-265-9900
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
CT	Wallingford, Utronics, Inc. Coghlin	203-265-2724
DE	Wilmington, Wholesale Elctrns. Inc.	302-656-9988
FL	Largo, Electronic Precepts of FL	813-544-3636
FL	Longwood, Intertec Comps.	305-834-7777
FL	Tampa, Sunex Elctrns.	813-885-4074
FL	West Palm Beach, Nurmi Elctrns.	305-686-8553
GA	Norcross, American Elctrn. Supp.	800-562-8740
GA	Norcross, Dow Elctrns., Inc.	404-448-4004
GA	Norcross, EMSCO	404-925-8366
HI	Honolulu, Precision Radio, Ltd.	808-537-5291
ID	Boise, Radar Elec.	208-336-2227
IL	Berwyn, BB & W Inc.	312-242-1533
IL	Champaign, Klaus Radio	217-356-1896
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove, Martec Assocs.	312-956-8090
IL	Mt. Prospect, Tri State Elctrns.	312-255-0600
IL	Northbrook, Classic Comps.	312-291-0019
IL	Peoria, Klaus Radio	309-691-4840
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Meunier Elctrns.	317-635-3511
IA	Cedar Rapids, Iowa Radio Supply	319-393-4510
MD	Beltsville, P.S.I.	301-937-4960
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Westborough, In-Stock Products Co.	508-870-5750
MI	Grand Rapids, S. F. Elctrns.	616-459-0216
MI	Livonia, RS Elctrns.	313-525-1155
MI	Taylor, Tel Van Elctrn. Supp.	313-291-3515
MN	Minneapolis, AEI Elctrn. Parts	612-338-4754
MN	Minneapolis, Berquist	612-835-2322
MN	New Brighton, Parts I	612-633-8079
MO	Kansas City, Walters Indl. Elctrns.	816-531-7015
NE	Lincoln, Scott Elctrns.	402-466-8221
NH	Salem, Sager Elctrl. Supp.	603-898-1348
NJ	Rockaway, Tonar Inds., Inc.	201-586-9000
NM	Albuquerque, Walker Elctrns. Supp.	505-883-2992
NY	Buffalo, Summit Distr.	716-887-2800
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Rochester, Masline Elctrns., Inc.	716-546-5373
NY	Rochester, Summit Distr.	716-334-8110
NC	Raleigh, Sager Svc. Plus Elctrns.	919-850-9550
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, R. S. Elctrns.	513-793-2450
OH	Cleveland, Roberts Elctrns.	216-238-1711
OH	Columbus, Hughes-Peters	614-294-5351
OK	Tulsa, Radio Inc.	918-587-9123
OR	Beaverton, Rose Elctrns	503-629-9288
OR	Portland, Radar Elec.	503-232-3404
PA	Exton, VSH Elctrns.	215-363-2250
PA	Mars, Sager Elctrns.	412-772-2233
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Force Elctrns.	214-247-9955
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Ft. Worth, Tandy Natl. Pts.	817-870-5600
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Richardson, Off-the-Shelf Comps.	214-238-0808
UT	Salt Lake City, Standard Supp.	801-486-3371

VA Charlottesville, Virginia Elctrn. Comps. 804-296-4184
WA Seattle, Radar Elec. 206-282-2511
WI Grafton, Lake View Elctrns. Corp. 414-377-8250
WI Milwaukee, Industrial Elctrns., Inc. 414-276-1212
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Classic Comps. Supp., Inc. 414-786-5300
WI Oshkosh, Electronic Inds., Inc. 414-235-8930
Can Burnaby, BC, Intek Elctrns. 604-294-8100
Can Mississauga, Ont., Rush Elctrns. 416-677-7280
Can Pointe Claire, Future Elctrns. 514-694-7710
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Vancouver, BC, Future Elctrns. 604-294-1166
Can Victoria, BC, Queale Elctrns., Ltd. 604-388-6111

PAINE CORPORATION, 2401 S. Bayview St., Seattle, WA 98144, Tel: 206-329-8600, 800-426-0366, FAX: 206-329-1615; FSC No.: 13624; Empl.: 93; *Sls. Mgr.:* John Sagvold

PAKTRON, See ITW Paktron

PAK-TRONIC, See Tracor Paktronics

PAKTRONICS CONTROLS, INC., P.O. Box 185669, Ft. Worth, TX 76181, Tel: 817-284-5241, FAX: 817-284-1712; Empl.: 30; *Sls. Mgr.:* D. R. Sundberg, Acting

PALADIN CORP., 3543 Old Conejo Rd., No.101-102, Newbury Park, CA 91320, Tel: 805-499-0318, FAX: 805-499-4006; Empl.: 20; *Sls. Mgr.:* Scott Allen

PALOMAR ENGINEERS, Box 455, Escondido, CA 92033, Tel: 619-747-3343, FAX: 619-747-3346; Empl.: 9

PAMRAN INC., 1900 Williams St., Young Ind. Pk., Racine, WI 53404, Tel: 414-637-7999, FAX: 414-637-2303; FSC No.: K 8-67203; Empl.: 28; *Sls. Mgr.:* R. C. Pfeil

PANAMETRICS, 221 Cresent St., Waltham, MA 02154-3497, Tel: 617-899-2740, TELEX: 6817337, TWX: 951006, FAX: 617-899-1552; Empl.: 200; *Sls. Mgr.:* Bob Mel

PANASONIC FACTORY AUTOMATION CO., Matsushita Elect. Corp. of America, 9401 W. Grand Ave., Franklin Park, IL 60131, Tel: 708-452-2410, 708-452-2650, FAX: 708-452-2575; *Sls. Mgr.:* Art Hagiwara

Panasonic

FAX: 201-392-4782

PANASONIC INDUSTRIAL CO., Battery Sales GP, Box 1511, Secaucus, NJ 07096-1511, Tel: 201-348-5266; Empl.: 25 ..... **D•1470-1475**

Local Sales Offices & Reps

AZ Scottsdale, Dar-C 602-948-2240
CA Glendale, Halbar Assocs. Inc. 818-246-8263
CA Pleasanton, Moulthrop Sls. Inc. 415-463-0450
CA San Diego, Tauber & Assocs. 619-274-7242
MA Burlington, Conti-Younger Assocs. Inc. 617-273-1582
MN Eden Prairie, Electro Mark Inc. 612-944-5850
OH Beachwood, Elctrn. Salesmasters Inc. 216-831-9555
OR Beaverton, Advanced Power Prods. ... 503-646-0994

Local Distributors

AL Huntsville, Resistacap Inc. 205-883-4270
AZ Scottsdale, Electro Mktg. 602-991-0110
CA San Diego, Tauber Elctrns. Inc. 619-274-7242
CA San Jose, Rose Elec. Distrbg. Co. 408-943-0440
CA Santa Clara, Cypress Elctrns. Inc. 408-980-2500
CA Van Nuys, NESCO 818-781-0505
CO Englewood, AVT 303-779-8056
CT Woodbury, Cell Technlg. 203-575-1103
FL St. Petersburg, Micro Precision 813-854-2861
GA Norcross, Applied Power, Inc. 404-263-0421
IL Morton Grove, Power Pak Inc. 312-966-6000
IL Palatine, Ohm Elctrns. 708-359-9686
IN Indianapolis, Bell Inds. 317-634-8200
MD Beltsville, Mark Elctrns. 301-792-0072
MA Canton, Impact Sls. Co. Inc. 617-821-1500
MI Danvers, Generation Elctrns. Inc. 508-683-1177
MI Brighton, Applied Power Inc. 313-227-3604
MN Thief River Falls, Digi-Key 800-344-4539
MN Minneapolis, Stark Elctrns. Supp. Inc. 612-332-1325
NJ Camden, Gen. Radio 609-964-8560
NJ Clifton, Engineered Assem. 201-288-4477
NC Raleigh, Engrd. Assemblies Inc. 919-790-9700
NC Winston Salem, Kirkman Elctrns. 800-334-0158
OH Columbia, Promark Elctrns. Inc. 614-876-8885
OH Columbus, Hughes-Peters 614-294-5351
OR Beaverton, Micro Power 503-626-7086
TX Dallas, Computer Comps. Corp. 214-239-0271
TX Dallas, Norvell Elctrns. Inc. 214-233-0020
TX Fort Worth, Allied Elctrns. 817-336-5401
WI Mequon, Taylor Elec. Co. 414-241-4321

PANASONIC INDUSTRIAL COMPANY, Custom Peripheral Dept., Two Panasonic Way, Secaucus, NJ 07094, Tel: 201-392-6313, FAX: 201-348-7849; *Dist. Mgr.:* Edmund Silvia Jr., Prod. Mgr.

PANASONIC INDUSTRIAL CO., 1616 McCandless Dr., Milpitas, CA 95035, Tel: 408-946-7200, FAX: 408-946-3753

PANAVISE PRODUCTS, INC., 1485 Southern Way, Sparks, NV 89431, Tel: 702-353-2900, FAX: 702-353-2929; Empl.: 35; *Sls. Mgr.:* Mark Thorsell; *Dist. Mgr.:* Mark Thorsell

PANDUIT CORP., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, Tel: 800-777-3300, FAX: 708-532-1811; FSC No.: ;06383; Empl.: 2000 .... **C•1480-1482, 1800-1802**

Local Sales Offices & Reps

AL Birmingham, Frank Parker & Assocs. 205-655-4801
AL Mobile, Frank Parker & Assocs. 205-675-7213
AK Anchorage, Bar Elec. Agt. 907-562-0011
AZ Phoenix, Maddox Sls. 602-437-1002
AR Little Rock, Byron Carson Co. 501-663-6870
CA Los Altos, Ewing-Foley, Inc. 415-941-4525
CA Los Angeles, Maddox Sls. 213-949-7400
CA Sacramento, Ewing-Foley, Inc. 916-885-6591
CO Denver, Panduit Corp. 800-777-3300
CT Glastonbury, Panduit Corp. 203-657-4105
DC Washington, Agency Group, Inc. 301-858-1600
FL Ft. Lauderdale, Panduit Corp. 800-282-9209
FL Orlando, Panduit Corp. 800-282-9209
GA Atlanta, Panduit Corp. 404-256-5940
HI Honolulu, PEFCO, Inc. 808-832-0000
IL Burr Ridge, Panduit Corp. 708-887-1000
IN Indianapolis, Panduit Corp. 800-777-3300
KS Kansas City, Panduit Corp. 800-777-3300
KY Louisville, A. L. Pickens Co. 502-491-4215
LA Baton Rouge, Wells-Keown & Assocs. 504-292-6578
LA New Orleans, Wells- Keown & Assocs. 504-733-0301
LA Shreveport, Wells-Keown & Assocs. .. 318-688-6040
MD Baltimore, Agency Group, Inc. 301-793-0023
MA N. Andover, Panduit Corp. 508-681-0451
MI Fraser, Panduit Corp. 313-791-1700
MI Grand Rapids, Panduit Corp. 800-777-3300
MN Minneapolis, Electric Comp. Sls. 612-933-2594
MO St. Louis, Panduit Corp. 314-894-7800
NE Omaha, Panduit Corp. 402-391-0452
NV Las Vegas, Maddox Sls. 702-870-1151
NJ Leonia, Panduit Corp. 201-461-7790
NM Albuquerque, F P Sls. 505-345-5553
NY Buffalo, Panduit Corp. 800-777-3300
NY Rochester, Panduit Corp. 800-777-3300
NY Schenectady, Panduit Corp. 800-777-3300
NY Syracuse, Panduit Corp. 800-777-3300
NC Raleigh, L. G. White Southern 919-872-6049
NC Winston-Salem, L. G. White Southern 919-725-3612
OH Cincinnati, Panduit Corp. 800-777-3300
OH Cleveland, Panduit Corp. 800-777-3300
OH Columbus, Panduit Corp. 614-888-6224
OK Oklahoma City, Elctrl. Prods. of Okla. 405-842-8371
OR Portland, Panduit Corp. 503-654-9455
PA Philadelphia, Kunz, Powell & Assoc. .. 215-296-9490
PA Pittsburgh, Cody Assocs., Inc. 412-787-5336
SC Greenville, L. G. White Southern 803-271-0630
TN Memphis, Byron Carson Co. 901-276-0614
TN Nashville, Panduit Corp. 800-777-3300
TX Dallas, Panduit Corp. 214-518-0004
TX Houston, Panduit Corp. 713-686-5600
UT Salt Lake City, Ray Walker Co. 801-973-7454
VA Richmond, L. G. White Southern 804-752-7055
WA Seattle, Panduit Corp. 800-777-3300
WA Spokane, Lighting, Inc. 509-467-6650
WI Appleton, H. Mercer Co. 414-739-6223
WI Milwaukee, Panduit Corp. 800-777-3300
PR Santurce, L. Gandia & Assocs. 809-725-3473
Can Markham, Ont., Panduit Canada Ltd. .. 416-475-6922

PANEL COMPONENTS CORPORATION

FAX: 707-578-5478

PANEL COMPONENTS CORP., P.O. Box 6626M, Santa Rosa, CA 95406, Tel: 707-523-0600; Empl.: 25 ..... **A•2316; B•1382-1383; C•1484-1492, 1804-1809; D•2222**

Local Sales Offices & Reps

AL Huntsville, DHR Mktg. Inc. 205-722-0440
CA Santa Clara, Ross Mktg. Assoc. 408-988-8111
CA Tustin, Schoenbachler-Dobson Co. ... 714-544-1888
CO Englewood, Omega Ltd. 303-762-1921
GA Duluth, DHR Mktg., Inc. 404-564-0529
IL Northbrook, Raines & Assocs. 708-498-0890
IA Marion, M-S-B Assocs., Inc. 319-377-6261
KS Roeland Park, M-S-B Assocs., Inc. 913-432-2131
MA Scituate, Olsen Tech. Sls. 617-545-5101
MN St. Paul, Arkco Sls. 612-777-7454
MO St. Louis, M-S-B Assocs., Inc. 314-946-5577
NJ Kenvil, CFE/Gray 201-927-6662
NY Victor, Net Sls. 716-924-1844
NC Raleigh, DHR Mktg., Inc. 919-829-1970
OH Medina, Rockford Controls 216-725-3705
OR McMinnville, Electro-Design 503-472-0481
PA Philadelphia, Eastern Sci. Mktg. 215-368-4570
SC Greenville, DHR Mktg. Inc. 803-235-3594
TX Lewisville, Jim Hughes Co. 214-221-1536
WA Redmond, Electro-Design 206-867-9300
EXP Burnaby, B.C., Darmac Agencies, Ltd. 604-520-7121
Can Ottawa, Ont., Ellam & Assoc. 613-727-3892

PANELTEC, 3307 Edward Ave., Santa Clara, CA 95054, Tel: 408-496-1175, FAX: 408-970-1277; Empl.: 65

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FAX: 714-989-9935

PAN INTERNATIONAL (USA), INC., 9477 E. Archibald Ave., Rancho Cucamonga, CA 91730, Tel: 714-945-1365; Empl.: 21; *Sls. Mgr.:* Barry Park; *Dist. Mgr.:* Barry Park, Natl. Sls. Mgr. ..... **C•1810-1812; D•1107**

Local Sales Offices & Reps

CA	San Jose, Enhance Sls.	408-293-2425
CO	Littleton, Taylor Mktg.	303-850-0207
NH	Londonderry, RJR Assoc.	603-437-6343
TX	Garland, Hamilton & Savarese	214-271-4003
UT	Ogden, Taylor Mktg.	801-546-9570

Local Distributors

CA	San Jose, Enhance Sls.	408-293-2425
NH	Londonderry, RJR Assoc.	603-437-6343

PAN-MAGNETICS, See Tamura Corp. of America

PAPST

FAX: 401-849-4640

PAPST MECHATRONIC CORP., Aquidneck Indl. Pk., Newport, RI 02840, Tel: 401-849-8810; Empl.: 30 ..... **C•1654-1659**

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Phoenix, Jr. Engrg. Sls., Inc.	602-956-4670
CA	Foster City, Papst Mechatronic Corp.	415-571-9591
CA	Los Gatos, Luscombe Engrg. Co of San Francisco	408-370-2020
CA	Montrose, Luscombe Engrg. Co. of So. Calif.	818-249-9000
CA	San Diego, Luscombe Engrg. Co. of So. Calif.	619-549-9699
CO	Englewood, Quorum 3	303-799-8100
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Altamonte Springs, Over & Over, Inc.	407-332-1222
GA	Norcross, Over & Pver, Inc.	404-449-6205
IL	Arlington Heights, Brainard-Wilson Mktg; Inc.	708-437-2700
IL	Arlington Heights, Papst Mechatronic Corp.	708-981-1404,FAX:708-981-1642
IL	Arlington Hgts., Brainard-Wilson Mktg.	708-437-2700
IN	Indianapolis, Elctrn. Mktg. Consits.	317-921-3450
IA	Marion, MSB Assocs. Inc.	319-377-6261
KS	Shawnee Mission, MSB Assocs., Inc.	913-432-2131
MA	Needham, Sturgeon Tech. Sls.	617-444-6603
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NJ	Englewood, Harold Gray Assocs., Inc.	201-894-0894
NY	Johnson City, Tech-Mark, Inc.	607-729-6340
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Utica, Tech-Mark, Inc.	315-733-0575
NC	Charlotte, Over & Over, Inc.	704-542-9111
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Portland, Venture Elctrns.	503-624-0617
PA	Knoxville, Trinkle Sls., Inc.	215-922-2080
RI	Newport, Papst Mechatronic Corp.	401-849-8810
TX	Dallas, JYSCO/Comps., Inc. (except El Paso)	214-349-1650
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Pickering, Ont., A.C. Simmonds & Sons, Ltd.	416-839-8041

PARAGON ELECTRIC CO., INC., 606 Parkway Blvd., Two Rivers, WI 54241, Tel: 414-793-1161, TELEX: 26-3450, FAX: 414-793-3736; Empl.: 500; *Sls. Mgr.:* Don Karman

PARALINE

FAX: 818-281-5867

PARA-LINE TRANSFORMER CO., INC., 511 South Palm Ave., Alhambra, CA 91803, Tel: 818-281-0222; FSC No.: 59465 ..... **A•2317**

PARKER HANNIFIN CORP., 17325 Euclid Ave., Cleveland, OH 44112-1290, Tel: 800-272-7537, 800-C-PARKER, TELEX: 980636; Empl.: 33,225

PARKER HANNIFIN CORP., Compumotor Div., 5500 Business Park Dr., Rohnert Pk., CA 94928, Tel: 707-584-7558, FAX: 707-584-8015

PARKER HANNIFIN CORP., Daedal Div., P.O. Box 500, Sandy Hill Road, Harrison City, PA 15636, Tel: 412-744-4451, FAX: 412-744-7626

PARKER HANNIFIN CORP., Filter Division, 16810 Fulton County Rd. No.2, Metamora, OH 43540, Tel: 419-644-4311, FAX: 419-644-6205

PARKER HANNIFIN CORP., Fluidpower Pump Division, 100 Parker Drive, Ostego, MI 49078-1495, Tel: 616-694-9411, FAX: 616-694-4638

PARKER HANNIFIN CORP., Hose Products Division, 30240 Lakeland Blvd., Wickliffe, OH 44092, Tel: 216-943-5700, FAX: 216-943-7088

PARKER HANNIFIN CORP., Hydraulic Valve Division, 520 Ternes Ave., Elyria, OH 44035, Tel: 216-366-5100, FAX: 216-366-5253

PARKER HANNIFIN CORP., Instrumentation Connectors Div., 9400 S. Memorial Pkwy., Huntsville, AL 35802, Tel: 205-881-2040, FAX: 205-881-5730

PARKER HANNIFIN CORP. PARFLEX DIVISION, 1300 N. Freedom Street, Ravenna, OH 44266, Tel: 216-296-2871, FAX: 216-296-8433

PARKER HANNIFIN CORP. PNEUMATIC DIV., 8676 E M-89, Richland, MI 49083, Tel: 616-694-9411, FAX: 616-629-5385

PARKER HANNIFIN CORP., Refrigerating Specialties Division, 2445 South 25th Ave., Broadview, IL 60153, Tel: 708-681-6300, FAX: 708-681-6300 Ext.315

PARKER HANNIFIN CORP., Rotary Actuator Division, 135 Quadral Drive, Wadsworth, OH 44281-0450, Tel: 216-336-3511, FAX: 216-334-3335

PARKER HANNIFIN CORP., Schrader Bellows Division, 200 W. Exchange Street, Akron, OH 44309-0631, Tel: 216-375-5202, FAX: 1-800-446-7451

PARKER HANNIFIN CORP., Seal Group, 18321 Jamboree Rd., P.O. Box C-19510, Irvine, CA 92713, Tel: 714-851-3763, FAX: 714-851-2127

PARKER HANNIFIN CORP., Tube Fittings, 3885 Gateway Blvd., Columbus, OH 43228, Tel: 614-279-7070, FAX: 614-279-7685

PARKER MCCRORY MFG. CO., 2000 Forest Ave., Kansas City, MO 64108, Tel: 816-221-2000, FAX: 816-221-9879; *Sls. Mgr.:* Ken Turner; *Dist. Mgr.:* Ken Turner

PARKER SEAL GROUP, 18321 Jamboree Road, Irvine, California 92715, Tel: 714-851-3763, FAX: 714-851-2127; Empl.: 2,200; *Sls. Mgr.:* Joe Vicic; *Dist. Mgr.:* John Dick

Local Sales Offices & Reps

CA	Arcadia, Van Gott & Assocs.	818-445-9728
TX	Dallas, Glitsh Special Prods.	214-631-0120

Local Distributors

AL	Birmingham, Alabama Seal & Packing	205-879-7225
AZ	Phoenix, State Seal Co.	602-437-1532
CA	Garden Grove, Cal-State Seal & Fluid Comps., Inc.	714-554-9080
CA	La Mirada, Ad-Tech Seal, Inc.	213-921-6608
CA	San Leandro, Nor-Cal Seal Co.	415-568-7371
CA	Woodland Hills, Valley Seal Co.	213-873-3630
CO	Englewood, Aspen Seal & Packing	303-761-9049
CT	Newington, Niantic Rubber Co.	203-666-5661
GA	Atlanta, United Seal & Rubber	404-729-8880
GA	Hapeville, Go-Air, Inc.	404-768-1121
IN	Indianapolis, Seal Prods., Inc.	317-633-7277
MA	Northborough, Hope Co.	508-393-7660
MA	Woburn, Seal Distrbn. Ctr.	617-491-0100
MI	Farmington Hills, Roger Zatkoff Co., Inc.	313-478-2400
MI	Grand Rapids, Roger Zatkoff Co., Inc.	616-698-6880
MI	Kalamazoo, Depatie Fluid Power Co.	616-381-4590
NY	Rochester, Web Seal, Inc.	716-546-1320
NC	Raleigh, Smith Seal of North Carolina	919-790-1000
OH	Holland, Roger Zatkoff Co.	419-866-1600
OR	Portland, Air-Oil Prods.	503-234-0866
PA	Allentown, Staver Hydraulics Co., Inc.	215-837-1818
PA	Exton, Staver Hydraulics Co., Inc.	215-594-0540
PA	Newton, D.B.R. Inds.	215-968-6100
RI	Cranston, Niantic Rubber Co.	401-942-0900
TX	Arlington, Texas Seal Supp. Co.	817-640-1193
TX	Houston, Parker Seal Distrbn. Ctr.	713-649-7592
Can	Mississauga, D & D Packing & Seals	416-625-2033
Can	Mississauga, Sealtech Supply, Inc.	416-238-5885
Can	Port Credit, Seals Unlimited, Inc.	416-278-1326
Can	Ville St. Laurent, Les Joints & Garnitures D & D	514-745-4044
Can	Ville St. Laurent, Les Joints Entanches R.B	514-334-2220

Since 1922

FAX: 718-774-0583

PAR METAL PRODUCTS, INC., Par Industrial Complex, 1246 Atlantic Ave., Brooklyn, NY 11216, Tel: 718-774-5900, TELEX: 424 823 SNDS UI ATTN:PAR; FSC No.: 3449;3469; Empl.: 100; *Sls. Mgr.:* J. Troiano ..... **C•1077**

PARSONS MANUFACTURING, 1055 O'Brien Dr., Menlo Park, CA 94025-1476, Tel: 415-324-4726, FAX: 415-324-3051; Empl.: 45; *Sls. Mgr.:* S. Wurzer

PARSYTEC INC., Bldg. 9, Unit60, 245 W. Roosevelt Rd., West Chicago, IL 60185, Tel: 708-293-9500, FAX: 708-293-9525; Empl.: 8; *Sls. Mgr.:* Reinhard Rinn

PARVEX SERVO SYSTEMS, GEC Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977, Tel: 914-425-6908, FAX: 914-425-6314

PASO SOUND PRODUCTS, 14 First St, Pelham, NY 10803, Tel: 914-738-4800, FAX: 914-738-3954; Empl.: 18; *Sls. Mgr.:* Ken O'Brien

PASS & SEYMOUR/LEGRAND, Pass & Seymour/Inc., P.O. Box 4822, Syracuse, NY 13221, Tel: 315-468-6211, TELEX: 93-7232, FAX: 315-468-6305; Empl.: 1700; *Sls. Mgr.:* Sergio Palluci, Sls. Mgr./Kristin Northrop, Prod. Mgr.

PASTERNACK ENTERPRISES, P.O. Box 16759, Irvine, CA 92713, Tel: 714-261-1920, FAX: 714-261-7451; FSC No.: 53919; *Sls. Mgr.:* Elayne Wilson

PATTON-MACGUYER INC., 17 Virginia Ave., Providence, RI 02905, Tel: 401-941-6000, FAX: 401-941-5290; FSC No.: 77147; Empl.: 45; *Sls. Mgr.:* F. Spunzo

PAVE TECHNOLOGY CO., INC., 2751 Thunderhawk Ct., Dayton, OH 45414-3445, Tel: 513-890-1100, FAX: 513-890-5165

PAYNE ENGINEERING, Box 70, Scott Depot, WV 25560, Tel: 304-757-7353, TELEX: 88-5452, FAX: 304-757-7305; Empl.: 40; *Sls. Mgr.:* R. B. Vogelbach

PCA ELECTRONICS, 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-892-0761, TWX: 910-496-1525, FAX: 818-894-5791; FSC No.: 97722; Empl.: 45; *Sls. Mgr.:* Nand Aggarwal ..... **A•1589-1594, 2318-2322**

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
CA	Irvine, Ramsey & Assocs.	714-851-2340
CA	San Diego, Ramsey & Assocs.	619-451-8865
CA	San Jose, Arnold Techn. Sls.	408-954-0400
FL	Ft. Lauderdale, Sunland Assoc.	305-561-1303

FL Goldenrod, Sunland Assocs. 305-365-9533
IL Westchester, Emtronics, Inc. 312-345-6500
IL Wheaton, Emtronics, Inc. 708-665-6222
IN Carmel, Emtronics, Inc. 317-848-2016
MA Sudbury, KSA of New England 508-443-5881
MN Bloomington, Bill Deming and Assocs. 612-888-5000
MS Meridan, Southeast Tech. Grp. 601-485-7055
AL Huntsville, Southeast Tech. Grp. 205-534-2376
GA Lawrenceville, Southeast Tech. Grp. .. 404-979-2055
NC Zebulon, Southeast Tech. Grp. 919-269-5589
OH Beavercreek, Electro-Com 513-299-0864
OH Dayton, Electro-Com 513-898-5140
OR Tigard, Elctrn. Comp. Sls. 503-245-2342
PA Exton, Linear Sls. 215-524-8080
TX Dallas, Blackburn Assocs. 214-750-8484
UT Salt Lake City, Sage Sls. 801-467-5451
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

Local Distributors

CA Buena Pk., Cypress Elctrns. Inc. 714-521-5230
CA San Diego, Cypress Elctrns. Inc. 619-535-0011
CA San Jose, Cypress Elctrns. 408-980-2500
CA Santa Clara, Cypress Elctrns. Inc. 408-980-8400
CA Sherman Oaks, DLDI-Delay Lines Distrs. 818-986-9455
CO Englewood, Cypress Elctrns. 303-792-5829
CO Wheatridge, Cypress Elctrns. Inc. 303-431-2622
MA Sudbury, ASK Elctrns. 508-443-5880
NJ Rockaway, NASCO Elctrns. 201-625-7777
OR Beaverton, Cypress Elctrns. 503-641-2233
OR Portland, Cypress Elctrns. 503-223-8900
PA Exton, VSH Elctrns. 215-363-2250
WA Bothwell, Cypress Elctrns. 206-483-1140

P.C. BOARDS, INC., 210 West Main, Chanute, KS 66720, Tel: 316-431-0406, FAX: 316-431-2013; Empl.: 43; *Sls. Mgr.:* Greg Bilyeu

PCB PIEZOTRONICS, 3425 Walden Ave., Depew, NY 14043-2495, Tel: 716-684-0001, TWX: 710-263-1371, FAX: 716-684-0987; Empl.: 210; *Sls. Mgr.:* John Lally

PCD, 2 Technology Dr., Peabody, MA 01960, Tel: 508-532-8800, FAX: 508-532-6800; FSC No.: 58982; *Sls. Mgr.:* A. Arcisz

P C EXPRESS, INC., 15103 U.S. Hwy. 19, Hudson, FL 34667, Tel: 813-863-6114; Empl.: 15

PCI, INC., 1530 Parkmoor Ave.-Ste. A, San Jose, CA 95128, Tel: 408-282-0200, FAX: 408-282-0216; Empl.: 2500; *Sls. Mgr.:* Mike Clarke; *Dist. Mgr.:* Jane Campbell

PCK ELASTOMERICS, INC., See Elastomeric Technologies, Inc.

PC TRANSFORMER CORP., 64 D Nancy St., West Babylon, NY 11704, Tel: 516-491-3300, FAX: 516-491-3689; FSC No.: 62281; Empl.: 15; *Sls. Mgr.:* Stanley L. Goldstein ..... **A•2324-2331**

PDS TECHNOLOGIES, See Power-Pac

PEARL TECHNOLOGY, 1000 E. William St.-Ste. 100, Carson City, NV 89701, Tel: 702-883-1979, FAX: 702-883-4874

PEARSON ELECTRONICS, INC., 1860 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-494-6444, TELEX: 171-412, FAX: 415-494-6716; FSC No.: 05280; Empl.: 23; *Sls. Mgr.:* Michelle Kelsey ..... **A•2332**

PECA, INC., 592 Winks Lane, Bensalem, PA 19020, Tel: 215-245-1550, FAX: 215-639-3545; Empl.: 30; *Sls. Mgr.:* Jean Douglass

THE PEDRO COMPANIES, 104 E. 10th St., St. Paul, MN 55101, Tel: 612-224-9491, FAX: 612-224-8674; Empl.: 1000; *Sls. Mgr.:* Douglas Bieniek

PEERLESS, 19 Wilbur St., Lynbrook, NY 11563, Tel: 516-593-2121, 1-800-645-2268

PEER PROTOCOLS, 3176 Pullman, Ste. 101, Costa Mesa, CA 92626, Tel: 714-662-1929, FAX: 714-662-1437; Empl.: 10; *Sls. Mgr.:* Don Bergis

PENBERTHY, INC., De Vlieg-Bullard, P.O. Box 112, Locust St., Prophetstown, IL 61277, Tel: 815-537-2311, TWX: 257-339 PMCO PRWN, FAX: 815-537-5764; Empl.: 160; *Sls. Mgr.:* Craig Hagel

PENFIELD, INC., 8 West St., Plantsville, CT 06479, Tel: 203-621-9141, TWX: 5101003285, ESYLNK: 6287757, FAX: 203-621-2380; Empl.: 77; *Sls. Mgr.:* Gary Zoccolante; *Dist. Mgr.:* Gary Zoccolante

PENN ENGINEERING & MANUFACTURING CORP., 5190 Old Easton Rd. PO Box 1000, Danboro, PA 18916, Tel: 215-766-8853, 800-237-4736, FAX: 215-766-0143; FSC No.: CAGE 46384; Empl.: 850; *Sls. Mgr.:* John E. O'Brien

PENN KEYSTONE CORP., 30 N. Plains Ind. Ste.13, Wallingford, CT 06492, Tel: 203-294-0537, FAX: 203-294-0361; FSC No.: 03034; *Sls. Mgr.:* Robert Ginter

PENN-TRAN CORP.,SUB. OF SPECTRUM ELCTRNS. INC., Box 1321, Rte. 144N, Wingate, PA 16880, Tel: 814-355-1521, FAX: 814-355-1524; FSC No.: 50783; Empl.: 80; *Sls. Mgr.:* Jeffrey Krauss ..... **D•1918**

Local Sales Offices & Reps

CA Los Altos, Cain-White & Co. 415-948-6533
CA Pasadena, A-F Sls. Engrg., Inc. 213-681-5631
MN Minneapolis, International Sls. Co. 612-831-8423
OR Portland, Intertech Sls. 503-775-7885
PA Glenside, Koebert Assocs., Inc. 215-887-2310
TX Dallas, Seaton Corp. 214-980-9860

PENNY & GILES, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401, Tel: 213-393-1497, TELEX: 65-2337; *Dist. Mgr.:* Rose Riedel Prod. Mgr.

Penny+Giles

FAX: 404-740-0420

PENNY & GILES DATA SYSTEMS, INC., 1250 Northmeadow Pkwy., Ste. 114, Roswell, GA 30076, Tel: 404-740-0415, FAX: 404-740-0420 ..... **D•1310**

Local Sales Offices & Reps

AZ Tempe, Scientific Dvcs.-West 602-730-9774
GA Atlanta, Magard & Assocs. 404-451-8862
CA Huntington Bch., Scientific Dvcs.-West 714-840-3501
CA San Jose, P & M Elctrns. 408-287-0402
CO Denver, Scientific Dvcs.-West 303-469-5145
IL Chicago, Sector Eng. 312-530-7850
IN Indianapolis, Sector Eng. 317-253-9221
MD Annapolis, Blackwood Associates 301-269-1676
MA Andover, Saret Assocs. 508-475-9332
MN Minneapolis, Sector Eng. 612-378-2123
NM Albuquerque, Scientific Dvcs.-West ... 505-883-3668
NC Raleigh, Lee Assoc./Carolinas 919-848-8818
OH Columbus, Robert Cloon Assocs. 614-459-2890
PA Philadelphia, G.L. Williams Assocs. 609-428-6060
TX Dallas, Scientific Dvcs.-Southwest 214-231-8106
WA Seattle, Scientific Dvcs.-West 206-637-0945
WI Milwaukee, Sector Eng. 414-352-8280
Can Ontario, Giga-Tron Assocs. Ltd. 613-225-4090

PENRIL DATACOMM NETWORKS, 1300 Quince Orchard Blvd., Gaithersburg, MD 20878, Tel: 301-921-8600, TWX: 710-828-0522; Empl.: 200

PENSTOCK ENGINEERING LABS., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, Tel: 408-730-0300, 800-PENSTOCK, FAX: 408-730-4782; Empl.: 46; *Sls. Mgr.:* Steve Ulett; *Dist. Mgr.:* Steven Ulett

Local Sales Offices & Reps

CA Sunnyvale, Penstock, Inc. 800-PENSTOCK

Local Distributors

AZ Phoenix, Penstock Desert Sls. 800-PENSTOCK
CA Anaheim, Penstock, Inc. 800-PENSTOCK
CA Beverly Hills, Penstock, Inc. 800-PENSTOCK
CA San Diego, Penstock, Inc. 800-PENSTOCK
CA Sunnyvale, Penstock Intl. 800-PENSTOCK
CA Sunnyvale, Penstock, Inc. 800-PENSTOCK
CO Denver, Penstock, Inc. 800-PENSTOCK
IL Palatine, Penstock Midwest 800-PENSTOCK
IN Indianapolis, Penstock, Inc. 800-PENSTOCK
NJ Fairfield, Penstock East 800-PENSTOCK
NJ Teterboro, Penstock East 800-PENSTOCK
OR Portland, Penstock Northwest 800-PENSTOCK
UT Salt Lake City, Penstock, Inc. 800-PENSTOCK
WA Bellevue, Penstock Northwest 800-PENSTOCK
EXP CA/Sunnyvale, Penstock Intl. 800-PENSTOCK
Can Vancouver, BC, Penstock Canada 604-662-3475

PERCEPTICS CORP., 725 Pellissippi Parkway, Knoxville, TN 37922, Tel: 615-966-9200, FAX: 615-966-9330; Empl.: 90; *Sls. Mgr.:* J.R. Johnson; *Dist. Mgr.:* J.R. Johnson

PENTICA SYSTEMS, INC., One Kendall Sq., Bldg. 200, 4th Floor, Cambridge, MA 02139, Tel: 617-577-1101, FAX: 617-494-9162; Empl.: 4

PERCON, INC., 1710 Willow Creek Circle, Ste. 37, Eugene, OR 97402-9153, Tel: 1-800-8-PERCON, 503-344-1189, FAX: 503-344-1399; Empl.: 26; *Sls. Mgr.:* Nonie Mansfield, Sls.; *Dist. Mgr.:* Dean VanPeursem, V.P. Mktg/Sls.

PERFECT GEAR & INSTRUMENT, Designatronics, Inc., 2101 Jericho Tpk., New Hyde Park, NY 11040, Tel: 516-328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 210; *Sls. Mgr.:* Murray Ores

PERFECTION MICA CO., See Magnetic Shield Corp.

PERFORMANCE CONTROLS, INC., 433 Caredean Drive, Horsham, PA 19044, Tel: 215-675-6500, TELEX: 88-1478, FAX: 215-674-8714; FSC No.: 61773; Empl.: 40

PERIPHERALS, 1363 Logan Ave., Costa Mesa, CA 92626, Tel: 714-540-4925, 800-468-6888, FAX: 714-540-2026; Empl.: 20; *Sls. Mgr.:* Elizabeth O'Rouke

PERKIN-ELMER CORP., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, Tel: 203-762-4786, TWX: 710-468-3213; Empl.: 70; *Sls. Mgr.:* D. P. Duggan

PERMALUSTER, INC., 1844 N. Keystone St., Burbank, CA 91504, Tel: 213-849-4543, 213-849-6454, FAX: 818-566-4232; Empl.: 6; *Sls. Mgr.:* J. Ross

PERMA POWER ELCTRNS., 5601 W. Howard Ave., Chicago, IL 60648, Tel: 312-763-0763, FAX: 312-763-8330; Empl.: 80/100; *Sls. Mgr.:* Michael Shatz; *Dist. Mgr.:* Michael Shatz

Local Distributors

CA Los Angeles, Marshall Ind. 800-522-0084
IL Chicago, Newark Elctrns. 800-367-3573
TX Ft. Worth, Allied Elctrns. 800-433-5700

PERRY AMPLIFIER, 138 Fuller St., Brookline, MA 02146, Tel: 617-734-0844; Empl.: 18; *Sls. Mgr.:* N. Geskos

PERX,INC., 525 Tamal Plaza, Corte Madera, CA 94925, Tel: 415-927-0155, FAX: 415-927-0159; Empl.: 5

PETER PARTS & ASSOCS., 82 E. Main St., Webster, NY 14580, Tel: 716-265-2540, FAX: 716-265-2542; *Sls. Mgr.:* Peter Parts

PFC, See Southern Elctrns. Co. Inc.

P.G. ELECTRONICS LTD., 800 Arrow Rd., 8, Weston, Ont., Canada M9M2Z8, Tel: 416-741-7682, FAX: 416-741-9927; FSC No.: 38243

PHASE CONTROL ELECTRONICS, 87-27 Myrtle Ave., Glendale, NY 11385, Tel: 718-441-4278; Empl.: 16; *Sls. Mgr.:* Jack Stanley

PHELPS DODGE MAGNET WIRE, P.O. Box 600, Ft. Wayne, IN 46801, Tel: 219-458-4444, 800-255-CLIC (2542), TWX: 810-332-1506, FAX: 219-422-1667; *Sls. Mgr.:* G. H. Guyer

PHENIX TECHNOLOGIES, Central Garrett Ind'l. Pk., Accident, MD 21520, Tel: 301-746-8118, FAX: 301-895-5570; Empl.: 35; *Sls. Mgr.:* Bill Robeson

PHILADELPHIA INSULATED WIRE CO. INC., 333 New Albany Rd., Moorestown, NJ 08057, Tel: 800-257-8357, 609-235-6700, FAX: 609-235-5480; Empl.: 150; *Sls. Mgr.:* Glenn McCleery

PHILIPS AUDIO VIDEO SYS. CORP., See AKG Acoustics

PHILIPS CIRCUIT ASSEMBLIES:A DIVISION OF NORTH AMERICAN PHILIPS CORP., 2601 S. Moorland Rd., New Berlin, WI 53151, Tel: 414-785-6506, TWX: 910-262-3032, FAX: 414-785-6516

PHILIPS CIRCUIT ASSEMBLIES, 3602 W. Waters Avenue, Tampa, FL 33614-2797, Tel: 813-933-5113, TELEX: 3727509, FAX: 813-932-1373; *Sls. Mgr.:* C. Maslona

PHILIPS CIRCUIT ASSEMBLIES:NORTH AMERICAN PHILIPS CORP., 100 Providence Pike, Slatersville, RI 02876-2078, Tel: 401-762-3800, FAX: 401-762-2324

Philips Components
Discrete Products Division
A North American Philips Company

FAX: 407-881-3300

PHILIPS COMPONENTS DISCRETE PRODUCTS DIVISION, A North American Philips Company, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404, Tel: 407-881-3200, TELEX: 136461, TWX: 810-848-0228; *Dist. Mgr.:* Jess Hall ..... **A•1124-1128, 1286-1287, 1289-1292, 1972-1974, 2100-2116; B•1026-1027, 1112-1113, 1336-1338, 1856-1857**

Local Sales Offices & Reps

AL	Huntsville, Over & Over Inc.	205-837-7105
AZ	Tempe, Philips Comps.	602-820-2225
CA	Anaheim, Philips Comps.	714-441-0385
CA	Folsom, Webster Assocs.	916-989-0843
CA	Harbor City, Refrigeration Comp.	213-325-3420
CA	Mission Hills, Philips Comps.	818-891-6299
CA	San Diego, Philips Comps.	619-453-0332
CA	Santa Clara, Philips Comps.	408-748-1563
CA	Sunnyvale, Philips Comps.	408-746-2066/2808
CO	Englewood, Philips Comps.	303-779-9696
FL	Altamonte Springs, Philips Comps.	407-339-5073
FL	Ft. Lauderdale, Philips Comps.	305-485-0115
GA	Norcross, Over & Over, Inc.	404-449-6205
GA	Roswell, Philips Comps.	404-992-0150
IL	Bannockburn, GMR Sls., Inc.	312-295-8440
IL	Rolling Meadows, Philips Comps.	708-670-9494
IN	Fort Wayne, Corrao Marsh, Inc.	219-482-2725
IN	Green Field, Corrao Marsh, Inc.	317-462-4446
IN	Kokomo, Philips Comps.	317-456-1615
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Merriam, Lorenz Sls., Inc.	913-384-6556
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Woburn, Philips Comps.	617-932-4748
MI	Farmington Hills, Philips Comps.	313-553-6000
MN	Minneapolis, Electric Comp. Sls., Inc.	612-933-2594
MO	St. Louis, Lorenz Sls., Inc.	314-997-4558
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660
NJ	Englewood Cliffs, ED Glass Assocs.	201-592-0200
NJ	Parsippany, Philips Comps.	201-455-1507
NY	Binghamton, Empire Tech. Assoc., Inc.	607-772-0651
NY	East Rochester, Empire Tech. Assoc., Inc.	716-381-8500
NY	Port Ewen, Empire Tech. Assoc., Inc.	914-331-5553
NY	Skaneateles, Empire Tech. Assoc., Inc.	315-685-5703
NC	Charlotte, Over & Over, Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
NC	Raleigh, Philips Comps.	919-782-3334
OH	Dayton, Philips Comps.	513-436-0066
OH	Wickliffe, Philips Comps.	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Willow Grove, Philips Comps.	215-659-6069
TX	Austin, Philips Comps.	512-331-8828
TX	Houston, Philips Comps.	713-987-0034
TX	Richardson, Philips Comps.	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	Milwaukee, Philips Comps.	414-228-7632
PR	Caparra Hgts., M. Anderson Co. Inc.	809-793-6544
Can	Scarborough, Ont., Philips Comps.	416-292-5161

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 5083 Kings Hwy., Saugerties, NY 12477, Tel: 914-246-2811, TWX: 510-247-5410, FAX: 914-246-2811(Ext 427); FSC No.: 02114; *Sls. Mgr.:* B. Grindle ..... **A•1286-1292**

Local Distributors

CA	Canoga Park, Philips Comps. Magnetic Prods.Svc.Ctrs.	1-800-343-1370
IL	Rolling Meadows, Philips Comps. Magnetic Prods. Svc. Ctrs	1-800-241-7667
MA	Norwood, Philips Comps. Magnetic Prods.Svc.Ctrs.	1-800-367-8083
NY	Woodstock, Elna Ferrite	914-246-5861
PA	West Conshohocken, Eastern Comps.	215-825-8610

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 5900 Australian Avenue, W. Palm Bch., FL 33407, Tel: 407-863-1800, TELEX: 820677, FAX: 407-863-1811 ..... **A•1124**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 6071 St. Andrews Rd., Columbia, SC 29212-3198, Tel: 803-772-2500, TELEX: 805024, FAX: 803-772-2445; *Sls. Mgr.:* Bill Cvirko ..... **A•1125-1126**

DC Aluminum Electrolytic Capacitors(Computer Grade, Radial)Indl. & Consumer AC Motor Starts, Film Capacitors (Film/Foil, Metallized) Tantalum Capacitors (Foil) Film Trimmer Capacitors

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV, A North American Company, 6-D Founders, El Paso, TX 79906, Tel: 915-775-4200, FAX: 915-775-4249 ..... **A•1128**

See Philips Components, Riviera Beach

PHILIPS COMPONENTS DISCRETE PRODUCTS DIVISION, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, Tel: 817-325-7871, FAX: GPR 817-325-1052 SPR 817-325-8397; *Sls. Mgr.:* Tom McKelvy ... **A•1972-1973**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A NORTH AMERICAN PHILIPS CO., Professional Components Grp, 100 Providence Pike, Slatersville, RI 02876, Tel: 401-762-3800, FAX: 401-762-4497(mktg); FSC No.: 73445 ..... **B•1112-1113**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A NORTH AMERICAN PHILIPS CO., Discrete Semiconductor Group, 100 Providence Pike, Slatersville, RI 02876-2078, Tel: 401-762-3800, FAX: 401-767-4497 ..... **A•2100-2109, 2111-2116; B•1112-1113, 1336-1338**

PhilipsECG
A North American Philips Company

FAX: 717-323-4691

PHILIPS ECG, North American Philips Co., 1025 Westminster Dr., Williamsport, PA 17701, Tel: 717-323-4691; *Sls. Mgr.:* L.R. Brophy, Gen. Mgr. Mktg.; *Dist. Mgr.:* E. H. Frost ..... **A•2118-2119**

Local Sales Offices & Reps

CA	Anaheim, Philips ECG	714-441-0385
CA	Santa Clara, Philips ECG	408-727-6132
FL	Maitland, Hutto Hawkins Assoc.	407-831-2474
FL	Tampa, Hutto Hawkins Assoc.	813-251-2970
GA	Atlanta, Millar Elctrns.	404-634-3350
MA	Woburn, Philips ECG	617-932-4748
MI	Farmington Hills, R.C. Merchant & Co.	313-476-4600
MO	Kansas City, Philips ECG	816-741-4019
NY	Seneca Falls, Philips ECG	315-568-5432
NC	Raleigh, Millar Elec., Inc.	919-828-8840
OH	Dayton, Philips ECG	513-436-0066
PA	Willow Grove, Philips ECG	215-659-6096
TX	Richardson, Philips ECG	214-231-8274
Can	Dorval, Que., ECG Canada Inc.	514-685-5800

For distributor information, call 1-800-225-8326. (In Massachusetts, call 1-890-6107.)

Local Distributors

MA	For Distributor information,call	800-526-9354

PHILMORE MANUFACTURING, 2240 15th St. P.O. Box 6386, Rockford, IL 61125-1386, Tel: 815-229-7773, FAX: 815-229-7785; Empl.: 18

PHI TECHNOLOGIES, INC., 4605 North Stiles, Oklahoma City, OK 73105, Tel: 405-521-9000, TWX: 910-831-3286, FAX: 405-524-4254; Empl.: 40; *Sls. Mgr.:* Robert P. Gelernter ..... **D•1048-1049**

Local Sales Offices & Reps

CA	North Hollywood, Martin & Assocs.	213-872-1990
DC	Gans & Pugh Assoc.	703-527-3262
MA	Wenham, Ellis Assoc.	508-468-4990

PHOENIX CONTACT INC., P.O. Box 4100, Harrisburg, PA 17111, Tel: 717-944-1300, FAX: 717-944-1625; *Sls. Mgr.:* Howard C. Minnick, Jr.; *Dist. Mgr.:* Mark F. Gilliford

PHOENIX DATA, INC., 3384 W. Osborn Rd., Phoenix, AZ 85017, Tel: 602-278-8528, 800-828-4327, FAX: 602-278-8679; Empl.: 55; *Sls. Mgr.:* David Norgord

PHOENIX MICROSYSTEMS, 991 Discovery Dr., Huntsville, AL 35806, Tel: 205-922-1200, TELEX: 752592, FAX: 205-837-1256; Empl.: 180

PHOENIX WIRE, INC., 100 Teflon Ave., S. Hero, VT 05486, Tel: 802-372-4561; Empl.: 25; *Sls. Mgr.:* Ohmer Corbin; *Dist. Mgr.:* Ohmer Corbin ..... **C•1813**

PHONON CORPORATION, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070, Tel: 203-651-0211, TELEX: 294705, FAX: 203-651-8618; FSC No.: 6Y858; Empl.: 24

PHOTON, INC., 1115 Space Park Dr., Santa Clara, CA 95054-3432, Tel: 408-492-9449, FAX: 408-492-9659; *Sls. Mgr.:* J. M. Darchuk

PHOTON SOURCES, INC., See Lumonics Material Processing Corp.

PHOTO RESEARCH:KOLLMORGEN, 9330 DeSoto Ave./PO Box 2192, Chatsworth, CA 91313-2192, Tel: 818-341-5151, TELEX: 69-1427; FSC No.: 92434; Empl.: 90; *Sls. Mgr.:* M. L. Woolsey

PHO-TRONICS DIV., E. R. Wagner Mfg. Co., 8701 W. Bradley Rd., Milwaukee, WI 53224, Tel: 414-355-6704, FAX: 414-355-0593; Empl.: 155; *Sls. Mgr.:* Steven J. O'Brien, Sls./Mktg. Mgr.

PHYSICS INTERNATIONAL CO., Olin Defense Systems Grp., 2700 Merced St., San Leandro, CA 94577, Tel: 415-577-7236, TWX: 910-366-7033; Empl.: 360

PIC DESIGN, Remington Technologies, Inc., P.O. Box 1004, Middlebury, CT 06762, Tel: 203-758-8272, TWX: 910-997-0989, FAX: 203-758-8271; FSC No.: 00141; Empl.: 105; *Sls. Mgr.:* Gary Hampton

PICO Electronics, Inc.

FAX: 914-699-5565

PICO ELECTRONICS, INC., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, Tel: 914-699-5514, 800-431-1064; FSC No.: 31669; *Sls. Mgr.:* Joe Sweeney ..... **A•1236-1246, 2333-2366; D•1919-1959**

Local Sales Offices & Reps

CA	Santa Clara, Fisher Assocs.	408-733-7350
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665/1264
WA	Seattle, W. Spaulding Co.	206-282-9173

FAX: 508-649-9643

PICONICS, INCORPORATED, 26 Cummings Road, Tyngsboro, MA 01879, Tel: 508-649-7501, TELEX: 754759; FSC No.: 26618; Empl.: 48; *Sls. Mgr.:* V. Dibiase ..... **A•1248-1249, 1975**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Scottsdale, Semper-Fi Sls.	602-730-9553
CA	N. Hollywood, Jewett Co.	818-789-8103
CA	Palo Alto, J/M Assocs.	415-857-1260
CO	Parker, Mikro Sls. Co.	303-841-4131
FL	Lighthouse Point, R.C. Simon & Co.	305-941-2757
IL	No. IL.& WI, R.H.I. Sls.	708-888-0099
IN	Huntington, Ellet Sls.	219-356-1866
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Natick, Wayland Engrg. Sls. Co.	508-655-6080
MN	Minneapolis, Peterson Sls. Assocs.	612-835-5281
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NY	Huntington, Regulus Indl. Sls. Co.	516-673-6252
NY	Rochester, Welch/Mulgahy Inc.	716-244-1100
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Cincinnati, G & H Sls. Co.	513-272-0580
PA	Glenside, Koebert Assocs. Inc.	215-887-2310
TX	Ft. Worth, El-Tec Sls.	817-268-2896
WA	Belleview, Reptronix	206-820-0833
WV	Inwood, Koebert & Assocs., Inc.	304-229-8401

PICOSECOND PULSE LABS, INC., P.O. Box 44, Boulder, CO 80306, Tel: 303-443-1249, FAX: 303-447-2236; Empl.: 6; *Sls. Mgr.:* J.R. Andrews; *Dist. Mgr.:* J.R. Andrews

PIEZO CRYSTAL CO., 100 K St., Box 619 , Carlisle, PA 17013, Tel: 717-249-2151, FAX: 717-249-7861; FSC No.: 74306; Empl.: 250; *Sls. Mgr.:* Glenn R. Kurzenknabe

PIEZO ELECTRIC PRODUCTS, INC., 212 Durham Ave., Metuchen, NJ 08840, Tel: 908-548-2800, TWX: 710-998-0592, FAX: 908-548-3625; Empl.: 75; *Sls. Mgr.:* M.R. Scarillo

PIEZO KINETICS INC., P.O. Box 756, Pine and Mill Streets, Bellefonte, PA 16823, Tel: 814-355-1593, FAX: 814-355-4342; FSC No.: 5Y690; Empl.: 28; *Sls. Mgr.:* Harry D. Shirey

PIEZO TECHNOLOGY INC., 2525 Shader Rd., Orlando, FL 32804, Tel: 407-298-2000, TWX: 810-850-4136, FAX: 407-293-2979; FSC No.: 25120; *Sls. Mgr.:* Paul Dechen

PIHER INTERNATIONAL CORP., 903 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 708-390-6680, 800-323-6693, FAX: 708-390-9866; FSC No.: 54869; Empl.: 25; *Sls. Mgr.:* Kimberly Mack, Sls. Supp. Mgr.

PILLAR INDUSTRIES, INC., 1780 Evergreen Street, Duarte, CA 91010, Tel: 818-358-1337, FAX: 818-358-0398; Empl.: 3 ..... **D•1960-1961**

Local Sales Offices & Reps

CA Los Angeles, Power Partner, Inc. 213-215-0800
CA Santa Cruz, LEREP 408-458-0667

PIND TESTERS INC., 19-B Thomas, Irvine, CA 92718, Tel: 714-380-1551, FAX: 714-951-1269; FSC No.: 66; Empl.: 25; *Sls. Mgr.:* J. Baker

PINE INSTRUMENT CO., 101 Industrial Dr., Grove City, PA 16127, Tel: 412-458-6391, FAX: 412-458-4648; Empl.: 60

PIONEER COMPONENTS, 2352 E. 66th St., Brooklyn, NY 11234, Tel: 718-444-3880; Empl.: 3; *Sls. Mgr.:* Michael R. Verter; *Dist. Mgr.:* Michael R. Verter

Pioneer Magnetics

FAX: 213-453-3929

PIONEER MAGNETICS, 1745 Berkeley St., Santa Monica, CA 90404, Tel: 213-829-6751, TELEX: 182-093, TWX: 910-343-6249; FSC No.: 08676; Empl.: 475; *Sls. Mgr.:* A. Hagiwara, V.P. of Mktg. ..... **D•1963-1965**

Local Sales Offices & Reps

AL Huntsville, Pen-Tech Assocs. 205-881-9298
AZ Scottsdale, Williams Assocs. 602-947-4297
CA Santa Monica, Pioneer Magnetics, Inc. 213-829-6751
CO Commerce City, Williams Assocs. 303-289-5647
FL Boca Raton, Pen-Tech Assocs. 305-394-7400
GA Marietta, Pen-Tech Assocs. 404-424-1931
MD Columbia, Stein Instrmn. 301-596-3748
MA Needham Hts., Kanan Assoc. 617-449-7400
MI Ann Arbor, KRW Sls., Inc. 313-769-0056
MN St. Paul, Cahill, Schmitz & Cahill 612-636-7217
MO Lee's Summit, Omni Tech. Sls. 816-578-4221
NJ Glen Gardner, Daner-Hayes Inc. 201-537-4534
NM Albuquerque, Williams Assocs. 505-255-1368
NY Brewster, Daner-Hayes Inc. 914-279-2168
NY E. Norwich, Daner-Hayes Inc. 516-922-0080
NC Greensboro, Pen-Tech Assocs. 919-852-6000
OH Dublin, KRW Sls. Inc. 614-885-2598
OH Westlake, KRW Sales 216-871-7521
OR Lake Oswego, RTS, Inc. 503-244-4123
PA Cheltenham, Stein Instrm. 215-379-1990
PA Oakmont, KRW Sls. Inc. 412-828-1490
TX Dallas, Kruvand 214-437-3355
UT Salt Lake City, Williams Assocs. 801-485-6511
WA Vashon, RTS, Inc. 206-285-1363
Can LaSalle, Electrodesign Ltd. 514-363-0245

PIONEER RESEARCH, INC., 1745 Berkeley St., Santa Monica, CA 90404, Tel: 213-829-6751, FAX: 213-453-3929; Empl.: 450; *Sls. Mgr.:* A. Hagiwara

PIRELLI CABLE CORP., See Specialty Cable Corp.

PITTMAN®

FAX: 215-256-1338

PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, Tel: 215-256-6601; FSC No.: 98938; Empl.: 165 ..... **B•1308-1309**

Local Sales Offices & Reps

AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA Leucadia, Halbar Assocs. 619-942-4075
CA San Mateo, Halbar North, Inc. 415-349-4700
CA Van Nuys, Halbar Assocs. 818-906-3941
CO Englewood, Integrated Motion Sys. 303-792-5516
CT Bristol, M. L. Assocs., Inc. 203-589-2856
FL Fort Lauderdale, Motion Controls, Inc. 305-434-4197
IL Mount Prospect, K-W Assocs. 708-253-6680
IN Elkhart, Shaum Mfg., Inc. 219-264-0771
MA Wayland, M. L. Assocs. 508-358-5540
NY Glen Head, Marcus Sls. Assocs., Inc. 516-671-6820
NY Rochester, Application Spec. 716-586-6226
OH Cleveland, Servo-Mark 216-871-2353
OK Edmond, Motion Reps, Inc. 405-340-8100
PA Exton, Kiley Elect. Co., Inc. 215-363-8550
TX Austin, Motion Reps, Inc. 512-288-5758
TX Denton, Motion Reps, Inc. 817-382-4159
TX Houston, Motion Reps, Inc. 713-981-8700
WA Redmond, Halbar PNW, Inc. 206-882-0990
Can Downsview, Ont., Electomate Indl. Sls. Ltd. 416-665-0221

PIXELWORKS, INC., 7 Park Ave., Hudson, NH 03051, Tel: 603-880-1322, FAX: 603-880-6558; Empl.: 30; *Sls. Mgr.:* Rattan Dhar; *Dist. Mgr.:* Rattan Dhar

PLAINVIEW BATTERIES, INC., 23 Newtown Rd., Plainview, NY 11803, Tel: 516-249-2873, FAX: 516-249-2876; *Sls. Mgr.:* B. Erde ..... **D•1476-1479**

PLAINVIEW ELECTRONICS, See Plainview Battieries, Inc.

PLANAR SYSTEMS, INC., 1400 N.W. Compton Dr., Beaverton, OR 97006-1992, Tel: 503-690-1100, TELEX: 551961 Planer Syst, FAX: 503-645-7024; FSC No.: 5Z179; Empl.: 121; *Sls. Mgr.:* Jeff Hopkins

PLANT SPECIALTIES, INC., P.O. Box 110537, Carrollton, TX 75011-0537, Tel: 214-245-9673, FAX: 214-245-9673; *Sls. Mgr.:* J. E. Bryer

PLASMA RESEARCH CORP., 5675 Chappell Pl., Oakland, CA 94619, Tel: 415-530-1468, FAX: 415-530-2811; FSC No.: 8Y067; Empl.: 7

PLASTIC CAPACITORS, INC., 2623 N. Pulaski Rd., Chicago, IL 60639, Tel: 312-489-2229, FAX: 312-489-0496; FSC No.: 99120; Empl.: 90; *Sls. Mgr.:* Thomas J. Brown; *Dist. Mgr.:* Thomas J. Brown

PLASTIC FORMING, 20 S. Bradley Rd., Woodridge, CT 06525, Tel: 203-397-1338, TELEX: 963437, FAX: 203-389-0420; Empl.: 80; *Sls. Mgr.:* Bruce J. Dokurno

PLASTICORP, 24105 S. Frampton Ave., Harbor City, CA 90710, Tel: 213-539-9530, FAX: 213-539-8325; Empl.: 120; *Sls. Mgr.:* Robert Hurley

PLASTIMATIC, INC., Glynwed Int'l., 3 Oak Rd., Fairfield, NJ 07004, Tel: 201-575-0038, FAX: 201-575-8748; Empl.: 95; *Sls. Mgr.:* Art Lappine

PLASTOID CORPORATION, 45 Gingerbread Castle Rd., Hamburg, NJ 07419, Tel: 201-827-7141, FAX: 201-827-7141 (ext 52); Empl.: 200

PLASTRON CORP., 429 S. Evergreen St., Bensenville, IL 60106, Tel: 708-595-2212, FAX: 708-595-2599; Empl.: 245; *Sls. Mgr.:* Don Hennings

PLATO PRODUCTS, INC., 2120 Auto Center Dr., Glendora, CA 91740, Tel: 818-967-3821, TELEX: 287291, FAX: 714-592-7062; FSC No.: 32399; Empl.: 75; *Sls. Mgr.:* Walter Schaub

PLESSEY ELECTRIC SYSTEMS CORP., See GEC-Marconi

PLETRONICS, INC., 19015 36th Ave. West, Ste. H, Lynnwood, WA 98036, Tel: 206-776-1880, FAX: 206-776-2760; Empl.: 11; *Sls. Mgr.:* Les Podgorny; *Dist. Mgr.:* Les Podgorny ..... **A•1437-1443**

Local Sales Offices & Reps

AL Huntsville, MacKay, Smith & Assocs. .. 205-539-8000
AZ Phoenix, Sanford Sls. Assocs. 602-957-3570
CA Mission Viejo, Jay Mktg. Assocs. 714-768-7519
CA Pleasanton, Moulthrop 415-463-0450
CA Pleasanton, Moulthrop Sls. 415-463-0450
CO Aurora, Electrodyne 303-695-8903
FL Ft. Lauderdale, MacKay, Smith & Assocs. 305-973-3324
CT N. Haven, Radix 203-239-3611
FL Madeira Beach, MacKay, Smith & Assocs. 813-530-1873
FL Orlando, MacKay, Smith & Assoc. 407-423-4353
FL Orlando, MacKay, Smith & Assocs. ... 407-423-4353
GA Tucker, MacKay, Smith & Assoc. 404-496-9913
GA Tucker, MacKay, Smith & Assocs. 404-496-9913
IL Downers Grove, Golten Assocs. 708-512-0093
MD Baltimore, Chesapeake Ind. Mktg. 301-653-0476
MA Randolph, Bengal 617-961-4120
MN St. Paul, Countryman 612-645-9151
NJ Springfield, Radix 201-467-4970
NC Raleigh, MacKay, Smith & Assocs. 919-847-2277
OH Centerville, Omega 513-434-5507
OH Cleveland, Omega Sls. 216-360-9400
OH Shaker Hgts., Omega 216-751-9600
OR Oregon City, Halbar PNW, Inc. 503-656-3714
TX Austin, Sage Mktg. 512-335-0300
TX Bedford, Sage Mktg. 817-267-7781
UT Salt Lake City, Electrodyne 801-264-8050
WA Redmond, Halbar 206-882-0990

Local Distributors

AZ Phoenix, Arizona Comps 602-269-5655
CA El Segundo, Force 213-772-1324
CA San Diego, Kent Elctrns. 619-471-9561
CA Santa Clara, Force 408-748-1324
CA Santa Clara, Kent Elctrns. 408-727-9810
CA Santa Clara, Pyramid 408-727-9810
CA Sunnyvale, Capsco 408-734-3020
CA Sunnyvale, Target 408-733-0384
CA Torrance, Kent Elctrns. 213-320-2700
CA Yoriba Linda, Target Elctrns. 714-692-1630
CT Norwalk, Cobra Comps. 203-847-6442
GA Norcross, Century Elctrns. 404-729-2522
FL Sunrise, All American 800-432-6838
IL Downers Grove, Golten Assocs. 708-512-0093
MD Beltsville, PSI 301-937-4960
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Norwood, Gerber Elctrns. 619-796-6000
MA Wakefield, All American 617-246-2300
MN Fridley, Voyager 612-571-7766
NJ Hopelawn, Dove Elctrns. 201-324-7830
NY Mt. Vernon, All American 800-926-6668
NY Mt. Vernon, QAR/All American 1-800-456-2626
NY Stony Brook, Dove Elctrns. 516-689-7733
NC Raleigh, Century Elctrns. 919-782-2116
OH Cincinnati, Schuster Elctrns. 513-489-1400
OH Twinsburg, Schuster Elctrns. 216-425-8134
PA Norristown, Century Elctrns. 215-631-5404
TX Richardson, Ewing 800-966-9738
WA Redmond, Kent Elctrns. 206-883-7200
WA Redmond, Priebe 206-881-2363
WA Woodinville, Capsco 206-885-5283

PLITRON, 250 Wildcat Rd., Downsview, Ont., CAN M3J 2N5, Tel: 416-667-9914, FAX: 416-667-8928; Empl.: 25; *Sls. Mgr.:* Brad Jolly ..... **A•2368-2369**

Local Sales Offices & Reps

CA Burbank, De Angelo, Rothman & Co. .. 818-504-2425
FL Oviedo, Comps. Co. 407-366-7399
FL Tamarac, Southtech Instrs. 305-762-5120
NJ Rahway, R.E. Breuer 201-388-5045
IL Schaumberg, McNulty & Assocs. 708-980-9868
NC Raleigh, Eastern Elctrns. 919-876-7591
OH Dayton, J.C. Hofstetter Co. 513-296-1010
PA Pittsburg, J. C. Hofstetter 513-296-1010
Can Toronto, Plitron 416-667-9914

PLUMER PRECISION OPTICS, 601 Montgomery Ave., Pennsburg, PA 18073, Tel: 215-679-6272, FAX: 215-679-2277; Empl.: 180; *Sls. Mgr.:* Joe Tiberii

PMC/BETA LTD. PARTNERSHIP, 4 Tech Circle, Natick, MA 01760, Tel: 617-237-6920, FAX: 508-651-9762; Empl.: 25; *Sls. Mgr.:* Jack Newton

PMI MOTION TECHNOLOGIES, Kollmorgen Corporation, 49 Mall Dr., Commack, NY 11725-5703, Tel: 516-864-1000, FAX: 516-864-2084; Empl.: 175; *Sls. Mgr.:* Peter Dougherty

PMT DIVISION, Ametek, Inc., 820 Pennsylvania Blvd., Feasterville, PA 19053, Tel: 215-355-6900, FAX: 215-355-2937; Empl.: 125; *Sls. Mgr.:* James Snyder

POCO SLS., Porter Co., 8925 Fullbright St., Chatsworth, CA 91311, Tel: 818-700-8727, FAX: 818-700-8453; FSC No.: 69-1603; Empl.: 8

POINT 4 DATA CORP., 15442 Del Amo Ave., Tustin, CA 92680, Tel: 714-259-0777, FAX: 714-259-0921; Empl.: 50; *Sls. Mgr.:* Mr. Ted Cooper; *Dist. Mgr.:* Mr. Ted Cooper

POLARA ENGINEERING INC., 4115 W. Artesia Ave., Fullerton, CA 92633, Tel: 714-521-0900, TELEX: 688489, FAX: 714-522-8001; Empl.: 62

POLAROID CORPORATION, Polarizer Div., 1 Upland Rd., Norwood, MA 02062, Tel: 800-225-2770, FAX: 617-446-4600

POLE/ZERO CORPORATION, 4480 Lake Forest Dr. Ste. 308, Cincinnati, OH 45242, Tel: 513-563-1133, FAX: 513-563-4345; *Sls. Mgr.:* Joseph J. Janning

POLYCASE PRODS., ECP Corp., 4726 Superior Ave, Cleveland, OH 44103, Tel: 216-391-0444, FAX: 216-391-2891; Empl.: 14 ..... **C•1078**

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Fremont, Allied Elctrns.	415-770-0590
CA	Torrance, Allied Elctrns.	213-373-8828
CO	Englewood, Allied Elctrns.	303-790-1664
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Casselberry, Allied Elctrns.	407-831-3331
FL	Pompano Beach, Allied Elctrns.	305-978-3008
GA	Norcross, Allied Elctrns.	414-446-8595
IL	Des Plaines, Allied Elctrns.	312-803-1040
IN	Indianapolis, Allied Elctrns.	317-875-0448
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Billerica, Allied Elctrns.	508-667-7921
MI	Livonia, Allied Elctrns.	313-462-0190
MN	Eden Prairie, Allied Elctrns.	612-829-7554
NJ	Fairfield, Allied Elctrns.	201-227-8776



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POLYFLON COMPANY, Crane Co., 35 River Street, New Rochelle, NY 10801, Tel: 914-636-7222, FAX: 914-633-3664; Empl.: 32; *Sls. Mgr.:* Joseph A. Seminoro

POLYGENEX INTERNATIONAL INC., 105 Eaton Place, Cary, NC 27513, Tel: 919-380-8100, FAX: 919-380-9556; *Sls. Mgr.:* J.D. McGarry

POLYPHASE INSTRUMENT, 175 Commerce Dr., Ft. Washington, PA 19034, Tel: 215-643-6950, FAX: 1-215-643-5237; FSC No.: 98330; Empl.: 160; *Sls. Mgr.:* Paul Stevens

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POLYPHASER CORPORATION, 2225 Park Place, P.O. Box 9000, Minden, NV 89423-9000, Tel: 702-782-2511, 800-325-7170, TELEX: 272718 PolyPhaser; FSC No.: 61114; Empl.: 45 ..... **B•1385**

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CA	Costa Mesa, Tech Mktg. Assoc., Inc.	714-979-0412
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MI	Rochester Hills, Webster Assocs., Inc.	313-375-0420
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NV	Minden, PolyPhaser Corp.	702-782-2511
NH	Manchester, Assocd. Sys.	603-472-2297
TX	Rowlett, Horizon Comm. Sls. Co.	214-475-1179
WA	Kirkland, Manon Engrg.	206-827-7449

Local Distributors

CA	Hayward, Talley Elctrns.	415-783-2111
CA	Sacramento, Sacramento Elctrns.	916-441-4821
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FL	Melbourne, Technical Equip. Dist., Inc.	407-259-2711
HI	Honolulu, Honolulu Elctrns.	808-949-5564
IL	Joliet, Primus Elctrns. Corp.	815-436-8945
IL	Libertyville, Harger Lightning Protection	708-362-4848
MD	Hunt Valley, Tessco	301-785-5300
MN	St. Paul, Pulstar Dist., Inc.	612-645-3411
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NJ	Clarksboro, W.R. Block & Assocs.	800-421-7170
NC	Greensboro, West Antenna	919-621-2473
OH	Cincinnati, Cartwright Comms. Co.	513-489-1755
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CA	San Jose, P & M Elctrns.	408-287-0402
NY	Canandaigna, Mamula Sls.	716-394-5560

POLYTRONIX, INC., 805 Alpha Dr., Richardson, TX 75081, Tel: 214-238-7045, FAX: 214-644-0805; Empl.: 65

POMFRET RESEARCH OPTICS, P. O. Box 1265, Orange, VA 22960, Tel: 703-854-4350; Empl.: 5

POMONA ELECTRONICS, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, Tel: 714-623-3463, FAX: 714-629-3317; FSC No.: 05276; Empl.: 170; *Sls. Mgr.:* Thomas Barber; *Dist. Mgr.:* Thomas Barber ..... **C•1493-1499**

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AL	Hazel Green, Braden & Assocs.	205-828-6290
AZ	Phoenix, More Sls.	602-788-9181
AR	Little Rock, Erickson Sls., Inc.	501-455-0618
CA	Burbank, Darco	818-504-2425
CA	Irvine, Vale Elctrn. Assocs.	714-551-4004
CA	Santa Clara, Engrg. Assocs. Corp.	408-988-5001
CA	So. San Francisco, Carelli/EMA	415-873-2524
CO	Broomfield, Connors Co.	303-466-9628
FL	Maitland, EIR Inc.	407-660-9600
IL	Palatine, W. M. Linz	708-705-8555
IN	Indianapolis, Blind Elctrn. Sls. Co.	317-241-3742
IA	West Des Moines, Nevco	515-225-9866
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MD	Baltimore, David S. Linz, Inc.	301-882-6289
MA	Burlington, Gerber Sls. Corp.	617-229-1150
MI	Jenison, C. A. Geer Co.	616-534-9449
MI	Kentwood, C. A. Geer Co.	616-534-9449
MN	Minneapolis, Hei-lite Sls., Inc.	612-550-0506
OH	Cleveland, Marlow Assocs.	216-831-8232
MO	Crestwood, Nevco, Inc.	314-843-7406
NJ	Franklin, D. F. Tobias & Co.	201-209-7255
OR	Beaverton, Eclipse Mktg. Grp. Ltd.	503-642-1661
PA	Philadelphia, David S. Linz, Inc.	215-379-0734
NC	Raleigh, Pinnacle Mktg.	919-878-4658
TX	Dallas, Erickson Sls., Inc.	214-739-5833
TX	Houston, Erickson Sls., Inc.	713-266-1604
TX	Round Rock, Erickson Sls., Inc.	512-244-3068
WA	Redmond, Eclipse Mktg. Grp., Ltd	206-885-6991
WA	Spokane, Eclipse Mktg. Grp., Ltd.	509-922-3972
EXP	CA, Tarzana, Nate Beckerman & Co., Inc.	818-708-0021
Can	Pickering, AC Simmons & Sons	416-739-8041

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AZ	Phoenix, More Sls.	602-788-9181
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CO	Boulder, Promotional Technlgs.	303-447-2474
FL	Tampa, APM Assoc.	813-447-2474
GA	Norcross, Interep Assocs., Inc.	404-449-8680
IL	Chicago, Rendell Sls. Co.	312-539-1820
IN	Carmel, Frank E. Kahsar Sls.	317-844-9353
MA	Burlington, New Tech Solutions	617-229-8888
MI	Spring Lake, Frank E. Kahsar Sls.	616-846-7590
MI	Warren, Frank E. Kahsar Sls.	313-795-3530
MN	Minneapolis, Holmgren Assocs.	612-786-7641
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OK	Tulsa, Advance Tech. Sls.	918-664-0482
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UT Midvale, Promotional Tech. Sls. 801-566-8919
VA Ashland, Glasscock Assocs. 804-798-2125
WA Redmond, Interstate Elctrns. 206-885-5257
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POTTER & BRUMFIELD, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, Tel: 812-386-1000, TELEX: 27-8451; Empl.: 3000; *Sls. Mgr.:* Don Patton; *Dist. Mgr.:* Sherry Colborn ..... **B•1565**

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CA San Diego, CERCO 619-792-5555
CA Santa Ana, Jones & McGeoy Sls., Inc. 714-547-6466
CO Littleton, Simpson Assocs. 303-794-8381
CT Wallingford, John E. Boeing Co. 203-265-1318
FL Apopka, Cartwright & Bean 407-889-9100
FL Deerfield Beach, Cartwright & Bean ... 305-429-3400
GA Norcross, Cartwright & Bean 404-368-0160
IL Rolling Meadows, Sumer, Inc. 708-991-8500
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IN Indianapolis, R. O. Whitesell & Assocs. 317-876-9000
IN Kokomo, R. O. Whitesell & Assocs. ... 317-457-9127
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MS Jackson, Cartwright & Bean 601-981-1170
MO Bridgeton, Dy-Tronix, Inc. 314-291-4777
NJ Medford, The McCoy Grp., Inc. 609-953-0770
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NY Melville, Comtronic Assocs. 516-249-0505
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OK Tulsa, Components, Inc. 918-583-9149
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FL Tampa, SRT Mktg. 813-884-4805, FAX:813-882-9149
GA Atlanta, Naylor Assocs., Inc. 404-373-5036, FAX:404-373-5052
IL Des Plaines, Esco Assocs. 708-298-5310, FAX:708-298-3833
MA Burlington, Tritek, Inc. 617-272-4550, FAX:617-270-9147
MN Minnetonka, Mill-Tech Sls., Inc. 612-933-8090, FAX:612-933-2353
NJ Haddonfield, M & S Assocs., Inc. 609-429-7055, FAX:609-795-1493
NY Great Neck, F & F Metro, Inc. 516-482-4080, FAX:516-482-4589
NY Newark, W-L Sls. 315-331-1645, FAX:315-331-2143
NC Cornelius, Naylor Assocs., Inc. 704-892-1366, FAX:704-892-9758
NC Durham, Naylor Assocs., Inc 919-544-6630, FAX:919-544-7211
OH Dayton, Five Star Elctrns., Inc. 513-299-1718, FAX:513-299-1345
OH Solon, Five Star Elctrns., Inc. 216-349-1611, FAX:216-349-0381
OK Tulsa, Comptech Sls. 918-622-7744, FAX:918-660-0340
OR Albany, Henry Sharpe 503-928-9221, FAX:503-928-5604
TX Austin, Comptech Sls. 512-343-0300, FAX:512-345-2530
TX Harlingen, Comptech Sls. 512-428-7503, FAX:512-345-2530
TX Houston, Comptech Sls. 713-492-0005, FAX:713-492-6116
TX Irving, Comptech Sls. 214-751-1181, FAX:214-550-8113
WA Redmond, Projects Intl. 206-883-8212
Can Ontario, Ed Irving 519-822-9795, FAX:519-763-1931

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CA Costa Mesa, Battery Specialties 714-755-0888, FAX:714-755-0889
CA Mountainview, Energy Sls., Inc. 415-969-0800, FAX:415-961-2000
CA San Diego, Tauber Elctrns. 619-274-7242, FAX:619-274-2220
CO Denver, Cargo Batteries 303-296-8763, FAX:303-295-7125
MD Beltsville, Mark Elctrns. Supp. 301-595-5040, FAX:301-937-0491
MA Sandwich, JV/EPC Elctrns., Inc. 508-833-0700
MN Minneapolis, Stark Elctrns. 612-333-3361, 800-334-6154
NJ Bellmawr, Mid-Atlantic Elctrns. Corp. 609-931-5303,F,609-931-4928
NY Bohemia, Lamp Technlg., Inc. 516-567-1800, FAX:516-567-1806
NY Farmingdale, Delta Concepts 516-845-1294, FAX:516-293-0493
NY Plainview, Plainview Batteries 516-249-2873, FAX:516-249-2876
WA Redmond, Energy Sls. 206-883-2343, FAX:206-867-0606
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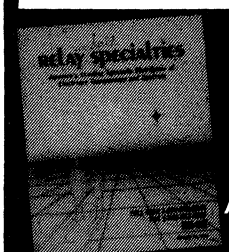
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CA	Los Angeles, EIL Instrs.	213-685-7020
CA	N. Hollywood, O'Halloran Assocs.	213-877-0173
CA	Palo Alto, O'Halloran Assocs.	415-969-1600
CA	Santa Clara, EIL Instrs.	408-727-0396
CO	Denver, EIL Instrs.	303-534-4160
CT	Middletown, EIL Instrs.	203-346-6646
FL	Palm Bay, EIL Instrs.	305-725-8300
GA	Atlanta, U.S. Instr. Rentals	404-955-4473
IL	Chicago, EIL Instrs.	312-430-2292
IN	Indianapolis, EIL Instrs.	317-545-1373
KS	Kansas City, U.S. Instr. Rentals	913-677-0011
KY	Louisville, EIL Instrs.	502-454-3420
MD	Sparks, EIL Instrs.	301-771-4800
MA	Burlington, EIL Instrs.	617-272-9450
MI	Detroit, U.S. Instr. Rentals	313-493-1919
MN	Minneapolis, U.S. Instr. Rentals	612-881-3743
MO	St. Louis, U.S. Instr. Rentals	314-454-0210
NJ	Belmar, Accutest Instrs.	201-681-6560
NJ	Rockaway, A&J Assocs.	201-625-3169
NM	Albuquerque, U.S. Instr. Rentals	505-884-0529
NY	Great Neck, The Instr. Mart	516-487-7430
NY	Hauppauge, EIL Instrs.	516-231-6333
OH	Cincinnati, U.S. Instr. Rentals	513-863-4446
OH	Dayton, EIL Instrs.	513-435-2134
OK	Oklahoma City, U.S. Instr. Rentals	405-525-2659
PA	Philadelphia, EIL Instrs.	609-488-0474
TX	Dallas, EIL Instrs.	214-931-1236
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WA	Springfield, EIL Instrs.	206-575-1888
Can	Toronto, EIL Instrs.	416-624-6660

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Power Dynamics, Inc.

FAX: 201-736-8930

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Local Sales Offices & Reps

CA	Laguna Hills, David Budge & Assoc.	714-582-8720
CA	San Diego, Bart Budge Assocs.	619-272-8630
CA	San Diego, David Budge Assocs.	619-272-8630
CA	San Jose, Ruppert Sls.	408-998-8717
CO	Denver, West Inc.	303-477-1134
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
GA	Lilburn, Adams Elctrns.	404-925-9115
IL	Palatine, Golbeck & Milota Assocs., Inc.	312-705-0602
IN	Indianapolis, L.M. DeVoe Assocs.	317-842-3245
KS	Shawnee Mission, Microtronics, Inc.	913-262-1444
MI	Grand Rapids, R.P. Urban Assocs.	616-245-0511
MN	Bloomington, Horizon Technlgs.	612-884-6515
MO	St. Charles, Microtronics, Inc.	314-946-8500
NH	Amherst, D.A. Crowley & Assocs	603-673-7050
NJ	Audubon, DAS Assocs.	609-546-1133
NJ	Pt. Pleasant, Jade Mktg.	201-899-8108
NJ	Audubon, D.A.S. Assocs.	609-546-1133
NY	Marcellus, Mullahy-Welch Sls.	315-673-3891
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Raleigh, Barker Assocs.	919-876-0282
OH	Dayton, Shamrock Sls. Inc.	513-258-1227
OH	Worthington, Shamrock Sls. Inc.	614-888-7638
OR	Tigard, Electronic Comp. Sls.	503-245-2342
MI	Detroit, R.P. Urban Assocs.	313-535-2355
TX	Dallas, Rem-Air Comp.	214-234-1069
UT	Murray, Aspen Sls., Inc.	801-265-8365
UT	Salt Lake City, Aspen Sls., Inc.	801-467-2401
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301
Can	Downsview, Tienkay, Inc.	416-736-1221

Local Distributors

AR	Ft. Smith, Radio, Inc.	501-646-5200
CA	El Segundo, Force Elctrns.	714-522-1324
CA	Livermore, Fuse-Com	415-449-1213
CA	San Diego, Fuses Unlimited/Western Fuse	619-569-9620
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Rose Elctrns.	408-943-0200
CA	Santa Clara, Force Elctrns.	408-748-1324
CA	So. San Francisco, Peters-DeLaet, Inc.	415-873-9595
CA	Van Nuys, Fuses Unlimited	818-786-8111
CO	Arvada, Denver Wintronics	303-431-7161
CT	Hamden, Connector Co.	203-288-0044
CT	Wallingford, Sager Elect. Supp. Co.	203-265-4600
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
GA	Atlanta, KSM Elctrns.	404-458-2013
IL	Cary, Gama Elctrns.	708-639-3322
IL	Crystal Lake, Sub-Sem	312-782-3954
MA	Canton, Impact Sls.	617-821-1500
MA	Hingham, Sager Elect. Supp. Co.	508-749-4700
MA	Marlboro, Now Elctrns.	508-460-0187
MN	Hibbing, Minn Tech Elctrns.	218-262-5228
TX	Dallas, Wofford Elec.	214-320-0294
NH	Salem, Sager Elctr.	603-898-1348
NJ	Kenilworth, Federated Purchaser Co.	201-272-0505
NY	Hauppauge, Sager Elctrns	516-348-1300
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Pennyan, Advcom Technlg.	716-396-9050
NC	Raleigh, Sager Svc. Plus Elctrns.	919-850-9550
OH	Cincinnati, Schuster Elctrns	513-489-1400
OH	Twinsburg, Schuster Elctrns	216-425-8134
OK	Oklahoma City, Radio, Inc.	405-789-0741
OK	Tulsa, Radio, Inc	918-587-9123
OR	Beaverton, Micro Power Elctrns.	503-626-7086
PA	Bristol, Aim Elctrns	215-785-3500
TX	Austin, Wofford Elctrns.	512-339-1131
OR	Beaverton, Rose Elctrns.	503-629-9288
TX	Dallas, Off The Shelf Comps.	214-247-0052
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Richardson, Off The Shelf Comps.	214-238-0808
WI	Milwaukee, Progressive Image	414-321-4722
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Redmond, Energy Sls.	206-883-2343
WA	Redmond, Fuse-Com	206-881-2442
Can	Downsview, Ont., PS Comps.	416-665-9546

POWER ELECTRONIC COMPONENTS, INC., PEC, Inc, 3408 Kamer Miller Rd., New Albany, IN 47150, Tel: 812-941-9205, 800-245-0193, FAX: 812-941-9205; *Dist. Mgr.:* Brenda DeSpain

POWEREX

FAX: 412-925-4393

POWEREX, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697, Tel: 412-925-7272, TWX: 510-468-2840; Empl.: 550; *Dist. Mgr.:* Kathy Cullen ..... **A•2117**

Local Sales Offices & Reps

AZ	Chandler, Lindberg Co.	602-786-9115
CA	Agoura Hills, Westpower Assocs.	818-706-2550
CA	Laguna Hills, Westpower Assocs.	714-582-6716
CA	Santa Clara, Engineering Assocs. Corp.	408-988-5001
CO	Denver, Lindberg Co.	303-758-9033
CO	Westminster, Jerry Wolfgang	303-252-0215
CT	Southington, The Orion Grp.	203-621-8371
FL	Maitland, EIR, Inc.	407-660-9600
GA	Alpharetta, Southeast Power Comps.	404-664-5460
GA	Norcross, Southeast Power Comps.	404-448-2458
IL	Naperville, L&W Power Corp.	708-416-8838
IN	Carmel, Giesting & Assocs.	317-844-5222
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-Tronix, Inc.	913-339-6333
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
KY	Versailles, Giesting & Assocs.	606-873-2330
MA	Newton, Ed Freeley	617-630-9512
MA	Peabody, The Orion Grp.	508-532-6266
MI	Plymouth, L&W Power Corp.	313-451-1150
MN	Minneapolis, PSI Co.	612-944-8545
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NJ	Ringwood, J&L Sls. Assocs., Inc.	201-962-6315
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Ronkonkoma, J&L Sls. Assocs., Inc.	516-737-2801
NY	Wappinger Falls, Bob Dean, Inc.	914-297-6406
NC	Charlotte, Southeast Power Comps.	704-846-8532
NC	Greensboro, Southeast Power Comps.	919-854-9410
NC	Henderson, Southeast Power Comps.	919-438-4450
OH	Cincinnati, Giesting & Assocs.	513-385-1105
OH	Cleveland, Giesting & Assocs.	216-261-9705
OH	Columbus, Giesting & Assocs.	614-459-4800
OK	Tulsa, NOVA Mktg.	918-660-5105
OR	Tigard, Vantage Corp.	503-620-3280
PA	Hatboro, Delta Tech. Sls., Inc.	215-957-0600
PA	Pittsburgh, Bear Mktg.	412-531-2002
PA	Youngwood, Bob Hirche	412-925-4468
PA	Youngwood, Powerex, Inc.-USA/Intl.	412-925-7272
TX	Austin, NOVA Mktg., Inc.	512-343-2321
TX	Dallas, NOVA Mktg., Inc.	214-750-6082
TX	Houston, NOVA Mktg., Inc.	713-988-6082
VA	Roanoke, Southeast Power Comps.	703-774-8478
WA	Bellevue, Vantage Corp.	206-455-3460
WI	Elm Grove, L&W Power Corp.	414-782-0799
Can	Montreal, Que., GMA Assocs.	514-335-9572
Can	Ottawa, Ont., GMA Assocs.	613-838-4480
Can	Toronto, Ont., GMA Assocs	416-671-8111
Can	Vancouver, B.C., Blakewood Elec. Sys., Inc.	604-273-9910

Local Distributors

AL	Birmingham, Industrial Elec. Supp. Co.	205-951-4601
AL	Huntsville, Hamilton/Avnet	205-837-7210
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Chandler, Hamilton/Avnet	602-961-6411
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Agoura Hills, Almo Elctrns.	818-991-3984
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Costa Mesa, Hamilton Electro Corp.	714-754-6097
CA	Costa Mesa, Hamilton Electro Sls.	714-641-4100
CA	Culver City, Hamilton Electro Sls.	213-558-2000
CA	Gardena, Hamilton/Avnet	213-217-6888
CA	Roseville, Hamilton/Avnet	916-781-6614
CA	San Diego, All American	619-268-1505
CA	San Diego, Hamilton/Avnet	619-571-7510
CA	San Diego, Time Elctrns.	619-586-1331
CA	San Jose, All American	408-943-1200
CA	San Jose, Almo Elctrns.	408-436-8822
CA	Santa Ana, Almo Elctrns.	714-757-0444
CA	Sunnyvale, Hamilton/Avnet	408-743-3610
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, All American	213-320-0240
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Time Elctrns.	714-669-0100
CA	Woodland Hills, Hamilton/Avnet	818-594-0404
CO	Englewood, Hamilton/Avnet	303-799-7800
CO	Englewood, Time Elctrns.	303-799-8851
CT	Cheshire, Time Elctrns.	203-271-3200
CT	Danbury, Hamilton/Avnet	203-797-2800
CT	East Haven, J. V. Elctrns.	203-469-2321
CT	Wallingford, GRS Midan Elects.	203-265-2077
FL	Ft. Lauderdale, Hamilton/Avnet	305-971-2900
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Miami, All American	305-621-8282
FL	Orlando, Time Elctrns.	407-841-6565
FL	St. Petersburg, Hamilton/Avnet	813-573-3930
FL	Winter Park, Hamilton/Avnet	407-628-3888
GA	Norcross, Hamilton/Avnet	404-447-7507
GA	Norcross, Time Elctrns.	404-448-4448
IL	Bensenville, Hamilton/Avnet	312-860-7700
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elmhurst, Semiconductor Specialists, Inc.	708-279-1000
IL	Schaumberg, Time Elctrns.	708-308-3000
IL	Schaumburg, QPS Elect., Inc.	708-884-6620
IN	Carmel, Hamilton/Avnet	317-844-9333
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Hammond, WESCO	312-454-6970
IN	Indianapolis, Bell Inds.	317-875-8200
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Cedar Rapids, Hamilton/Avnet	319-362-4757
KS	Lenexa, Hamilton/Avnet	913-888-1055
KY	Lexington, Hamilton/Avnet	606-259-1475
MD	Columbia, GRS Elctrns.	301-995-6744
MD	Columbia, Hamilton/Avnet	301-995-3500
MD	Columbia, Time Elctrns.	301-964-3090
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Peabody, Hamilton/Avnet	508-531-7430
MA	Peabody, Time Elctrns.	508-532-6200

MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Madison Heights, Galco Elctrns. 313-542-9090
MI Novi, Hamilton/Avnet 313-347-4270
MN Edina, Time Elctrns. 612-835-1250
MN Minnetonka, Hamilton/Avnet 612-932-0600
MO Chesterfield, Hamilton/Avnet 314-537-1600
MO Manchester, Time Elctrns. 314-391-6444
NJ Camden, GRS Elctrns. 609-964-8560
NJ Cherry Hill, Hamilton/Avnet 609-424-0100
NJ East Hanover, Delburn Elctrns., Inc. ... 201-884-0800
NJ Fairfield, Hamilton/Avnet 201-575-3390
NJ Marlton, Time Elctrns. 609-596-6700
NJ Wayne, Time Elctrns. 201-882-4611
NM Albuquerque, Hamilton/Avnet 505-345-0001
NM Albuquerque, Harrison Equip. Co. 505-291-9951
NY East Syracruse, Time Elctrns. 315-432-0355
NY Fairport, Time Elctrns. 716-383-8853
NY Freeport, Semtex Inds. Corp. 516-223-0200
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Hauppauge, Time Elctrns. 516-273-0100
NY Plainview, ACI Elctrns. 516-293-6630
NY Rochester, Hamilton/Avnet 716-475-9130
NY Rome, Rome Elctrns. 315-337-5400
NY Syracruse, Hamilton/Avnet 315-437-2641
NY Westbury, Hamilton/Avnet 516-997-6868
NC Charlotte, Electronics Mktg. Corp. 704-394-6195
NC Charlotte, Time Elctrns. 704-522-7600
NC Raleigh, Hamilton/Avnet 919-878-0810
OH Cincinnati, Hughes Peters 513-351-2000
OH Cleveland, CAM/RPC Elctrns. 216-461-4700
OH Cleveland, Darrah Elec. 216-631-0912
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Columbus, Hughes Peters 614-294-5351
OH Dayton, Electronics Mktg.Corp. 513-439-4711
OH Dayton, Hamilton/Avnet 56 513-439-6732
OH Dayton, Hamilton/Avnet 64 513-439-6700
OH Dublin, Time Elctrns. 614-761-1100
OH Highland Heights, Electronics Mktg.Corp. 216-442-3441
OH Solon, Hamilton/Avnet 216-349-5100
OH Westerville, Hamilton/Avnet 614-882-7004
OK Tulsa, Altair Co. 918-252-5781
OK Tulsa, Hamilton/Avnet 918-252-7297
OR Beaverton, Hamilton/Avnet 503-627-0201
OR Portland, Dunn Elctrns. 503-285-0214
OR Portland, Time Elctrns. 503-684-3780
PA Pittsburgh, CAM/RPC Elctrns. 412-782-3770
PA Pittsburgh, Hamilton/Avnet 412-281-4150
TX Addison, Hamilton/Avnet 214-308-8140
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Harrison Equip. Co. 512-258-1320
TX Austin, Time Elctrns. 512-339-3051
TX Brownsville, Harrison Equip. Co. 512-548-2376
TX Dallas, Harrison Equip. Co. 214-239-2750
TX El Paso, Harrison Equip. Co. 915-598-3406
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
TX Stafford, Hamilton/Avnet 713-240-7733
TX Stafford, Harrison Equip. Co. 713-879-2750
UT Salt Lake City, Hamilton/Avnet 801-972-2800
UT West Valley, Time Elctrns. 801-973-8181
VA Charlottesville, Virginia Elec. Comps. .. 804-296-4184
WA Redmond, Hamilton/Avnet 206-881-6697
WA Redmond, Time Elctrns. 206-882-1600
WV Charleston, McJunkin Corp. 304-348-5211
WI Mequon, Taylor Elec. Co. 414-241-4321
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Waukesha, Hamilton/Avnet 414-784-4510
WY Gillette, WESCO 307-687-0014
Can Burnaby, BC, Hamilton/Avnet 604-420-4101
Can Burnaby, BC, ITT/Multicomps. 604-291-8866
Can Calgary, Alberta, Hamilton/Avnet 403-250-9380
Can Calgary, Alberta, ITT/Multicomps. 403-273-2780
Can Concord, Ont., ITT/Multicomps. 416-736-1144
Can Dartmouth, Nova Scotia, ITT/Multicomps. 902-465-2350
Can Edmonton, Alberta, ITT/Multicomps. .. 403-438-4982
Can Mississauga, Ont., Hamilton/Avnet 416-677-7432
Can Mississauga, Ont., Time Elctrns. 416-672-5300
Can Nepean, Ont., Hamilton/Avnet 613-226-1700
Can Nepean, Ont., ITT/Multicomps. 613-596-6980
Can St. Laurent, Que., Hamilton/Avnet 514-335-1000
Can St. Laurent, Que., ITT/Multicomps. 514-335-7697
Can Stoney Creek, Ont., Westinghouse Canada, Inc. 416-664-3300
Can Willowdale, Ont., Electro Sonic, Inc. ... 416-494-1666
Can Winnipeg, Manitoba, ITT/Multicomps. 204-786-8401

POWER FUNCTIONS ENGINEERING, 3831 Cavalier Dr., Garland, TX 75042, Tel: 214-278-0996; Empl.: 9

POWER GENERAL
A SUBSIDIARY OF UNITRODE CORPORATION

FAX: 617-828-3215

POWER GENERAL, Unitrode Corp., 152 Will Dr., Canton, MA 02021, Tel: 617-828-6216; Empl.: 300; *Sls. Mgr.:* Steve Forrester ..... **D•1987**

Local Sales Offices & Reps

AL Huntsville, Elec. Mktg. Assoc., Inc. 205-880-8050
AZ Tempe, Westrep 602-820-9932
CA Anaheim, Westrep 714-527-2822
CA Buena Park, Cypress Elctrns. 714-521-5230
CA San Diego, Cypress Elctrns. 619-535-0018
CA San Diego, Westrep 619-566-6580
CA Santa Clara, Westrep 408-988-8833
CO Englewood, Delltron Co. 303-741-2122
CT Wallingford, APEX Assocs. 203-267-6914
FL Altamonte Springs, Vantage Comp. ... 407-682-1199
FL Margate, EPM Corp. 305-977-0331
FL Orlando, EPM Corp. 407-425-6149
GA Atlanta, Elec. Mktg. Assoc., Inc. 404-448-1215
IL Itasca, Beta Technlg. Sls. 708-250-9586
IN Indianapolis, Schuster Elctrns. 317-253-9065
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Cedar Rapids, Spectrum Sls. 319-366-0576
KS Overland Pk., SPECTRUM Sls. 913-648-6811
MD Columbia, Sager 301-995-6580
MA Canton, Power Gen. 617-828-6216
MA Westwood, APEX Assocs. 617-444-8070
MI Brighton, Applied Power 313-227-3604
MI Flint, RS Elctrns. 313-472-5000
MI Livonia, Leading Edge Sls. 313-478-6700
MN Eden Prairie, Com-Tek Sls. 612-941-7181
MO Florissant, Spectrum Sls. 314-921-1313
MO Hazelwood, Spectrum Sls. 314-921-1313
NJ Clifton Parks, Net Sls. 518-371-6864
NY Cortland, Net Sls. Co. 607-756-6592
NY Great Neck, F & F Metro, Inc. 516-482-4080
NY Victor, Net Sls. Co. 716-924-1844
NC Raleigh, Elec. Mktg. Assoc., Inc. 919-847-8800
OH Cincinnati, RS Elec. 513-793-2450
OH Cleveland, Schuster Elctrns. 216-425-8134
OH Cleveland, Schuster Elec. 216-425-8134
OH Columbus, McFadden Sls. 614-761-3177
OH Toledo, RS Elec. 419-893-0721
OR Portland, Venture Elctrns., Inc. 503-624-0617
PA Mars, Sager 412-772-2233
SC Greenville, EMA, Inc. 803-233-4637
TX Austin, Tesco, Inc. 512-834-8374
TX Dallas, Tesco, Inc. 214-553-1200
TX Houston, Tesco, Inc. 713-690-4909
TX Stafford, Southwest Elctrns. 713-240-4000
UT American Fork, Delltron Co. 801-263-9413
VA Sterling, Beacon North .. 800-877-3747,703-478-2480
WA Bellevue, Venture Elctrns. 206-454-4594
WI Milwaukee, Beta Technlg. Sls., Inc. 414-543-6609
Can Burnaby, B.C., Kaytronics Vancouver .. 604-294-2000
Can Concord, Ont., Kaytronics Inc.-Toronto 416-669-2262
Can Edmonton, I.T.T. Multicomp. 403-436-9555
Can Kanata, Ont., Kaytronics Inc.-Ottawa .. 613-564-0080
Can Montreal, Que., Kaytronics 514-745-5800
Can Ottawa, I.T.T. Multicomp. 613-596-6980
Can Winnipeg, I.T.T. Multicomp. 204-697-2300

Local Distributors

AL Huntsville, Cypress Elctrns. 800-526-6231
AZ Tempe, Cypress Elctrns. 602-966-2256
CA Buena Park, Cypress Elctrns. 714-521-5230
CA San Diego, Cypress Elctrns. 619-535-0018
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Englewood, Cypress Elctrns. 303-792-5829
CT Wallingford, Sager 203-265-4600
FL Deerfield Beach, Vantage Comps., Inc. 305-429-1001
FL Orlando, Sager 407-240-3114
GA Norcross, Applied Power 404-263-0421
IL Bensenville, Cypress Elctrns. 708-350-2005
IL Wood Dale, N. E. P. Elctrns. 708-595-8500
IA Cedar Rapids, Dee Elctrns. 319-365-7551
KS Kansas City, Olive Elctrns 913-362-1923
KS Overland Park, RS Elctrns. 913-362-1923
MD Columbia, Vantage Comp. 301-720-5100
MA Andover, Vantage Comp. 508-687-3900
MA Hingham, Sager 617-749-6700
MI Grand Rapids, RS Elctrns. 616-241-3483
MI Livonia, RS Elctrns. 313-525-1155
MN Eden Prairie, Cypress Elctrns. 612-934-2104
MO St. Louis, Olive Elctrns. 314-997-7709
NH Salem, Sager 603-898-2741
NY Buffalo, Summit Distrs. 716-887-2800
NY Hauppauge, Fairmont Elec. 516-231-3313
NY Hauppauge, Sager 516-348-1300
NC Raleigh, Sager 919-850-9550
OH Cincinnati, Schuster Elctrns. 513-489-1400
OR Beaverton, Cypress Elctrns. 503-223-8900
PA Philadelphia, Sager 215-464-4336,609-964-0830
TX Dallas, Cypress Elctrns. 214-255-0065
TX Stafford, Southwest Elctrns. 713-240-4000
WA Bothell, Cypress Elctrns. 206-483-1144
WI New Berlin, NEP Elctrns. 414-785-9100
Can Burnaby, B.C., I.T.T. Multicomps. 604-291-8866
Can Calgary, Alb., I.T.T. Multicomps. 403-273-2780
Can Concord, Ont., I.T.T. Multicomps. 416-736-1144
Can Montreal, I.T.T. Multicomp. 514-335-7697

POWER INTEGRITY CORP., 1834 Pembroke Rd., Greensboro, NC 27429-0682, Tel: 919-379-9773, 800-237-6260, TELEX: 919-379-1301; *Sls. Mgr.:* James T. Fesmire

POWERLINE,INC., Chloride Power Elctrns., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7329, TELEX: 5161003630, FAX: 508-879-8669

POWER MAGNE-TECH CORPORATION, 441 High Street, Perth Amboy, NJ 08861, Tel: 908-826-4700, FAX: 908-826-4706; Empl.: 65; *Sls. Mgr.:* Arthur Zuckerman; *Dist. Mgr.:* Arthur Zuckerman ..... **A•2371**

POWERMARK, See Topaz, Inc., 9192 Topaz Way, San Diego, CA 92123

POWER/MATE CORPORATION, 2727 Kurtz St., San Diego, CA 92110, Tel: 800-843-8544, 619-299-3800, TWX: 910-335-1241, FAX: 619-291-2584; Empl.: 175

POWER MEASUREMENT LTD., 6702 Rajpur Place, Victoria, BC, Canada V8X 3X1, Tel: 604-652-5118, FAX: 604-652-0411; Empl.: 25; *Sls. Mgr.:* William I. McMillan, Gen. Mgr.

POWERNETICS LTD., Clarence St. Loughborough, Leics, ENG LE11 1DX, Tel: 0509 214153, TELEX: 34306, FAX: 0509 262460; Empl.: 66; *Sls. Mgr.:* Margaret A. Foggon, Export Sls. Mgr.

Power-One
D.C. Power Supplies

FAX: 805-388-0476

POWER-ONE, INC., 740 Calle Plano, Camarillo, CA 93012, Tel: 805-987-8741, TWX: 910-336-1297; FSC No.: 54407; Empl.: 320; *Dist. Mgr.:* Julius Hirsch,V.P. Sls. ..... **D•1988-1999**

Local Sales Offices & Reps

AZ Huntsville, Capstone Elctrns. 602-437-0172
AZ MESA, Sys. Sls. of AZ 602-464-9989
CA Escondido, Eagle Tech. Sls. 619-743-6550
CA Santa Clara, Nova-Tronix, Inc. 408-727-9530
CA Woodland Hills, Varigon, Inc. 818-594-5080
CO Denver, Quorum 3 303-799-8100
CT Hamden, Datcom 203-288-7005
FL Boca Raton, Electrocraft 407-394-9686
FL Clearwater, Electrocraft 813-573-2277
GA Norcross, Montgomery Mktg. Inc. 404-447-6124
IL Chicago, M. Gottlieb & Assocs. 312-775-1151
IN Carmel, Technlg. Mktg. Corp. 317-844-8462
MN Edina, G.P. Sls., Inc. 612-831-2362
IN Ft. Wayne, Technlg. Mktg. Corp. 219-432-5553
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
KS Lenexa, Midwest Tech. Sls. 913-888-5100
KY Louisville, Technlg. Mktg. Corp. 502-893-1377
MD Baltimore, Eastern Comps. Sls. 800-223-3851
MA Waltham, Datcom, Inc. 617-891-4600
MI Farmington Hills, Rathsburg Assocs., Inc. 313-489-1500
MI Grand Rapids, Rathsburg Assocs. Inc. 616-949-7400
MO Earth City, Midwest Tech. Sls. 314-298-9843
NM Albuquerque, Sys. Sls. of AZ 505-889-2901
NY Great Neck, Trionic Assocs. 516-466-2300
NY Syracuse, Nycom, Inc. 315-437-8343
NC Cary, Montgomery Mktg. Inc. 919-467-6319
NC Raleigh, Montgomery Mktg. Inc. 919-851-0010
OH Columbus, Tom Mulligan Co. 614-457-2242
OK Tulsa, Advance Tech. Sls. 918-664-0482
OR Beaverton, Pacific Mktg. Specialist 503-641-9373
PA W. Conshohocken, Eastern Comp. Sls. 215-825-8610
TX Dallas, Advance Tech. Sls. 214-340-1300
TX Houston, Advance Tech. Sls. 713-440-3888
UT Salt Lake City, Quorum 3 801-943-9227
VA Redmond, Pacific Mktg. Specialist 206-882-3144
WI Milwaukee, M. Gottlieb & Assocs. 414-546-4466

Local Distributors

AL Huntsville, Bell Inds. 205-837-1074
AL Huntsville, Capstone Elctrns. 205-837-2141
AL Huntsville, Pioneer Elctrns. 205-837-9300
AK Anchorage, Frigid North 907-561-4633
AZ Phoenix, Sterling Elctrns. 602-268-2121

NY Tempe, Bell Inds. 602-966-7800
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WA Kirkland, Northwest Comps. Sls. 206-828-2104
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POWER SYSTEMS & CONTROLS, INC., 3206 Lanvale Ave., Richmond, VA 23230, Tel: 804-355-2803, FAX: 804-358-0498; Empl.: 55

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NM Albuquerque, J. Smith & Assocs. 505-345-6501
OH Cleveland, Tiby Co. 216-371-5335
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PRECISION EXTRUSIONS, INC., Box 120, Bensenville, IL 60106, Tel: 708-766-0340, FAX: 708-766-0495; Empl.: 185; *Sls. Mgr.:* Richard Ziehm

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MA	Burlington, FJS Assocs.	617-273-5959
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NY	Hauppauge, Schmitt Mktg. Corp.	516-434-1313
OR	Portland, Caruso & Co.	503-620-0375
TX	Austin, S.W. Mktg. Assoc.	512-255-8010
TX	Dallas, S.W. Mktg. Assocs.	214-341-8631
TX	Houston, S.W. Mktg. Assocs.	713-537-8166
WA	Bellevue, Caruso & Co.	206-455-8811
WI	Colgate, Rep One & Assocs.	414-628-4016
WI	Madison, Rep One & Assoc.	608-246-8889

Local Distributors

CA	Chatsworth, Marshall Inds.	818-407-4150
CA	Costa Mesa, Marvac Elctrns.	714-540-3280
CA	Irvine, Marshall Inds.	714-458-5394
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Clara, Context Engrg.	408-748-8676
IL	Champaign, Klaus Radio	217-356-1896
MD	Rockville, Capitol Radio	301-881-2270
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Northboro, Papi Supp.	508-393-8564
MI	Grand Rapids, S F Elctrn. Supp.	616-459-0216
MI	Livonia, LWC Distributors	313-464-7700
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	New York City, Martin Audio	212-541-5900
OR	Portland, Radar Elec.	503-232-8353
TX	Austin, Altex Elctrns.	512-832-9131
TX	Fort Worth, Allied Elctrns.	817-595-3500
TX	San Antonio, Altex Elctrns.	512-828-0503
VA	Annandale, Arcade Elctrns.	703-256-4610
VA	Richmond, Norfolk Wire	804-355-1100
VA	Virginia Beach, Norfolk Wire	804-449-3449
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, NEP Elctrns.	414-785-9100

PRECISION FILTERS, INC.

FAX: 607-277-4466

PRECISION FILTERS, 240 Cherry St, Ithaca, NY 14850, Tel: 607-277-3550, TELEX: 646846; FSC No.: 66-II-F & 66-II-I; Empl.: 95; *Sls. Mgr.:* D. F. Chandler ..... **A•1650, 1706-1707; D•1015, 1192-1193**

Local Sales Offices & Reps

AZ	Tempe, Hannah-Hill	602-431-1771
CA	Chatsworth, Technologies West	818-349-2001
IL	Matteson, Instrumentation Sls. Inc.	708-720-0705
CA	Pleasonton, SECCO Sales, INc.	415-484-1030
CO	Denver, Hannah-Hill, Inc.	303-424-5390
AZ	Tempe, Hannah-Hill, Inc.	602-431-1771
DC	Arlington, Gans & Pugh	703-527-3262
FL	Orlando, Microspec	407-898-3504
GA	Lilburn, Microspec	404-921-3840
IL	Matteson, Instrumentation Sales. Inc.	708-720-0705
IN	Indianapolis, RDP Corp.	317-243-8788
MD	W. Friendship, Gans & Pugh Assocs.	301-442-2189
MA	Boston, Ellis Assocs.	617-367-2170
MI	Farmington Hills, RDP Corp.	313-471-0685
NH	Manchester, Ellis Assocs.	603-623-0185
NM	Albequerque, Hannah-Hill, Inc.	505-268-0950
NY	Amherst, Reliable Measurement	716-892-9484
NY	Port Chester, Radiation Elctrns.	914-937-2300
OH	Dayton, RDP Corp.	513-253-6175
OH	Richfield, RDP Corp.	216-659-3138
OK	Oklahoma City, Abcor, Inc.	405-749-1600
PA	North Wales, Gans & Pugh Associates, Inc.	215-699-6655
PA	Pittsburg, RDP Corp.	412-487-2217
SC	Rock Hill, Microspec	803-366-3015
TN	Nashville, Microspec	615-383-4064
TX	Houston, ABCOR, Inc.	713-486-9251
UT	West Valley City, Hannah-Hill, Inc.	801-364-0606
VA	Herndon, Gans & Pugh Assocs.	703-709-0305
WA	Bellevue, Syntek	206-462-7700

PRECISION GRAPHICS INC., 59 La Grange St., Raritan, NJ 08869, Tel: 908-707-8880, FAX: 908-707-8884; Empl.: 36; *Sls. Mgr.:* David K. Weissman

PRECISION IMAGE CORPORATION, 501 Chesapeake Dr., Redwood City, CA 94063, Tel: 415-366-8900, 1-800-338-3377, FAX: 415-366-2149; Empl.: 70; *Sls. Mgr.:* Mr. Rene Carillo; *Dist. Mgr.:* Mr. Rene Carillo

PRECISION INTERCONNECT, 16640 SW 72nd Ave., Portland, OR 97224, Tel: 503-620-9400, TELEX: 36-0963; FSC No.: 60381; Empl.: 295; *Sls. Mgr.:* Alex Guletsky

PRECISION LAMP, INC., 681 Portal St., Cotati, CA 94931, Tel: 707-792-0333, FAX: 707-792-2738; FSC No.: FSCM 58451; Empl.: 65

PRECISION MECHANISMS, 50 Bond St., Westbury, NY 11590, Tel: 516-ED3-5955, FAX: 516-333-5956; FSC No.: 08127; Empl.: 25; *Sls. Mgr.:* Leon N. Canick

PRECISION METAL PRODUCTS CO., Centennial Indl. Pk., Peabody, MA 01961-6026, Tel: 508-532-5500, FAX: 508-532-9403; FSC No.: 86577; Empl.: 54; *Sls. Mgr.:* Robert A. Degnan

PRECISION MONOLITHICS INC. SUBSIDIARY OF BOURNS INC., 1500 Space Park Dr. PO Box 58020, Santa Clara, CA 95052-8020, Tel: 408-727-1500, 800-843-1515, TELEX: 71-371-9541, ESYLNK: 408-727-1550; Empl.: 1000; *Sls. Mgr.:* Peter Smyth; *Dist. Mgr.:* Cindy Joyce

PRECISION PAPER TUBE CO., 1033 South Noel Ave, Wheeling, IL 60090, Tel: 708-537-4250, FAX: 708-537-5777; Empl.: 250

PRECISION POWER SYSTEMS, 1840 Industrial Circle, Longmont, CO 80501, Tel: 303-443-6250, FAX: 303-678-8360; Empl.: 110; *Sls. Mgr.:* Linda Tholen

FAX: 319-394-9280

PRECISION RESISTIVE PRODUCTS, INC., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, Tel: 319-394-9131; Empl.: 65; *Sls. Mgr.:* Oscar Cline; *Dist. Mgr.:* Oscar Cline ..... **A•1976-1977**

Local Sales Offices & Reps

AL	Huntsville, Hughes & Assocs.	205-533-9108
CA	Burbank, Darco	818-504-2425
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	San Diego, Darco	714-639-5698
CO	Grand Junction, Krebil Comp. Sls.	303-243-8220
MA	Lexington, Jesco, Inc.	617-893-1598
MN	Minneapolis, Intl. Sls. Co.	612-831-8423
TX	Rowlett, Campion Sls. Co.	214-475-8313

PRC

FAX: 813-546-9515

PRECISION RESISTOR CO., INC., 10601 75 St. N., Largo, FL 34647-1421, Tel: 813-541-5771, TELEX: 821788; FSC No.: 48615; Empl.: 45; *Sls. Mgr.:* Arleen Reid ..... **A•1978-1981**

PRECISION SPECIALTIES, INC., 19414 Londelius St., Northridge, CA 91324, Tel: 818-349-9774, FAX: 818-349-4367; FSC No.: 66785; Empl.: 10

PRECISION TECH. SEWING, 921 E. Charleston Rd., Palo Alto, CA 94303, Tel: 415-856-2128, FAX: 415-856-1638

PRECISION TUBE, Church Rd. & Wissahickon, N. Wales, PA 19454, Tel: 215-699-5801, FAX: 215-699-0761; FSC No.: 82413; Empl.: 240; *Sls. Mgr.:* William J. McNeil

PREFERRED ELECTRONICS, INC., Main Line Dr., P.O. Box 248, Westfield, MA 01086, Tel: 413-568-2301, 1-800-553-6374, TELEX: 955-329, FAX: 413-562-7275; Empl.: 225

PREH ELECTRONIC INDUSTRIES, INC., 470 E. Main St., Lake Zurich, IL 60047-2578, Tel: 708-438-4000, FAX: 708-438-5522; FSC No.: 36-3193682; Empl.; 7; *Sls. Mgr.:* Ken Wood; *Dist. Mgr.:* Bob Van Orden ..... **B•1765, 1827-1829; C•1508-1509**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, More Sls., Inc.	602-788-9181
CA	Irvine, Balzer/Wolf Assocs.	714-261-6877
CA	Mtn. View, Bart Budge Assocs.	415-961-0940
CO	Arvada, Arrowhead CSI/ Sls.	303-423-5597
CT	Cheshire, MacInnis	203-272-8877
FL	Miami, Indl. Comps.	305-477-0387
GA	Norcross, Hughes Assocs.	404-662-1587
IL	Des Plaines, Essco Assocs.	708-298-5310
MD	Columbia, L. D. Lowery, Inc.	301-381-0225
MA	Norwood, MacInnis Co.	617-762-8090
MI	Farmington Hills, R.C. Merchant	313-476-4600
MN	Bloomington, Electronic Sls. Agy.	612-884-8291
MS	Corinth, Hughes Assocs.	601-287-2915
MO	St. Louis, Jim Amberg	314-946-5777
NJ	Berkley Heights, Cambridge/Allen	201-464-0203
NC	Cary, Hughes Assocs.	919-467-7029
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
OR	Portland, SPS Elctrns.	503-297-6919
PA	Broomall, L.D. Lowery Inc.	215-356-5300
TN	Jonesboro, Hughes Assocs.	615-753-2719
TX	Round Rock, Encore Tech. Comps.	214-418-0188
UT	Salt Lake City, Arrowhead CSI/Sls.	801-268-8440
WA	Redmond, SPS Elctrns.	206-885-5257
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
CA	Belmont, LoDan Elctrns. Inc.	415-592-4600
CA	Compton, Harper S.I.D.	213-979-5090
CA	Gardena, California Switch & Signal	213-770-2330
CA	San Carlos, LoDan Elctrns.	415-592-4600
CA	San Diego, California Switch	619-231-6740
CA	San Diego, Harper S.I.D.	619-578-2500
CA	San Jose, Harper S.I.D.	408-943-9490
CO	Arvada, Denver Beta Wintronic	303-431-7161
CT	Norwalk, Cobra Comps.	203-847-6442
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Largo, LoDan Elctrns., Inc.	813-586-2851
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, Hammond Elctrns.	404-449-1996
IL	Arlington Hgts., LoDan Elctrns.	312-398-5311
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Indianapolis, P.E.I. Genesis	317-879-0700
MA	Hingham, Sager Elctrl. Supp. Co.	617-749-6700
MA	Westborough, In Stock Prods. Co.	617-870-5750
MN	New Brighton, Parts 1	612-633-8079
MO	Jackson, Rapco Inds.	314-243-1433
NJ	Camden, Gen. Radio Supp. Co.	609-964-8560
NY	Bohemia, Key Comps.	516-567-7500
NY	Hempstead, Elctrn. Equip.	516-538-5510
NY	Rochester, Whirlwind Music Distrs.	716-663-8820
NC	Greensboro, Hammond Elctrns.	919-275-6391
OR	Beaverton, Component Resources	503-641-8488
PA	Harrisburg, Cumberland Elctrns.	717-232-5999
PA	Philidelphia, P.E.I. Genesis	215-673-0400
SC	Greenville, Hammond Elctrns.	803-232-0872
TX	Richardson, Off The Shelf Comps.	214-238-0808
WA	Seattle, Radar Elec.	206-282-2511
Can	London, Ont., C. M. Peterson Co. Ltd.	519-434-3204
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-9999
Can	Willowdale, Ont., Electrosonic Inc.	416-494-1666

PREMA PRECISION ELECTRONICS, INC., 4650 Arrow Hwy. Suite E-5, Montclair, CA 91763, Tel: 714-621-7292, FAX: 714-625-2098

FAX: 212-993-9211

PREMIER METAL PRODS. CO., 381 Canal Pl., Bronx, NY 10451, Tel: 212-993-9200; Empl.: 75; *Sls. Mgr.:* Anthony E. Bozza ..... **C•1090-1091**

Local Sales Offices & Reps

AZ	Tempe, Scientific Dvcs.	602-730-9774
CA	Fontana, Premier Metal	714-829-3089
CA	Huntington Bch., Scientific Dvcs.	714-840-3501
CA	San Jose, Scientific Dvcs.	408-554-0455
CO	Denver, AKI Enterprises	303-338-4488
CT	East Haven, Eagle Assocs.	203-467-6542
GA	Marietta, Adams & Assocs.	404-973-0853
IL	W. Chicago, May Assocs.	708-293-7763
KS	Kansas City, Delltron Co.	816-436-6445
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, Eagle Assocs.	617-444-3446
MI	Brighton, Electronic Sources	313-227-3598
MN	Minneapolis, J.E.M. Anderson Co.	612-823-6459
MO	Florissant, Delltron Co.	314-839-0033
NM	Albuquerque, Brytec-Scientific Devices	505-883-3668

NY	New Hyde Park, Harris & Aldrich Sls.	516-488-2622
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Greenboro, Adams & Assocs.	919-272-6838
OH	Cleveland, Del Steffen & Assoc.	216-461-8333
PA	Penndel, Delta Mktg.	215-750-1440
TX	Richardson, Spectra Sls. Corp.	214-234-3600
WA	Redmond, Scientific Dvcs	206-885-0004
EXP	FL, Ft. Lauderdale, GM Intl.	305-434-6617
	Local Distributors	
AZ	Phoenix, Dalis Elctrns.	602-275-2885
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Jose, Rose Elctrns.	408-943-0255
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
ID	Boise, Radar Elec.	208-336-2227
IL	Skokie, Anixter	708-677-2600
LA	Baton Rouge, Menard Elctrns.	504-355-0323
MD	Baltimore, Resco	301-823-0070
MA	Hingham, Sager Electrical Supp.	617-749-6700
MI	Ann Arbor, Purchase Radio Supp.	313-668-8696
MO	St. Louis, Gateway Elctrn. Supp.	314-427-6116
NJ	Cranford, Garden State Indl. Elec.	201-272-6400
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Hauppauge, Broadline Elec. Dist.	516-231-4100
NY	Hempstead, Davis Elctrn. Corp.	516-483-9200
NY	LIC, H. L. Dalis Inc.	212-361-1100
NY	New York, Martin Audio/Video Corp.	212-541-5900
NY	Portchester, Wise Comps.	914-939-8600
NY	Rochester, Simcona Elctrn. Corp.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Warren, Rem Elctrns.	216-248-1636
OR	Portland, Radar Elec.	503-232-3404
PA	Horsham, Toner Cable Equip.	215-675-2053
PA	West Chester, West Chester Elec. Supp.	215-696-7500
SC	Charleston, Wholesale Indl. Elec.	803-722-2634
TN	Clarksville, Randolph Hale & Matthews	615-647-2325
TN	Cookeville, Randolph & Parks	615-526-6184
TN	Nashville, Randolph & Rice	615-255-5601
TN	Tullahoma, Randolph Rice & Williams	615-455-4531
TX	Ft. Worth, Swieco Inc.	817-335-6521
TX	Houston, Lenert Co.	713-225-1465
VA	Arlington, Arlington Elctrns.	703-524-2412
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511

PREMIER MICROWAVE, 35 New Broad St., Port Chester, NY 10573, Tel: 914-939-8900, FAX: 914-939-9239; FSC No.: 15870; Empl.: 65; *Sls. Mgr.:* Mel Radner

PREM

FAX: 815-385-8578

PREM MAGNETICS, INC., 3521 N. Chapel Hill Rd., McHenry, IL 60050, Tel: 815-385-2700; FSC No.: 20462; Empl.: 180; *Sls. Mgr.:* D. Hertel ..... **A•1250-1253, 2372-2383**

PRES-AIR-TROL CORP., 1009 Boston Post Rd., Mamaroneck, NY 10543, Tel: 914-698-2026, 800-431-2625 (outside NY), FAX: 914-698-9456; Empl.: 25; *Sls. Mgr.:* Doug Robinson ..... **B•1766**

PRESCO, INC., 8 Lunar Drive, Woodbridge, CT 06525, Tel: 203-397-8722, FAX: 203-389-1129; Empl.: 11

PRESIDIO COMPONENTS, INC., 7185 Construction Ct., San Diego, CA 92121, Tel: 619-578-9390, FAX: 619-578-6225; FSC No.: 60212

PRESS-ON PRODUCTS, 21 Factory Rd., Addison, IL 60101, Tel: 708-628-2255, FAX: 708-543-4414; Empl.: 20; *Sls. Mgr.:* T. Cummins

PRESSURE CONTROLS, INC., 406 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-5002, FAX: 201-751-9653; FSC No.: 52193; Empl.: 15; *Sls. Mgr.:* P. Emmarco

PRESSURE SYSTEMS, INC., 34 Research Dr., Hampton, VA 23666, Tel: 804-865-1243, TELEX: 901406, FAX: 804-766-2644; Empl.: 98; *Sls. Mgr.:* J. S. Yakshe

PRIMELINE, Soltec Corporation, P. O. Box 670, San Fernando, CA 91341-0670, Tel: 818-365-0101, TELEX: 494-3094 SOLTEC UI, FAX: 818-365-7839; *Sls. Mgr.:* Byron McIntire

PRIME POWER, A Prime Technology Co., Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; *Sls. Mgr.:* J. L. Jamieson

PRIME TECHNOLOGY, INC., See General Resistance, A Prime Technology Co.

PRIMO COMPANY LIMITED, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan 181, Tel: 0422-43-3121; FSC No.: 0422 49 8865; Empl.: 391; *Sls. Mgr.:* H. Ikoma; *Dist. Mgr.:* S. Mizutani

PRINCETON CASE CO., INC., 667 Lehigh Ave., Union, NJ 07083, Tel: 908-687-1750, FAX: 908-687-1755; Empl.: 60; *Sls. Mgr.:* S. E. Parker

PRINCETON ELECTRONIC PRODUCTS, 2549 U.S. Highway 1, North Brunswick, NJ 08902, Tel: 908-297-4448, FAX: 908-821-5950; Empl.: 29; *Sls. Mgr.:* H. Center; *Dist. Mgr.:* H. Center

PRINCO INSTRUMENTS, INC., 1020 Industrial Hwy., Southampton, PA 18966; FSC No.: 48620; Empl.: 70; *Sls. Mgr.:* G. G. Pfaff

PRINTER PRODUCTS, 25 Denby Road, Boston, MA 02134, Tel: 617-254-1200, FAX: 617-254-6848; Empl.: 200; *Sls. Mgr.:* Bruce Burgess; *Dist. Mgr.:* Bruce Burgess

PRO BATTERY, INC., 3941 Oakcliff Indl. Ct., Atlanta, GA 30340, Tel: 800-451-7171, FAX: 404-449-5457; Empl.: 35; *Sls. Mgr.:* Neal A. Zucker

PROBE MASTER, INC., 4898 Ronson Ct., San Diego, CA 92111, Tel: 619-560-9676, 800-772-1519, FAX: 619-560-7354; *Sls. Mgr.:* Dick Press

PROBE-RITE, INC., P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-243-7219; *Sls. Mgr.:* Frank J. Ardezzone

PRO COM TECHNOLOGY INC., 28 Commerce Dr., Farmingdale, NY 11735, Tel: 516-293-4443, 800-762-3785, FAX: 516-293-4456; Empl.: 11; *Sls. Mgr.:* Alan Spiegel

PRODELIN CORPORATION, P.O. Box 368, Conover, NC 28613, Tel: 704-464-4141, FAX: 704-464-5725; Empl.: 100; *Sls. Mgr.:* Dan Johnson

PRODIGIT ELECTRONICS, 9301-101 Jordan Ave., Chatsworth, CA 91311, Tel: 818-341-6987, FAX: 818-341-5726; Empl.: 100; *Sls. Mgr.:* Daniel Erb ..... **D•2003**

PRODUCTION AUTOMATION, INC., 3160 De la Cruz Blvd. Ste. 210, Santa Clara, CA 95054, Tel: 408-980-9880, FAX: 408-980-8018; Empl.: 4; *Sls. Mgr.:* Bill Minnick; *Dist. Mgr.:* Bill Minnick

PRODUCTRONICS INC., 7616 Disalle Blvd., Fort Wayne, IN 46825, Tel: 219-489-8201, FAX: 219-489-6573; Empl.: 4; *Sls. Mgr.:* Bernard James

PRODUCTS ENGRG. CORP., 503 S. Vincent Ave., Azusa, CA 91702, Tel: 818-969-5879, TELEX: 910-587-1559, FAX: 818-969-9381; FSC No.: CAGE 3S621; Empl.: 45; *Sls. Mgr.:* Richard Mitchell

PRODUCTS FOR RESEARCH, 88 Holten St., Danvers, MA 01923, Tel: 508-774-3250, FAX: 617-245-1628; Empl.: 17; *Sls. Mgr.:* Skip Moccia

PTI PRODUCT TECHNOLOGY INC.

FAX: 714-474-1340

PRODUCT TECHNOLOGY, INC., 2811-B McGaw Avenue, Irvine, CA 92714, Tel: 714-474-8998; FSC No.: 1Z295; Empl.: 45 ..... **C•1661, 1684**

	Local Sales Offices & Reps	
AL	Huntsville, Mec-Elec	205-881-1522
AZ	Tempe, Integrated Tech. Sls.	602-968-5118
CA	San Diego, Qualtronics	619-695-0118
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
TX	Dallas, Passive Comps. Assocs.	214-824-6162
UT	Salt Lake City, Sierra Tech. Sls.	801-566-9719
	Local Distributors	
AZ	Scottsdale, Added Value	602-951-9788
CA	San Diego, Added Value	619-558-8890
CA	Tustin, Added Value	714-259-8258
CA	Visalia, Added Value	209-734-8861
CA	Westlake Village, Added Value	818-889-2861
CO	Wheat Ridge, Added Value	303-422-1701
TX	Austin, Added Value	512-454-8845
TX	Dallas, Added Value	214-404-1144
UT	West Valley City, Added Value	801-975-9500

PROF. A/V & SPECIALTY PROD. DIV., 223-5N-01, St. Paul, MN 55144-1000, Tel: 612-733-7644, FAX: 612-737-5583; Empl.: 38,351

PROFESSIONAL ENGINEERING SYSTEMS, 425 Parkway Dr., Erie, PA 16511-1051, Tel: 814-453-5452

PROGRAMMABLE DEVICES, INC., 155-T New Boston St., Woburn, MA 01801, Tel: 617-935-9530, FAX: 617-935-3654; Empl.: 10

PTS FREQUENCY SYNTHESIZERS

FAX: 508-486-4495

PROGRAMMED TEST SOURCES, 9 Beaver Brook Road, P.O. Box 517, Littleton, MA 01460, Tel: 508-486-3008; FSC No.: 66381; Empl.: 30 ..... **D•1312**

PRB LINE®

FAX: 1-800-635-8101

PROJECTOR RECORDER BELT CORP., Route 3 Highway 59 P.O. Box 176, Whitewater, WI 53190, Tel: 1-800-533-9654; Empl.: 30; *Sls. Mgr.:* Ed Wetzel; *Dist. Mgr.:* Nancy Smith ..... **C•1597**

	Local Sales Offices & Reps	
CA	Burlington, William Purdy Co.	415-347-7701
CA	Santa Ana, Mike Roth Sls.	714-647-0606
CO	Colorado Springs, Norris & Co.	303-576-8697
FL	Maitland, Hawkins-Frederickson Assocs., Inc.	407-831-2474
GA	Roswell, HW Phillips	404-992-3070
IL	Addison, Elctrn. Specialists	708-250-9080
IA	W. Des Moines, Nevco	515-225-9866
MA	Milford, Jonel Sls. Assoc.	508-478-4650
MI	Southfield, Robert Milsk Co.	313-354-3310
MN	Excelsior, Procon	612-937-6024
NY	Victor, Imco	716-924-3671
OH	Stow, J.W. Lehner Co.	216-686-1965
OR	Beaverton, Pacific Mktg. Grp.	503-641-9373
TX	Rowlett, Campion Sls.	214-475-8313
VA	Charlottesville, Crown Assocs.	804-293-6373
Can	Dorval, Quebec, ECG Canada	514-685-5800

PROJECT RESOURCES INC., 16 Kendrick Rd., Wareham, MA 02571, Tel: 508-295-7444, FAX: 508-295-7497; FSC No.: OEF11; Empl.: 18; *Sls. Mgr.:* T.R.Egan

PROJECTS UNLIMITED, 3680 Wyse Rd., Dayton, OH 45414, Tel: 513-890-1918, FAX: 513-890-4911; Empl.: 61; *Sls. Mgr.:* Greg Kimpton ..... **D•1050-1052**

	Local Sales Offices & Reps	
AL	Huntsville, ElectroSales, Inc.	205-830-2715
AZ	Scottsdale, Williams Assocs.	602-947-4297
CA	Irvine, Cal Rep	714-250-0567
CA	San Jose, Comtech Mktg.	408-294-3330
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Seymour, Sturdy Corp.	203-888-1480
FL	Lakeland, Munday Sls. Co.	813-858-5606
GA	Atlanta, ElectroSales, Inc.	404-394-1122
IL	Downers Grove, Golten Assocs. Inc.	708-512-0093
IN	Indianapolis, The J. C. Hofstetter Co.	317-897-7914
KS	Overland Park, Thomas L. Dowell	913-599-1100
MA	Wellesley Hills, Sturdy Corp.	617-235-2330
MN	Edina, G.P. Sls.	612-831-2362
MO	St. Louis, Thomas L. Dowell	314-849-4234
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Patchogue, Optimum Sls.	516-758-0644
NC	Raleigh, Tingen Tech. Sls., Inc.	919-870-6670
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
PA	Valley Forge, Providence Mktg.	215-935-3300
TX	Richardson, Eagle Mktg.	214-238-5383

IA Cedar Rapids, Thomas L. Dowell & Assocs. 319-364-3880
WA Redmond, Doran Sls. Assocs., Inc. 206-885-1885
Can Islington, Ont., D.T. Shaw Co., Ltd. 416-231-3494
Can Montreal, Que., D.T. Shaw Co. Ltd. 514-332-1163
Can Vancouver,B.C., F.D. Bolton, Ltd. 604-736-0351
Can Winnipeg, Man., F.D. Bolton, Ltd. 204-774-5708

Local Distributors

CA San Jose, Speakers Unlimited 408-453-5698
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Torrance, Pyramid Elctrns. 213-320-2700
CO Commerce City, Waco Elctrns. 303-289-4743
FL Lakeland, A-A Elec. 813-665-6941
GA Norcross, A-A Elec. 404-449-8670
IL Bensonville, Voyager Elctrns. Corp. 708-860-1300
MA Hingham, Hingham Bay 617-740-1900
MO St. Louis, Beckwith Elctrns. 314-343-6463
NY Rochester, Ray Baker Elctrns. 716-586-9164
MN Fridley, Voyager Elctrns. Corp. 612-571-7766
OH Dayton, Electro Supp. 513-299-5020
PA McKean, Advacom 814-476-7774
TX Austin, Southwest Elctrns. 512-837-8971
TX Stafford, Southwest Elctrns. 713-240-4000
TX Dallas, S.W. Elctrns. 214-234-3050
WA Redmond, Pyramid Elctrns. 206-883-7200
Can Willowdale, Ont., Electro Sonic 416-494-1666

PRO-LOG CORP., 2555 Garden Road, Monterey, CA 93940, Tel: 408-372-4593, TWX: 910-360-7082; Empl.: 120; *Sls. Mgr.:* Dick Thomas; *Dist. Mgr.:* Pat Laughlin

PROLOGIC SYSTEMS, 557-0 Burbank St., Broomfield, CO 80020, Tel: 303-460-0103, FAX: 303-469-5565; Empl.: 9

PROMAX-JOHNTON ELECTRONIC CORP., 17935 Sky Park Circle, Ste. H, Irvine, CA 92714, Tel: 714-975-1245, FAX: 714-975-1390; Empl.: 12; *Sls. Mgr.:* Dave Cooper

PROTEK INC., P.O. Box 59, Norwood, NJ 07648, Tel: 201-767-7242, FAX: 201-767-7343; *Sls. Mgr.:* Alex Orloff

PROTO STAMPING CORP., 811 Kaynyne St., Redwood City, CA 94063, Tel: 415-365-0498, FAX: 415-366-6329; Empl.: 35; *Sls. Mgr.:* Dave Anstead

PROTO SYSTEMS, 625 Sims Industrial Blvd., Alpharetta, GA 30201, Tel: 404-475-1330, 800-331-1797, FAX: 404-442-9751; FSC No.: FU 718; Empl.: 155; *Sls. Mgr.:* Keith Koehle

PROTOTEK, INC., 25 Standen Dr., Hamilton, OH 45015, Tel: 513-874-5094, FAX: 513-874-2252; FSC No.: 60813; Empl.: 45; *Sls. Mgr.:* Ron Nabors

PTC INDUSTRIES, INC., 5721 Research Drive, Huntington Beach, CA 92649, Tel: 213-598-9547, 714-891-7561, FAX: 714-373-0269; Empl.: 14; *Sls. Mgr.:* Steve Varonka

PTC TRANSFORMERS, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505, Tel: 609-298-8200, FAX: 609-298-8235; FSC No.: 05853; Empl.: 30; *Sls. Mgr.:* C. W. Harrison

PTS CORPORATION, Box 272, Bloomington, IN 47401, Tel: 812-824-9331; Empl.: 350; *Sls. Mgr.:* Jeff Hamilton; *Dist. Mgr.:* David Melwid

PTX-PENTRONIX INC., 1737 Cicotte, Lincoln Park, MI 48146, Tel: 313-388-3100, TELEX: 23-0398, FAX: 313-388-9171; Empl.: 21; *Sls. Mgr.:* J. Schultz

Z-LINE®

FAX: 714-641-9062

PULIZZI ENGINEERING, INC., 3240 S. Susan St., Santa Ana, CA 92704-6865, Tel: 714-540-4229; FSC No.: 70513; Empl.: 35; *Sls. Mgr.:* Roger A. Lea; *Dist. Mgr.:* Roger A. Lea ..... **D•2224-2228**

Local Sales Offices & Reps

CA Anaheim, Alpha Elctrn. Sls. 714-665-6580
CA Los Angeles, Power Partners 213-215-0800
CA Los Gatos, Norwest Elctrns. 408-395-1190
CA Santa Ana, Pulizzi Engrg., Inc. 714-540-4229
CT Westford, I.C.S. Assocs., Inc. 508-692-3545
IL Bensenville, E.S.I. 708-766-3667
IL Bensenville, R.L. Lang & Assoc. 312-766-3667
MD Columbia, L.G. White & Co., Inc. 301-290-8880
MD Silver Spring, L. G. White & Co., Inc. ... 301-792-0660
MA Westford, ICS Assocs., Inc. 508-692-3545
MO Bridgeton, BC Elctrn. Sls., Inc. 314-739-6683
MD Silver Spring, L.G. White 301-792-0660
OR Beaverton, Temper Tech. Mktg. 503-292-8201
PA Valley Forge, J.E. Cuesta & Co. 215-935-0400
Can Lac-Carre, Que., V.V.M. REG. 514-766-9270

Local Distributors

CA San Jose, Dansco Comp. Sls., Inc. 408-292-9740

PULNIX AMERICA, INC., 770 Lucerne Dr., Sunnyvale, CA 94086, Tel: 408-733-1560, TELEX: 172541 Pulnix America; *Sls. Mgr.:* Richard Hofmeister

PULSE INSTRUMENTS CO., 1234 Francisco, Torrance, CA 90502, Tel: 213-515-5330, FAX: 213-515-0068; Empl.: 30; *Sls. Mgr.:* Ron Perry

PUREDATA, 180 West Beaver Creek Rd., Richmond Hill, Ont., Canada L4B 1B4, Tel: 416-731-6444, FAX: 416-731-7017; Empl.: 150; *Sls. Mgr.:* Alex Kosarow, Cdn. Sls.; *Dist. Mgr.:* Dennis Robinson, US Sls.

PYLE INDUSTRIES, INC., 501 Center St., P.O. Box 620, Huntington, IN 46750, Tel: 219-356-1200, FAX: 219-356-2830; Empl.: 375; *Sls. Mgr.:* Tom Pyle; *Dist. Mgr.:* Mark Pyle, Natl. Sls. Mgr.

PYLE-NATIONAL, INC. LPL CO., 1334 N. Kostner Ave., Chicago, IL 60651, Tel: 312-342-6300 x210, TELEX: 25251, TWX: 910-221-0335, FAX: 312-342-0872; FSC No.: 49367; Empl.: 650; *Sls. Mgr.:* Mike Carroccia, V.P. Sls./Mktg.

PYLON CO., See Augat/Pylon Corp., Inc.

PYLON ELEX DEVELOPMENT CO. LTD., 2300 Victoria, Lachine, PQ, Canada H8S 1Z3, Tel: 514-637-1186, FAX: 514-636-1970; Empl.: 50; *Sls. Mgr.:* J. Guay

PYROCOM CO., 924 N. 143rd St., Seattle, WA 98133, Tel: 206-365-3535, FAX: 206-365-0402; *Sls. Mgr.:* Bill Kurtz

PYROFERRIC INTERNATIONAL, INC., 200 Madison St., Toledo, IL 62468, Tel: 217-849-3300, TWX: 910-663-0616, FAX: 217-849-2544; Empl.: 50; *Sls. Mgr.:* S. John Horner

Local Sales Offices & Reps

AZ Phoenix, Charles T. Fink & Assocs., Ltd. 602-992-9884
CA Alhambra, Deniston/JDA, Inc. 818-289-2844
CA Santa Clara, C. B. King Assocs. 408-988-7551
NY Commack, Marvin Scheck 516-864-9676
OH Shaker Hgts., Don Gype Co. 216-291-0103
TX Dallas, S.W. Elctrn. Ind., Inc. 214-690-9881
VA Roanoke, A.B. Kreger Co. 703-989-4738

PYROFILM RESISTOR CO., See KDI Electronics

PYROHM, INC., 24268 Indoplex Circle, Farmington Hills, MI 48018, Tel: 313-478-5060; *Sls. Mgr.:* Charles R. Berry

Q-CARD, INC., 2 Chellis Ct., Owings Mills, MD 21117-1634, Tel: 410-581-0112; *Sls. Mgr.:* Larry Nickel

QMI/NIEC, 12900 Rolling Oaks Rd., Twin Oaks, CA 93518, Tel: 805-867-2555, FAX: 805-867-2698 ..... **A•2126**

Local Sales Offices & Reps

AL Huntsville, EMA, Inc. 205-830-4030
CA Laguna Hills, 4-Star Elctrn. Comp. Sls. 714-583-9781
CA San Jose, Ruppert Sls. & Engrg., Inc. .. 408-998-8717
FL Boca Raton, Tech Sls. Specialists, Inc. 407-391-3718
GA Roswell, EMA, Inc. 404-992-7240
IL Rolling Meadows, Eagle Tech. Sls. Inc. 708-991-0700
MI Livonia, Leading Edge Sls. Corp. 313-478-6700
MN Prior Lake, Gleason Assoc., Inc. 612-447-7020
NJ No. Fairfield, Metro Logic Corp. 201-575-5585
NJ So. Medford, CEF Assocs. 609-953-3417
NY Syracuse, Murcan Sls. Corp. 315-455-8807
NC Raleigh, EMA, Inc. 919-846-6888
OH Columbus, The Tom Mulligan Co., Inc. 614-457-2242
TX Dallas, Electra Reps., Inc. 214-248-3852
WA Bellevue, N R Schultz Co. 206-746-1890

QSI CORPORATION, 2212 So. W. Temple No. 46, Salt Lake City, UT 84115, Tel: 801-466-8770, FAX: 801-466-8792; Empl.: 10; *Sls. Mgr.:* Gerri Mackey

Local Sales Offices & Reps

CT Orange, Isdale Assocs. 203-387-2704

Q-TECH CORP., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, Tel: 213-836-7900, TELEX: 69-6140, FAX: 213-836-2157; FSC No.: 51774; Empl.: 140; *Sls. Mgr.:* Sandra Rappaport ..... **A•1444-1447**

Local Sales Offices & Reps

AZ Tempe, Piper Sls. Co. 602-949-0048
CA Hermosa Beach, Quattro Sls. Assoc., Inc. 213-372-4221
CA Moorpark, Quattro Sls. Assoc., Inc. 805-523-2978
CA San Diego, Quattro Sls. Assoc., Inc. ... 619-581-3093
CA San Jose, Blue Elctrn. Sls. 408-345-0260
CA San Juan Capistrano, Quattro Sls. Assoc., Inc. 800-735-4510
CO Parker, Howard Assoc. 303-841-5755
CT Canterbury, The Cygnus Sls. Co., Inc. 203-546-6322
IL Northbrook, Allied Comp. Reps., Inc. .. 708-498-6658
IN Fort Wayne, TX Sales Inc. 219-489-4447
MD Baltimore, R.A. Wafer Assocs. 602-949-0048
MA Tewksbury, The Cygnus Sls. Co., Inc. 508-640-0001
MO St. Louis, Abrams & Assoc. 314-569-0447
NJ Glen Gardner, F & M Tech. Sls. 201-537-7888
NJ Paramus, Eltech Sls. 201-967-1309
NM Albuquerque, Piper Sls. Co. 505-828-1300
TN Winchester, C.J. Sls. 615-967-2156
TX Austin, Texoma Technical Sales, Inc. 512-441-1771
TX Houston, Texoma Technical Sales, Inc. 713-462-1432
VT So. Burlington, The Cygnus Sls. Co., Inc. 802-862-7754

QUAD DESIGN TECHNOLOGY, INC., 1385 Del Norte Road, Camarillo, CA 93010, Tel: 805-988-8250, FAX: 805-988-8259; Empl.: 16; *Sls. Mgr.:* Ron Lee; *Dist. Mgr.:* Jack Weaver

QUALCOMM, INC., 10555 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-587-1121, FAX: 619-452-9096; Empl.: 400; *Sls. Mgr.:* James Madsen; *Dist. Mgr.:* James Madsen

Qualidyne

FAX: 619-429-1011

QUALIDYNE SYSTEMS, INC., Lambda Group of Unitech, plc, 3055 Del Sol Blvd., San Diego, CA 92154, Tel: 619-575-1100; Empl.: 400; *Sls. Mgr.:* Barry A. Chenes ..... **D•2014-2019**

QUALITEC TECHNOLOGIES, INC., 43064 Christy St., Fremont, CA 94538, Tel: 415-498-1046, FAX: 415-498-5938; Empl.: 130; *Sls. Mgr.:* Kevin Daniels ..... **D•1313**

QUALITY AUTOMATION, INC., 1600 E. South Anaheim Blvd., Anaheim, CA 92805, Tel: 714-491-8535, FAX: 714-491-0417; Empl.: 22; *Sls. Mgr.:* Joe George; *Dist. Mgr.:* Joe George

QUALITY COMPONENTS, INC., P.O. Box 113, St. Marys, PA 15857, Tel: 814-834-2817, FAX: 814-834-9141; Empl.: 95; *Sls. Mgr.:* Michael Renaud, Mktg. Mgr.

QUALITY MICROWAVE INTERCONNECTS, INC., 301 Ballardvale St., Wilmington, MA 01887, Tel: 508-988-9090, FAX: 508-988-9393; FSC No.: 64023; Empl.: 30; *Sls. Mgr.:* Paul M. Tusini ..... **A•1824-1826**

Local Sales Offices & Reps

AL Huntsville, Bolton Assoc. 205-880-1164
AZ Tempe, Cain Technlg. 602-966-4322
CA Cupertino, Dura Sls. 408-255-2084
CA Van Nuys, Cain Technlg. 818-904-9392
CO Englewood, Cain Technlg. 303-220-8118
FL Orlando, Bolton Assoc. 407-856-0612
FL Pompano Beach, Bolton Assoc. 305-975-7245
FL St. Petersburg, Bolton Assoc. 813-864-2294
IN Park Ridge, Probe Elctrns. 708-696-2828
MD Laurel, Elec. Mktg. Assoc. 301-953-7800
MA Teskwbury, Sequel Assoc. 508-851-4010
MN New Hope, Baltz Assoc. 612-546-8520
NJ Deptford, Elec. Mktg. Assoc. 609-227-0925
NJ Linden, El-Tech Sls. 201-925-6162
NJ Paramus, El-Tech Sls. 201-967-1309
NY Syracuse, Em-Tech Assocs. 315-437-6410
SC Greenwood, Bolton Assoc. 803-223-4018
TX Garland, Cary McMahill Assoc. 214-681-1414
VA Abingdon, Bolton Assoc. 703-676-0500
WA Seattle, Data Com 206-285-2525
EXP Stamford, Dage Corp. 203-324-3123
Can Montreal, Que., Solid State Engrg. 514-481-3313

Local Distributors

CA Westlake Village, Sertek, Inc. 818-707-2872
MA Tewksbury, Sequel Sls. 508-851-4010

QUALITY POWER SYSTEMS, INC., 2400 S. Texas Ave., Pearland, TX 77581, Tel: 713-997-1700, 800-992-1701, FAX: 713-997-1907; Empl.: 20; *Sls. Mgr.:* Clarence Oliver

QUALITY RESEARCH COMPANY, North 11424 Judkins Lane, Spokane, WA 99207-9632, Tel: 509-924-6895; Empl.: 6; *Sls. Mgr.:* Jon Roath

QUALITY TECHNOLOGIES, 3400 Hillview Ave., Palo Alto, CA 93404, Tel: 415-493-0400, FAX: 415-493-7055; Empl.: 2000; *Sls. Mgr.:* Bob Taber; *Dist. Mgr.:* Candace Johnson

QUALITY THERMISTOR, 2147 Centurion Pl., Boise, ID 83709, Tel: 208-377-3373, FAX: 208-376-4754; FSC No.: 56866; Empl.: 45; *Sls. Mgr.:* John Mahoney ..... **B•1830, 1858-1859**

Local Sales Offices & Reps

EXP Oradell, NJ, Sylvan Ginsbury Ltd. 201-261-3200

QUALOGY INC., 109 Bonaventura Dr., San Jose, CA 95134, Tel: 408-434-5200, FAX: 408-434-5242; Empl.: 25; *Sls. Mgr.:* Mike Sills

QUALISTAR CORP., 9621 Irondale Ave., Chatsworth, CA 91311, Tel: 818-882-5822, TELEX: 510-600-2569, ESYLNK: 6289-9796, FAX: 818-882-4081; Empl.: 50

QUALTEK ELECTRONICS CORP., 7158 Industrial Pk. Blvd., Mentor, OH 44060, Tel: 216-951-3300, TELEX: 985319, FAX: 216-951-7252; Empl.: 75; *Sls. Mgr.:* Laura Yano/Regional Sls. Mgr.; *Dist. Mgr.:* Laura Yano/Regional Sls. Mgr.

QUAM-NICHOLS CO., 234 E. Marquette Rd., Chicago, IL 60637, Tel: 312-488-5800, FAX: 312-488-6944; Empl.: 200; *Sls. Mgr.:* William G. Little; *Dist. Mgr.:* Greg Johns ..... **D•1054-1055**

Local Sales Offices & Reps

AZ Mesa, Yocum Mktg. 602-834-3334
CA Belmont, Brian Trankle & Assocs. 415-595-4004
CA Gardena, Bidwell-Schwartz Assocs. 213-770-0300
UT Salt Lake City, Pro Tech Mktg. 801-943-8331
FL Orlando, Cartwright & Bean of FL 407-422-4531
GA Norcross, Cartwright & Bean of GA 404-368-0160
IL Mt Prospect, The Dombrow Co. 312-253-3326
IL North Brook, Levy, Grams, & Lassers 708-272-8500
IN Carmel, Green-Wissler Sls.,Inc. 317-843-5785
KS Prairie Village, R. W. Kunz & Assocs., Inc. 913-648-3535
MA Chicopee, Repworks, Inc. 413-533-0845
MN Edina, Mel Foster Techn. Sls. Inv. 612-941-9790
NJ Rahway, R. E. Breuer CO. 201-388-5045
NY Roslyn Hgts., Hudson Mktg. Inc. 516-625-0002
NY Syracruse, The Lewis & Dunnigan Co., Inc. 315-446-5522
OH Stow, J. W. Lehner Co. 216-686-1965
PA Broomall, Lowery Assocs. Co. 215-356-5300
TN Menphis, Cartwright & Bean of TN 901-362-8345
TX Dallas, J. Y. Schoonmaker CO., Inc. 214-349-4650
WA Seattle, Vector Manufacturers' Rep. 206-368-8400
EXP Yonkers, NY, Roburn Agencies, Inc. 914-968-1016
Can Waterloo, Ont., McBride Loudspeaker Source, Ltd. 519-884-3500
MI Southfield, Robert Milsk Co. 313-354-3310

QUAN-TECH, Stansbury Industries Inc., P.O. Box 28, Rte. 206, Flanders, NJ 07836, Tel: 201-927-1766, TWX: 710-987-7500; FSC No.: 63921; *Sls. Mgr.:* Richard A. Stansbury

QUANTRONIX, 49 Wireless Blvd., P.O. Box 9014, Smithtown, NY 11788, Tel: 516-273-6900, TELEX: 685-2167, FAX: 516-273-6958; Empl.: 175; *Sls. Mgr.:* R. J. Bruno; *Dist. Mgr.:* R. J. Bruno

QUANTUM BATTERIES, INC., 2772 Loker Ave. West, Carlsbad, CA 92008, Tel: 619-438-2202, TELEX: 01830, FAX: 619-438-0694; FSC No.: 01830; Empl.: 30; *Sls. Mgr.:* Gregg Kuehn; *Dist. Mgr.:* Terry Nielsen

QUANTUM CHROMODYNAMICS, INC., 2401 208th Street Unit 9, Torrance, CA 90501, Tel: 213-320-5717, FAX: 213-320-5848; Empl.: 3; *Sls. Mgr.:* David L. Hills

QUANTUM DATA®

FAX: 708-888-2802

QUANTUM DATA INC., 2111 Big Timber Road, Elgin, IL 60123, Tel: 708-888-0450, TELEX: 206725; Empl.: 23; *Sls. Mgr.:* Bill Down ..... **D•1315**

QUANTUM ELECTRONICS, INC., 31 Industrial Park Rd., Lewistown, PA 17044, Tel: 717-242-1132, FAX: 717-248-8680; Empl.: 20; *Sls. Mgr.:* Kit C. Kennedy

QUANTUM SCIENTIFIC INC., PO Box 219, Station J, Toronto, Ont M4J4Y1, Tel: 416-239-3363, 800-268-6000, FAX: 416-239-5791; Empl.: 10; *Sls. Mgr.:* Michael G. Sargeant

QUARTZITE PROCESSING, INC., 6 Holyoke St., Malden, MA 02148, Tel: 617-322-3611, FAX: 617-322-9623; Empl.: 11; *Sls. Mgr.:* P. S. Yanofsky

QUATECH INC., 662 Wolf Ledges Pkwy., Akron, OH 44311, Tel: 216-434-3154, TELEX: 5101012726, FAX: 216-434-1409; Empl.: 25; *Sls. Mgr.:* Michael Cenker; *Dist. Mgr.:* Michael Cenker

Q.V.S., INC., 20 North 15th St., East Orange, NJ 07017, Tel: 201-673-3996, FAX: 201-673-3997; FSC No.: 89820; Empl.: 45

QWINT DATA, INC., 333 Corporate Woods Parkway, Vernon Hills, IL 60061, Tel: 708-913-8765, TELEX: 27-0498, FAX: 708-913-8766; Empl.: 140; *Sls. Mgr.:* Tom O'Boyle

RACAL-DANA INSTRS. INC., 4 Goodyear St., Irvine, CA 92718, Tel: 714-859-8999; FSC No.: 21793; Empl.: 230

RACAL-GUARDATA, INC., 480 Spring Pk. Pl., Ste. 900, Herndon, VA 22070, Tel: 703-471-0892, FAX: 703-437-9333; FSC No.: 56496; Empl.: 30; *Sls. Mgr.:* Thomas Mitchell, VP

RACAL-MILGO, 1601 N. Harrison Parkway, Sunrise, FL 33323-2899, Tel: 305-846-1601, 800-327-4440, TWX: 510-955-4145, FAX: 305-846-4942; Empl.: 2800; *Sls. Mgr.:* H. Cheli

RACET COMPUTES, LTD., 3150 E. Birch St., Brea, CA 92621, Tel: 714-579-1725, TELEX: 701160, TWX: RACET UD, FAX: 714-579-3183; Empl.: 25; *Sls. Mgr.:* Michael Dendo, V.P. Sls.; *Dist. Mgr.:* Michael Dosch

RACORE COMPUTER PRODUCTS, INC., 170 Knowles Drive., Los Gatos, CA 95030, Tel: 408-374-8290, FAX: 408-374-6653; *Sls. Mgr.:* Joseph W. Rooney; *Dist. Mgr.:* Joseph W. Rooney

RADIAL CONTROLS, 2555 E. 55th Place, Indianapolis, IN 46220, Tel: 317-255-2796; Empl.: 25; *Sls. Mgr.:* R. L. Newsom

RADIALL, INC., 150 Long Beach Blvd., Stratford, CT 06497, Tel: 203-386-1030, TELEX: 311796, FAX: 203-375-3808; Empl.: 30; *Sls. Mgr.:* Peter Dionisio; *Dist. Mgr.:* Peter Dionisio

RADIANT COMMUNICATIONS CORP., 5001 Hadley Rd. P.O. Box 867, South Plainfield, NJ 07080, Tel: 908-757-7444, TELEX: 908-757-8666; Empl.: 10; *Sls. Mgr.:* Gene Thaw

RADIOMETRICS MIDWEST CORP., 2200 S. Main St., Lombard, IL 60148, Tel: 708-932-7262; FSC No.: Cage Code 1Z075 SIC Code 8748 Ext. 0021; Empl.: 5

RADIO RESEARCH INSTRUMENT CO., INC., 584 North Main Street, Waterbury, CT 06704-3506, Tel: 203-753-5840, TELEX: 962444 RADAR DURY, FAX: 203-754-2567; FSC No.: 57174; *Sls. Mgr.:* E. B. Doyle

RADIO SWITCH CORP., 64 S. Main St., P.O. Box A, Marlboro, NJ 07746, Tel: 908-462-6100, TELEX: 908-409-6695; FSC No.: 74217; Empl.: 40; *Sls. Mgr.:* J. L. Bernard

RADIO TELEVISION PRODUCTS CORP., 2702 Washington Ave. N., Douglas, AZ 85607, Tel: 602-364-4438, FAX: 602-364-4430; FSC No.: 5950; Empl.: 120; *Sls. Mgr.:* W. J. McGaw

RADIX WIRE CO., 26260 Lakeland Blvd., Cleveland, OH 44132, Tel: 216-731-9191, FAX: 216-731-7082; Empl.: 90; *Sls. Mgr.:* Peter B. Thurstone, Mktg. Admin.; *Dist. Mgr.:* Peter B. Thurstone, Mktg. Admin.

RADSTONE TECHNOLOGY, 20 Craig Rd., Montvale, NJ 07645, Tel: 201-391-2700, 800-368-2738, FAX: 201-391-2899; *Sls. Mgr.:* Larry Abzug

RAF ELECTRONIC HARDWARE, 95 Silvermine Rd., Seymour, CT 06483, Tel: 203-888-2133, FAX: 203-888-9860; FSC No.: 55566; Empl.: 120; *Sls. Mgr.:* William R. Bailey, Jr.; *Dist. Mgr.:* Dave Granger/John Capece

Distributor

RAG ELECTRONICS, INC., 21418 Parthenia St., Canoga Park, CA 91304, Tel: 818-998-6500, 800-732-3457 ..... 624, 628, 658, 681,696, 697, 721, 799, 801, 803

RAGEN CORP., Systems Div., 9 Porete Ave., N. Arlington, NJ 07032, Tel: 201-997-1000, FAX: 201-997-6948; Empl.: 400

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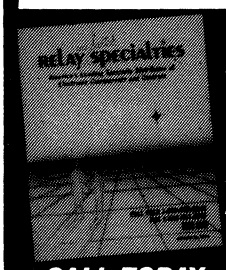

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MA	Needham, Ray Perron Co.	617-449-6162
MI	Brighton, A/P Assoc.	313-229-6650
MN	Plymouth, Twist Co.	612-550-0922
MO	Florissant, Delltron	314-839-0033
NJ	Leonia, Peter E. Schmitt	201-944-1096
OH	Cincinnati, Campisano	513-574-7111
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Can	Ontario, Haltronics	416-844-2121

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CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Southland Comp.	619-673-3800
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CA	San Jose, Compass Comps.	408-432-7575
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CT	Wallingford, Greene Shaw	203-265-3333
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IL	Schaumberg, Reptron	708-882-1700
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IL	Downers Grove, Richmar Elect. Corp.	312-968-0118
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IN	Indianapolis, Richmar Elctrns.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
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MI	Ada, Erin Engrg.	616-676-0665
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CA	Arcadia, Van Gott & Assoc.	818-445-9728
CA	La Jolla, Coastal Elctrn. Sls.	619-459-4148
CA	Santa Clara, Cummings & Assoc.	408-247-8656
CO	Aurora, Moss Mktg.	303-340-8535
CT	East Hampton, Apex Assocs.	203-269-8401
GA	Norcross, Spears & Assocs.	404-270-5661
MA	Needham, Apex Assocs.	617-444-8070
NY	Commack, Mars Engrg.	516-864-8676
NC	Raleigh, Spears & Assocs.	919-790-7606
UT	Salt Lake City, Moss Mktg.	801-363-5875
FL	Indian Harbor Bch., Post Mktg.	407-777-0994
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Baltimore, Eltron Sls. Ltd.	301-426-6637
MI	Grosse Point Pk., Greiner Assocs.	313-499-0188
OH	Westlake, Baehr Greenleaf & Assocs.	216-892-1770
OR	Hillsboro, Temco Northwest	503-645-2030
PA	Warrendale, Baehr Greenleaf & Assocs.	412-934-3088
TX	Dallas, Electra Reps	214-248-3852
VA	Front Royal, Eltron Sls. Ltd.	703-635-7201
WA	Bothell, Temco Nortwest	206-481-6150
WI	Milwaukee, Bert Wartchow Assocs.	414-964-0942
Can	Montreal, Que, Eli Manis, Inc.	514-484-2923

REN ELECTRONICS CORPORATION, C.C.G., An Insico Co., 755 New Ludlow Rd., S. Hadley, MA 01075, Tel: 413-536-1800, TELEX: 315617, FAX: 413-536-8425; FSC No.: 70143; Empl.: 75; *Sls. Mgr.:* S. W. Pai, Div. Mgr.

REPRODUCTION TECHNOLOGIES INC., P.O. Box 790, Bristol, IN 46507-0518, Tel: 219-848-5233, TELEX: 510 600 2378 R T I, FAX: 219-848-5333; Empl.: 10; *Sls. Mgr.:* Maxine Beasey

REPUBLIC ELECTRONICS CO., 200 Wireless Blvd, Hauppauge, NY 11788, Tel: 516-273-9800, FAX: 516-273-9820; FSC No.: 95750; Empl.: 145; *Sls. Mgr.:* Sy Newman, Mktg. Mgr.

RESEARCH DEVICES, INC., 121 Ethel Rd., Piscataway, NJ 08854, Tel: 908-572-4800, TELEX: 467058, FAX: 908-572-4808; Empl.: 25; *Sls. Mgr.:* Michael Schneider

RESEARCH SPECIALISTS, 1816 Settlers Oval, Cleveland, OH 44145, Tel: 216-871-8909; Empl.: 10; *Sls. Mgr.:* Tim Howard

RESISTANCE TECHNOLOGY INC., 1260 Red Fox Rd., St. Paul, MN 55112, Tel: 612-636-9770, FAX: 612-636-8944; *Sls. Mgr.:* Roger H. Falde



FAX: 708-863-4272

RESISTORS, INC., 5226 W. 26th St., Chicago, IL 60650, Tel: 708-652-7555; Empl.: 35; *Sls. Mgr.:* Theresa McGraw

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Local Sales Offices & Reps

CA	Santa Clara, K M Entprs.	408-986-1458



FAX: 408-982-0210

RESONANT POWER TECHNOLOGY, 3350 Scott Boulevard, Bldg.5302, Santa Clara, CA 95054, Tel: 408-982-0200; FSC No.: 0BZ13; Empl.: 10; *Sls. Mgr.:* Dan H. Burgoon ..... **D•2024-2025**

Local Sales Offices & Reps

FL	Land O Lakes, A.J.'S Power Source	813-996-2583
NH	Salem, OEM Marketing & Sales	603-893-0009
TX	Richardson, Jim Gray & Associates	214-699-9976

R.F. ELECTRONICS, INC., 1091 Duryea Ave., Irvine, CA 92714-5517, Tel: 714-263-0661, FAX: 714-263-0662; Empl.: 18; *Sls. Mgr.:* Michael Welter; *Dist. Mgr.:* Michael Welter

RFI CORPORATION, 100 E. Pine Aire Dr., Bay Shore, NY 11706, Tel: 516-231-6400, TWX: 510-227-6233, FAX: 516-231-6465; FSC No.: 13619; Empl.: 140; *Sls. Mgr.:* Dave Radford ..... **A•1633**

Local Sales Offices & Reps

CA	Alhambra, M.W. Riedel Co.	213-283-7694
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
FL	Clearwater, Tech-Rep Assocs.	813-572-9900
FL	Ft. Lauderdale, Tech Rep Assocs.	305-791-2708
FL	Merritt Island, Tech-Rep Assocs.	407-453-3313
FL	Winter Springs, Tech-Rep Assocs.	407-699-4010
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
MD	Rockville, Mechtronics Sls.	301-340-2130
MA	Burlington, Tritek, Inc.	617-272-4550
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NM	Albuquerque, M.G. Elctrns.	505-255-1638
NY	Buffalo, Upstate Engrg. Sls.	716-632-0011
NY	Great Neck, Trionic Assocs.	516-466-2300
NY	Rochester, Upstate Engrg.Sls.	716-225-2383
NY	Ronkonkoma, Compucon Distrs., Inc.	516-981-8810
NY	Utica, Upstate Engrg.Sls.	315-797-6721
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Glenside, Koebert Assocs.,Inc.	215-887-2310
TX	Garland, McBride Sci. Sls.	214-494-5000
Can	Bedford, N.S., Norgay Entprs. Ltd.	902-835-8530
Can	Neapean, Ontario, Norgay Entprs. Ltd.	613-745-4051
Can	Richmond B.C., Norgay Entprs. Ltd.	604-275-1121
Can	Toronto, Ontario, Norgay Entprs. Ltd.	416-234-8966
Can	Westmount, Quebec, Norgay Entprs. Ltd.	514-932-3233

Local Distributors

IL	Des Plaines, Compucon Distrs., Inc.	312-827-9444
MA	Reading, Compucon Distrs., Inc.	617-944-6875

RF INDUSTRIES, Celltronics, 10040 Mesa Rim Rd., San Diego, CA 92121, Tel: 619-587-0656, FAX: 619-587-0049

RFL INDS., INC., (DBA) Dowty Elctrns. Co., PO Box 250 Prospect St., Brandon, VT 05733, Tel: 802-247-6811, FAX: 802-247-3946; Empl.: 130; *Sls. Mgr.:* Dan Boutin; *Dist. Mgr.:* Dan Boutin

RF MONOLITHICS, INC., 4441 Sigma Rd., Dallas, TX 75244, Tel: 214-233-2903, TELEX: 463-0088, FAX: 214-387-8148; FSC No.: 2U874; Empl.: 120; *Sls. Mgr.:* C. Baker

R.F. POWER LABS., INC., Kalmus Engrg. Labs., Inc., 21820 -87th S.E., Woodinville, WA 98072, Tel: 206-481-8833, FAX: 206-486-1002; FSC No.: 057143; Empl.: 17; *Sls. Mgr.:* Jeannie Olson

RGB SPECTRUM, 2550 Ninth St., Berkeley, CA 94710, Tel: 415-848-0180, FAX: 415-848-0971; Empl.: 30; *Sls. Mgr.:* Lucien E. Long; *Dist. Mgr.:* Lucien E. Long

RHETOREX, INC., 1671 Deli Ave. No. 208, Campbell, CA 95008, Tel: 408-370-0881, FAX: 408-370-1171; Empl.: 15; *Sls. Mgr.:* Michael Ross

RHG ELECTRONICS LABORATORY, INC., 161 E. Industry Ct., Deer Park, NY 11729, Tel: 516-242-1100, FAX: 516-242-1222; Empl.: 205; *Sls. Mgr.:* David E. Krautheimer

RHOMBUS INDUSTRIES, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, Tel: 714-898-0960, TWX: 910-596-1826, FAX: 714-896-0971; FSC No.: 16714; Empl.: 60; *Sls. Mgr.:* Jim Earley; *Dist. Mgr.:* Jim Earley

RICHARD HIRSCHMANN OF AMERICAN, See Hirschmann

RICHARD-LEE CO., 3 Quine St., Cranford, NJ 07016, Tel: 201-276-0710, FAX: 201-276-6179; Empl.: 13

RICHARDS, ARKLAY S., CO., INC., 72 Winchester St., Newton Highlands, MA 02161-1796, Tel: 617-527-4385, FAX: 617-964-3746; *Sls. Mgr.:* L. K. Richards

RICHARDSON ELECTRONICS, LTD., 40W267 Keslinger Rd., LaFox, IL 60147, Tel: 800-323-1770, 708-208-2200, FAX: 708-208-2550; FSC No.: 5L804; Empl.: 625; *Sls. Mgr.:* Chris Cane; *Dist. Mgr.:* Chris Cane

RICHCO PLASTIC CO., P.O. Box 804238, Chicago, IL 60680, Tel: 312-539-4060, FAX: 312-539-6770; FSC No.: 06915; Empl.: 400; *Sls. Mgr.:* Ted E. Pavoris; *Dist. Mgr.:* Ted Pavoris

RIDGE TOOL CO., Sub. Emerson Elec. Co., 400 Clark St., Elyria, OH 44036, Tel: 216-323-5581, TELEX: 0243420, FAX: 216-323-5204; *Dist. Mgr.:* John Drew

RITTAL CORP., 3100 Upper Valley Pike, Springfield, OH 45504-9807, Tel: 800-477-4000, TELEX: 513-390-5599; Empl.: 150

RITZ ELECTRONICS/RELCO, 196 Queen St. N., New Dundee, Ont., Canada N0B 2E0, Tel: 519-696-2616, FAX: 519-696-2670; Empl.: 30; *Sls. Mgr.:* Leonard Snow; *Dist. Mgr.:* Leonard Snow ..... **C•1092; D•2027**

Local Sales Offices & Reps

CA	Torrance, U.S. Power Converting Co.	213-316-9984
KS	Wichita, US Power/Relco Midwest	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

Local Distributors

CA	Torrance, Leonard Snow & Assocs./U.S. Power	213-316-9984
KS	Wichita, US Power/Relco Midwest	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

RJF INTERANTIONAL CORP., 3875 Embassy Pkwy., Fairlawn, OH 44333, Tel: 216-668-7689, FAX: 216-668-7701

R-K ELECTRONICS, 11560 Goldcoast Dr., Cincinnati, OH 45249, Tel: 513-489-4060

RLC ELECTRONICS, INC., 83 Radio Cir., Mt. Kisco, NY 10549, Tel: 914-241-1334, TWX: 710-571-2103, FAX: 914-241-1753; FSC No.: 12598; Empl.: 75; *Sls. Mgr.:* Joseph Norelli; *Dist. Mgr.:* Joseph Norelli

RMF PRODUCTS, INC., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510, Tel: 708-879-0020, FAX: 708-879-6749; Empl.: 11; *Sls. Mgr.:* R. Frieders ..... **C•1593**

RMS COMPANY, Connector Division, 980 Osborne Rd., Minneapolis, MN 55432, Tel: 612-786-1520, FAX: 612-786-1771; Empl.: 50; *Sls. Mgr.:* Jack M. Lundeen

RMS TECHN., 11833 Canon Blvd., Ste 100, Newport News, VA 23606, Tel: 804-873-0100, FAX: 804-873-1512; FSC No.: 59606; Empl.: 42

ROANWELL, 180 Varick St., New York, NY 10014, Tel: 212-989-1090, TWX: 710-581-6555, FAX: 212-989-3285; FSC No.: 82872; Empl.: 80; *Sls. Mgr.:* Ray Lefebvre; *Dist. Mgr.:* Ray Lefebvre



RO ASSOCIATES

FAX: 408-744-1521

RO ASSOCIATES, INC., 246 Caspian Dr., Box 61419, Sunnyvale, CA 94088, Tel: 408-744-1450; FSC No.: 24230; Empl.: 47; *Sls. Mgr.:* R. D. Okada ..... **D•2028-2033**

Local Sales Offices & Reps

AL	JSI Inc.	205-883-4163
AL	Huntsville, JSI, Inc.	205-883-4163
AZ	Phoenix, Tech. Sls. Inc.	602-246-1614

CA Los Angeles, West Coast Reps. 213-690-9960
CA San Diego, W. Coast Rep 619-581-2406
CA San Jose, P & M Elctrns. 408-287-0402
CO Denver, F.G. Mktg. 303-795-9176
CT Woodbury, Power Factor 203-264-9812
DC Washington, Gans & Pugh 703-709-0305
FL Ft. Lauderdale, Panamtech 305-587-3769
FL Orlando, Panamtech 407-679-5506
IL Chicago, Mar-con Assocs. Inc. 708-675-6450
KS Kansas City, Midtec 913-541-0505
MD Baltimore, Gans & Pugh 301-442-2189
MA Boston, Power Factor 508-234-6415
MN Minneapolis, R J Inc. 612-866-3661
MO St. Louis, Midtec 314-275-8666
NM Albuquerque, Fry-Gates, Inc. 505-262-1525
NY Buffalo, NRM Mktg. 716-634-4300
NY Great Neck, M.O.S. Mktg. 516-487-3966
NY Rochester, NRM Mktg. 716-352-9166
NY Syracuse, NRM Mktg. 315-685-8991
OH Centerville, Omega Sls., Inc. 513-434-5507
PA Philadelphia, Gans & Pugh 215-699-6655
TX Houston, Barry Sls. 713-784-5860
TX Richardson, Barry Sls. 214-234-0255
WA Seattle, West Coast Reps. 206-483-5300
Can Vancouver, BC, Tracan Elctrn. Western Ltd. 604-984-4141

ROBBINS & MYERS/ELECTRO-CRAFT, 6950 Washington Ave. So., Eden Prairie, MN 55344, Tel: 612-942-3600, FAX: 612-942-3636; *Sls. Mgr.:* Terry McDonald; *Dist. Mgr.:* Brad Nelson

ROBINSON NUGENT, INC., 800 East 8th St., New Albany, IN 47150, Tel: 812-948-0564, TWX: 810-540-4082, FAX: 812-945-0804; Empl.: 567; *Sls. Mgr.:* Terry Johnson; *Dist. Mgr.:* Vic Siccone

Local Sales Offices & Reps
IN New Albany, Robinson Nugent, Inc. ... 812-948-0564

ROBISON ELECTRONICS, P.O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-8000, FAX: 805-544-8091; FSC No.: 19080; Empl.: 83

ROCKLAND INSULATED WIRE & CABLE, 87 Broadway, Haverstraw, NY 10927, Tel: 914-429-3103, FAX: 914-947-1712; FSC No.: 12111

ROCKLAND SCIENTIFIC CORPORATION, P.O. Box 3135, Princeton, NJ 08543, Tel: 609-896-2255, FAX: 609-895-9726; Empl.: 60; *Sls. Mgr.:* M. Classen

ROCKWELL INTERNATIONAL, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532 COLLINS CSMA, FAX: 714-641-5320; Empl.: 60; *Sls. Mgr.:* Robert A. Johnson

ROCKWELL INT'L:SEMICONDUCTOR PRODUCTS DIVISION, 4311 Jamboree Rd., Newport Beach, CA 92660, Tel: 714-833-4600, TWX: 910-591-1698; FSC No.: 34576; Empl.: 1995; *Sls. Mgr.:* Ernie Raper, Dir. of Sls.; *Dist. Mgr.:* K. Reutemann

RODALE
Technical Sales Inc.

FAX: 516-277-8375

RODALE TECHNICAL SALES INC., 577 Main Street, Islip, NY 11751, Tel: 516-277-5454, TELEX: 5106007812, ESYLNK: T8003254112; Empl.: 10; *Sls. Mgr.:* Gene Lipman ..... **B•1182, 1388; C•1662-1663, 1816-1817**

Local Sales Offices & Reps
CA Yorba Linda, Rodale Tech. Sls., Inc. ... 714-283-3140
KS Prairie Village, Crosslink Elctrl./Elctrns. 913-432-6100
NY Islip, Rodale Tech. Sls., Inc. 516-277-5454
OH Bedford Hgts., P.H.P. 515-472-5984

Local Distributors
AZ Phoenix, Storm Prods. 602-269-3485
CA Inglewood, Storm Prods. 213-776-8141
CA Sacramento, AVAC Sunset 1-800-AVAC-DIV
CA Santa Ana, BDS Elctrns., Inc. 714-662-1050
CO Broomfield, Storm Prods. 303-466-1991
MN St. Paul, AVAC Mid-America 1-800-AVAC-DIV
NJ Edison, AVAC National 1-800-AVAC-DIV
TN Nashville, AVAC Pioneer Tenn. 1-800-AVAC-DIV
TX Dallas, Storm Prods. 214-330-1381
WA Woodinville, Storm Prods. 206-488-7400

RODANN ELECTRONICS MFG. CO., 133 S. Brea Blvd, Brea, CA 92621, Tel: 714-529-1301, 800-366-7010, FAX: 714-529-9564; *Sls. Mgr.:* Alex Skarbek

RODELCO ELECTRONICS CORP., 111 Haynes Ct, Ronkonkoma, NY 11779, Tel: 516-981-0900, FAX: 516-981-1792; Empl.: 44

ROD-L
ELECTRONICS, INC.

FAX: 415-326-1993

ROD-L ELECTRONICS, INC., 923 Hamilton Ave., Menlo Park, CA 94025, Tel: 415-322-0711, 1-800-548-6305, TWX: 296210; *Sls. Mgr.:* Tom Cooke .... **D•1316-1317**

Local Sales Offices & Reps
CA Menlo Park, ROD-L (factory) 415-322-0711
CO Conifer, Energy Equip. Sls. 303-972-3335
IL Elk Grove, Loren Green Assocs. 312-593-0282
IN Indianapolis, Loren Green Assocs. 317-293-9827
KS Lenexa, Midtec Assocs. 913-541-0505
MD Cockeysville, Sci. Reps. 301-321-1411
MA Reading, Scheinfein Assocs. 617-944-2304
MI Detroit, Micro Sls 313-464-4520
MN Minneapolis, Hei-Lite Sls 612-861-6051
MO St. Louis, Midtec Assocs. 314-275-8666
NJ Fairfield, Addem Sls. 201-882-0993
NJ Pennsauken, Sci. Reps. 609-662-5222
NY De Witt, DB Assocs. 315-446-0220
OH Centerville, Micro Sls. 513-433-8171
OH N. Olmsted, Micro Sls 216-734-3080
OK Tulsa, Spectra Sls 918-663-7188
OR Beaverton, Core II Mktg 503-641-0877
TX El Paso, Venturesearch 915-594-4094
TX Houston, Spectra Sls. 713-270-8212
TX Richardson, Spectra Sls. 214-234-3600
VA Fairfax, Sci. Reps. 703-385-0600
WA Redmond, Core II Mktg 206-885-4344
WA Spokane, Core II Mktg 509-922-2971
WV Pittsburg, Micro Sls 412-471-0105
Can Ontario, Webster Instrs. Ltd. 416-625-0600

Local Distributors
CA Menlo Park, Rod-L (Factory) 415-322-0711
Can Ontario, Webster Instrs. Ltd. 416-625-0600

ROEAN INDUSTRIES, INC., 12970 Branford, Ste. C, Pacoima, CA 91331, Tel: 818-767-7047, FAX: 818-768-4974; Empl.: 8

ROGAN, 3455 Woodhead Dr., Northbrook, IL 60062, Tel: 708-498-2300, FAX: 708-498-2334; FSC No.: 86797; Empl.: 100; *Sls. Mgr.:* D. Pelletier; *Dist. Mgr.:* D. Pelletier

ROGERS CORP. DIV. POWER DISTBN.DIV., 5750 East McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370, FAX: 602-830-3370

ROGERS CORPORATION, Circuit Components Div., 2400 S. Roosevelt St., Tempe, AZ 85282, Tel: 602-967-0624, FAX: 602-967-9385

ROGERS CORPORATION, Circuit Materials Div., Box 4000, Chandler, AZ 85244, Tel: 602-963-4584, FAX: 602-732-9381

ROGERS CORPORATION, Flexible Interconnections Div., Box 700, Chandler, AZ 85244, Tel: 602-963-4584, TELEX: 140-223, TWX: 910-950-1961, FAX: 602-786-8490; *Sls. Mgr.:* Darrel Brasch

ROGERS CORPORATION, Microwave & Circuit Matls. Div., 100 S. Roosevelt Ave., Chandler, AZ 85226, Tel: 602-961-1382, FAX: 602-961-4533

ROGERS CORPORATION, Molding Materials Div., P.O. Box 550, Manchester, CT 06040, Tel: 203-646-5500, FAX: 203-646-5503

ROGERS CORPORATION, Power Distribution Div., 5750 E. McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370, FAX: 602-396-6401

ROGERS CORPORATION, Soladyne Div., 7447 Convoy Ct., San Diego, CA 92111, Tel: 619-279-7872, FAX: 619-277-9105; FSC No.: 55655; *Sls. Mgr.:* Dale Reed; *Dist. Mgr.:* Rick Jansen

ROGERS CORP., One Technology Dr., Rogers, CT 06263, Tel: 203-774-9605, TWX: 710-448-0047; Empl.: 2500

ROH, Portland Instrument, 6120 San Fernando Rd., Glendale, CA 91201, Tel: 818-500-0137, FAX: 818-240-1828; Empl.: 10; *Sls. Mgr.:* Dick Herbert

Local Distributors
CA Los Angeles, Hoffman Video Sys. 213-749-3311
FL Miami, Midwest Communications 305-592-5355
KY Hebron, TV One 606-689-4515

ROHDE & SCHWARZ, INC., 4425 Nicole Drive, Lanham, MD 20706, Tel: 301-459-8800, FAX: 301-459-2810; FSC No.: 82199; Empl.: 65

ROHM

FAX: 615-641-2022

ROHM CORPORATION, Rohm Electronics Division, 3034 Owen Drive, Antioch, TN 37013, Tel: 615-641-2020; Empl.: 115; *Sls. Mgr.:* Mike DelGrippo; *Dist. Mgr.:* Steve Bishop .... **A•1742, 1984-1985, 2120-2121; B•1183**

Local Sales Offices & Reps
AL Huntsville, Strategic Mktg. 205-464-0490
AZ Tucson, Clemick & Assocs. 602-749-4003
CA Camarillo, Eltec Entprs. 805-484-8298
CA Cupertino, GetSales 408-725-8384
CA Dana Point, Eltec Entprs. 714-493-7003
CA Diamond Bar, Eltec Entprs. 714-861-4779
CA San Diego, C.K. Assocs. 619-279-0420
CO Parker, A5 Company 303-841-3651
FL Altamonte Springs, Sales Engrg. Concepts 407-682-4800
FL Deerfield Bch., Sales Engrg. Concepts 305-426-4601
IL Lake Bluff, Hopewell Assocs. 708-234-3310
IN Kokomo, Schillinger Assocs., Inc. 317-455-2708
IA Cedar Rapids, Electromec Sls., Inc. ... 319-393-1637
KS Kansas City, B.C. Elctrn. Sls. 913-342-1211
MD Westminster, Chesapeake Technlgs. .. 301-876-4318
MA Harvard, Cycle Sls. 508-456-6868
MI Grosse Pointe Pk., Greiner Assocs., Inc. 313-499-0188
MN Burnsville, Electromec Sls., Inc. 612-894-8200
MO Bridgeton, B.C. Elctrn. Sls., Inc. 314-739-6683
NJ Springfield, Radix, Inc. 201-467-4970
NY Buffalo, Quality Comps., Inc. 716-837-5430
NY Manlius, Quality Comps., Inc. 315-682-8885
NY Rochester, Quality Comps., Inc. 716-342-7229
NC Cary, Rohm Corporation 919-460-5959
OR Tigard, Comps. West, Inc. 503-684-1671
PA Prospect Park, ELF Sls. Co. 215-534-3340
TN Jonesboro, Strategic Mktg. 615-753-5518
TN Nashville, Strategic Mktg. 615-883-7882
TX Austin, Sage Mktg. 512-335-0300
TX Bedford, Sage Mktg. 817-267-7781
TX Denton, Rohm Corporation 817-383-3931
WA Redmond, Comps. West, Inc. 206-885-5880
WA Spokane, Comps. West, Inc. 509-922-2412
PR Puerto Rico, Sales Engrg. Concepts ..... 809-250-0140 x 5321
Can Hamilton, Ont., Cartwright-Southall Assocs. 416-528-0294
Can Nepean, Ont., Cartwright-Southall Assocs. 613-723-6733

ROLYN OPTICS CO., 706 Arrowgrand Circle, Covina, CA 91722-2199, Tel: 818-915-5707/5717, TELEX: 67-0380, FAX: 818-915-1379

ROSE ELECTRONICS, INC., Energy Products Group, 1991 Concourse Dr., San Jose, CA 95131, Tel: 408-943-0440, FAX: 408-943-0360; Empl.: 13; *Sls. Mgr.:* Bob Burres; *Dist. Mgr.:* Bob Burres

ROSE ENCLOSURES SYS., INC., 7330 Executive Way, Frederick, MD 21701, Tel: 301-696-9800, FAX: 301-696-9494; FSC No.: 4Y520/C0242; Empl.: 45; *Sls. Mgr.:* Warren Hudacek ..... **C•1093**

Local Sales Offices & Reps
CA Irvine, Comp. Mktg. 714-951-5950
FL Tampa, Florida Comp. Sls. 813-960-7044
MA Needham, Todino Eng. Sls. 617-444-7925
IL Chicago, Paddock Mktg. 312-452-7852
IA Cedar Rapids, Tech. Elctrns. 319-366-5443
NY Rochester, Tech. Comp. Sls. 716-342-2406
NC Kernersville, Heritage Sls. 919-996-4374
OH Dayton, J.C. Hofstetter Co. 216-241-4880
PA Frazer, ICI 215-889-0650
TX Dallas, D.J. Sls. & Assoc. 214-783-8876
WA Federal Way, K. R. Jensen Sls. 206-874-2772

Local Distributors
Can Vancouver, BC, Memco 604-590-1553

ROSEMONT-NASHVILLE, INC., See Chromalox Instrs. & Controls

ROSEMOUNT®

FAX: 201-857-9403

ROSEMOUNT ANALYTICAL INC., 89 Commerce Rd., Cedar Grove, NJ 07009, Tel: 800-367-7242 .... **D•1318**

Local Sales Offices & Reps

AL	Birmingham	205-988-5759
AL	Mobile	205-343-9403
AZ	Phoenix	602-867-9374
CA	Concord	415-674-9799
CA	Laguna Hills, Kendall Mktg.	714-581-9951
CA	LaHabra	213-694-5504
CO	Lakewood	303-935-1524
FL	Maitland	407-740-0170
GA	Marietta	404-426-1300
HI	Honolulu	808-842-4484
IL	Lombard	708-495-8383
IN	Indianapolis	317-247-4613
KS	Shawnee Mission	913-642-8560
LA	Baton Rouge	504-756-7000
LA	Lake Charles	318-436-1828
TX	Stafford	713-274-0500
MD	Hunt Valley	301-527-1030
MA	Westborough	508-898-2444
MI	Brighton	313-227-3622
MN	Bloomington	612-832-5001
MO	Bridgeton	314-739-1540
NJ	Fairfield	201-808-9168
NY	Fairport	716-223-0400
NC	Charlotte	704-523-2223
NC	Raleigh	919-783-6730
OH	Cincinnati	513-381-5343
OH	Independence	216-661-9800
OK	Tulsa	918-663-6025
PA	King of Prussia	215-768-6900
PA	Pittsburgh	412-787-7340
TN	Knoxville	615-588-0014
TN	Memphis	901-365-9906
TX	Dallas	214-869-1461,62
TX	Round Rock	713-274-0500
VA	Midlothian	804-739-0660
WA	Bellevue	206-451-1111
WI	Appleton	414-731-8757

ROSENBERGER-MICRO COAX, (Formerly Micro-Coax Components, Inc.), Box E, Collegeville, PA 19426, Tel: 215-489-3700, FAX: 215-489-1103; Empl.: 50; *Sls. Mgr.:* Lloyd Deery

ROSS ENGINEERING CORP., 540 Westchester Dr., Campbell, CA 95008, Tel: 408-377-4621, FAX: 408-377-5182; FSC No.: 23598; Empl.: 45; *Sls. Mgr.:* Jim Ross; *Dist. Mgr.:* Jim Ross ..... **B•1230, 1567-1569; D•1319**

ROTEK INSTRUMENT CORP., 390 Main St., Waltham, MA 02254, Tel: 617-899-4611, TELEX: 928034; FSC No.: 06678; *Sls. Mgr.:* Eliot Warner

ROTORK CONTROLS, INC., 19 Jetview Drive, Rochester, NY 14624, Tel: 716-328-1550, FAX: 716-328-5848; Empl.: 65; *Sls. Mgr.:* Chris Warnett; *Dist. Mgr.:* Chris Warnett

ROWE INDUSTRIES, INC., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, Tel: 419-729-9761, FAX: 419-729-1794; FSC No.: 82878; Empl.: 89 ..... **C•1513-1515, 1819**

Local Sales Offices & Reps

AL	Huntsville, South Design & Mktg.	205-880-3623
AZ	Phoenix, Blackhart Assocs.	602-893-3488
CA	Morgan Hill, Val. C. Robinson	408-778-6210
FL	Maitland, EIR, Inc.	407-660-9600
IL	Lisle, Connect-Plus	708-355-6363
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Burlington, Don C. Richard	617-273-3888
MN	Stillwater, Kits, Co.	612-439-8088
PA	Glenside, Koebert Assocs.	215-887-2310
TX	Roanoke, CMR	817-379-6540
WA	Bellevue, Advanced Power Comps.	206-747-9127
WV	Inwood, Koebert Assocs.	304-229-8401

Local Distributors

MN	Bloomington, Triad Wire & Cable	612-884-7390

MILTON ROY CO., Environmental, 1238 W. Grove Ave., Orange, CA 92665-4134, Tel: 714-974-5560, FAX: 714-921-2531; Empl.: 60; *Sls. Mgr.:* Harold Peper

ROYONIC INC., 25345 Ave. Stanford, Ste. 201, Valencia, CA 91355, Tel: 805-257-0303, TELEX: 315672, ESYLNK: 62840158, FAX: 805-257-0802; Empl.: 11; *Sls. Mgr.:* Rory Stoner

RTRON CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 708-679-7180, FAX: 708-675-3709; FSC No.: 19130; *Sls. Mgr.:* R. McLean

RTS SYSTEMS, TELEX COMMUNICATIONS, INC., 1100 W. Chestnut St., Burbank, CA 91506, Tel: 818-566-6700, TELEX: 194855, FAX: 818-843-7953; FSC No.: 60572; Empl.: 45; *Sls. Mgr.:* Shelley Brown Harrison; *Dist. Mgr.:* Shelley Brown Harrison

RUBYCON AMERICA, INC., 4293 Lee Ave., Gurnee, IL 60031, Tel: 708-249-3450, FAX: 708-578-1300; Empl.: 8; *Sls. Mgr.:* Jeffrey W. Swanson; *Dist. Mgr.:* Jeffrey W. Swanson

RUNDEL PRODUCTS, Allied Controls Incorporated, 562 Captain Neville Drive, Waterbury, CT 06705, Tel: 203-757-4200, FAX: 203-757-4204; FSC No.: 02288; *Sls. Mgr.:* J. T. Kryjak; *Dist. Mgr.:* D. Varga ..... **B•1768-1769**

Local Sales Offices & Reps

AZ	Phoenix, BLS Comms.	602-841-6613
CA	Irvine, Component Mktg. Assoc.	714-727-0688
CA	Tarzana, Comp. Mktg. Assoc.	818-708-8058
CT	Waterbury, Allied Controls, Inc.	203-757-4200
FL	Lakeland, Munday Sls. Co.	813-858-5606
IL	Skokie, Indl. Reps.	312-967-8430
IN	Indianapolis, M & L Elctrn. Sls., Inc.	317-359-4742
MD	Burtonsville, Chesapeake Technlg.	301-236-0530
MN	Bloomington, Indl. Reps. Inc.	612-854-8027
NJ	Englewood, Gray Assocs., Inc.	201-894-0894
NJ	Kenvil, Gray Assocs., Inc.	201-927-6662
OH	Beachwood, Elctrn. Salesmasters Inc.	216-831-9555
TX	Austin, Comp. Technlg.	512-250-2450
TX	Dallas, Component Technlgy.	214-783-8831
TX	Houston, Comp. Technlg.	713-961-1262
WI	Brookfield, Indl. Reps. Inc.	414-789-9393

RUSH ENTERPRISES INC:A HEICO COMPANY, 20 Hampshire Drive, Hudson, NH 03051, Tel: 603-886-9460, FAX: 603-886-0372; Empl.: 14; *Sls. Mgr.:* William A. Walsh

RUSSTECH ENGINEERING COMPANY, INC., 23322 (D) Madero Road, Mission Viejo, CA 92691, Tel: 714-472-0880, FAX: 714-472-1081; FSC No.: 01EG24; *Sls. Mgr.:* David Zoscak

RUSTRAK INSTRUMENTS, Mark IV Company, Rte. 2 & Middle Rd., E. Greenwich, RI 02818, Tel: 401-884-6800, 800-332-3202, TWX: 710-387-1500; Empl.: 250; *Sls. Mgr.:* John Olobri; *Dist. Mgr.:* John Olobri ..... **D•1423**

Local Distributors

AZ	Tempe, CMI Metermaster	602-431-0015
CA	Fullerton, Rustrak	714-879-6384
CA	Hayward, Coast Inst.	415-786-9300
CA	San Marcos, Mitchell Inst.	619-744-2690
CO	Commerce City, WACO Elctrns.	303-289-4743
CT	Middletown, EIL Instrs.	203-346-6646
FL	Lakeland, AA Elec.	813-665-6941
GA	Forest Park, Brownell Electro	404-362-9009
IL	Des Plaines, Rustrak	312-803-5390
MD	Sparks, EIL Instrs.	301-771-4800
MA	Burlington, EIL Instrs.	617-272-9450
MI	Grand Rapids, Smith Inst.	616-245-1195
MI	Royal Oak, George Inst.	313-280-1111
MO	St. Louis, Indl. Svc. Labs	314-423-3141
NJ	Newark, Norman Bragar Prods.	201-344-1100
NC	Charlotte, Brownell Electro	704-597-1270
OH	Cincinnati, Schlemmer Assocs.	513-522-8340
OH	Cleveland, M.A. Blankenberg	216-251-7010
PA	Philadelphia, Sunshine Scientific	215-673-5600
RI	E. Greenwich, Rustrak	800-332-3202
TX	Dallas, Inotek Corp.	214-243-8370
TX	Houston, American Analog	713-941-7265
WA	Seattle, Branom Inst.	206-762-6050
WI	Waukesha, Wisconsin Control Corp.	414-796-0290
Can	Mississauga, Ont., Webster Inst.	416-625-0600

RUTHERFORD RESEARCH, Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 4; *Sls. Mgr.:* Dr. A. Blanck; *Dist. Mgr.:* Dr. A. Blanck

R X D INC., Relm Communications, 806 Custer Ave., Norfolk, NE 68701, Tel: 402-379-0012, 800-228-8108, FAX: 402-379-3074 ..... **A•1452-1454**

RYAN INTERNATIONAL CORP., 4800 Evanswood Dr., Columbus, OH 43229-6207, Tel: 614-885-3303, FAX: 614-885-8307; Empl.: 30

RYE INDUSTRIES, INC., 3337 Air Park Rd., Fuquay-Varina, NC 27526, Tel: 919-557-0511, TELEX: 919-557-0510; Empl.: 5

S A B NIFE, INC., Div. of Sonesson, P.O. Box 7366, 251 Industrial Blvd., Greenville, NC 27834, Tel: 919-830-1600, TELEX: 92-9407; Empl.: 150; *Sls. Mgr.:* Alan Feo; *Dist. Mgr.:* Alan Feo

SABRE COMMUNICATIONS CORP., 3400 Hwy 75 N., P.O. Box 536, Sioux City, IA 51102, Tel: 712-258-6690, FAX: 712-258-8250; FSC No.: 60348; *Sls. Mgr.:* Jerry W. Audus; *Dist. Mgr.:* Larry D. Vaydich

SABRITEC, 1733 Kaiser Ave., Irvine, CA 92714, Tel: 714-660-1970, TELEX: 678401, FAX: 714-660-9136; FSC No.: 58795; Empl.: 49

SACO CONTROLS INC., 9700 Trans Canada Hwy., Montreal,Qc., Canada H4S 1V9, Tel: 514-745-0310, TELEX: 055-62171, FAX: 514-745-0315; Empl.: 36; *Sls. Mgr.:* Pat Argento

SAFE POWER, Acme Electric Corporation, 5416 Amelia Earhart Dr., Salt Lake City, UT 84116, Tel: 801-539-0227, 1-800-325-5848, FAX: 801-539-0237; *Sls. Mgr.:* Rod Pullen; *Dist. Mgr.:* Jim Heidenreich

SAFT AMERICA INC., Power Sources Div., 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547620, TWX: 810-786-5866, FAX: 912-247-6680; Empl.: 200 ..... **D•1426, 1486-1488**

SAFT AMERICA INC., Advanced Battery Systems Div., 107 Beaver Ct., Cockeysville, MD 21030, Tel: 301-771-3200, FAX: 301-771-1144 ..... **D•1426**

SAFT

FAX: 912-247-6680

SAFT AMERICA, INC., Portable Battery Division, 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547-620; Empl.: 600; *Sls. Mgr.:* Michael Marcoux ..... **D•1426, 1486-1488**

Local Sales Offices & Reps

CA	Camarillo, SAFT America, Inc.	805-482-4101
CA	Granada Hills, SAFT America, Inc.	818-360-1853
CA	Redwood City, SAFT America Inc.	415-365-4539
FL	Boca Raton, SAFT America, Inc.	407-338-7730
GA	Kennesaw, SAFT America Inc.	404-429-4938
GA	Marietta, SAFT America, Inc.	404-992-6950
IL	Naperville, SAFT America, Inc.	708-355-8990
IL	Oak Forest, SAFT America, Inc.	708-687-6690
TX	Dallas, SAFT America, Inc.	214-239-3935
MN	Inver Grove Hgts., SAFT America Inc.	612-552-0121
OH	Brownsville, SAFT America, Inc.	216-861-1877
PA	McKean, Advacom	814-476-7774

Local Distributors

AZ	Phoenix, Lynntronics	602-433-0288
CA	Carlsbad, Quantum Batteries	619-438-2202
CA	Chatsworth, Mill Comm. Distrs., Inc.	818-998-3111
CA	Costa Mesa, House of Batteries	714-548-3968
CA	Hawthorne, Kent Elctrns.	213-970-0997
CA	Mountain View, Energy Sls.	415-969-0800
CA	N. Hollywood, C.H. & M	818-982-3150
CA	San Rafael, Elctrns. Plus	415-457-0466
CO	Littleton, AVT	303-798-1958
FL	Altamonte Springs, TNR Tech.	407-682-4311
FL	Hialeah, Pro Battery	305-884-4040
GA	Decatur, ELS Prods.	800-334-5066
IL	Downers Grove, Telecomms. Dvcs., Inc.	708-971-3460
IL	Lisle, Jabro Batteries	708-964-9358
IL	Rosemont, Advent Elctrns.	708-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MA	Andover, Generation Elctrns.	508-683-1177
MA	Billerica, A. W. Mayer Co., Inc.	617-229-2255
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Sharon, Adcour	617-784-8123
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, R. S. Elctrns.	313-525-1155
MI	Livonia, Vidcom	313-462-9400
MN	St. Paul, D. C. Battery Prods. Inc,	612-646-7478
NY	Farmingdale, Delta Concepts	516-845-1294
NY	Flushing, W & W Assocs.	718-961-2103
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Charlotte, Electro Sys., Inc.	704-525-2421

PA Bensalem, Avex Elctrns. Corp. 215-638-3300
PA McKean, Advacom 814-476-7774
TN Mt. Juliet, Batteries Unlimited 615-754-8179
TX Austin, Kent Elctrns. 512-834-1900
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Lone Star Mktg. 713-589-0853
TX Richardson, Kent Elctrns. 214-669-2600
TX Spring, Jabro Batteries, S.W. 713-367-9393
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VA Falls Church, Perrott Engrg. Labs, Inc. 703-532-0700
WA Redmond, Energy Sls. 206-883-2343

SAGE LABORATORIES, INC., 11 Huron Dr., Natick, MA 01760, Tel: 508-653-0844, TWX: 710-346-0390, FAX: 508-653-5671; FSC No.: 07180; Empl.: 43; *Sls. Mgr.:* Tony Cieri

SAINT SWITCH, INC., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174, Tel: 708-377-3779, FAX: 708-377-7438; FSC No.: 60198; Empl.: 30

SAMARIUS PRECISION INSTRUMENTS, INC., 562 Captain Neville Drive, Waterbury, CT 06705, Tel: 203-756-7030, FAX: 203-757-4204; FSC No.: 18065; Empl.: 25; *Sls. Mgr.:* Isabella Dobbins

SAMATIC WINDING MACHINE, Jenlor Ltd., 200 Highbridge St., Fayetteville, NY 13066, Tel: 315-637-9080, FAX: 315-637-9149; Empl.: 15; *Sls. Mgr.:* Jim Philips; *Dist. Mgr.:* Jim Phillips

SAMHWA

FAX: 805-584-9498

SAMHWA U.S.A. INC., 709 E. Cochran St. Bldg. 1A, 1B, Simi Valley, CA 93065, Tel: 805-584-9494, 800-800-0069; Empl.: 8; *Sls. Mgr.:* Joseph Buckle

SAMSUNG ELECTRON DEVICES, See Samtron Displays, Inc.

SAMTEC, INC., 810 Progress Blvd., P.O. Box 1147, New Albany, IN 47150, Tel: 812-944-6733, TWX: 810-540-4095, FAX: 812-948-5047; FSC No.: 55322; Empl.: 200; *Sls. Mgr.:* Mike Hynes

SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, 14251 E. Firestone Bl. No. 101, La Mirada, CA 90638, Tel: 213-802-8425, TWX: 183423 SEDLA; *Sls. Mgr.:* Myung Bang ..... **B•1114-1116**

Local Sales Offices & Reps

AL Huntsville, SCSI 205-533-6500
AZ Phoenix, Moss Mktg. 602-433-9349
CA Solana Beach, D2 619-481-9310
CT Torrington, Phoenix Sls. Co. 203-496-7709
GA Roswell, SCSI 404-594-7557
IL Arlington Heights, Coombs Assocs. ... 708-439-9810
IN Ft. Wayne, Gen II 219-436-4485
IN Louisville, Gen II 502-491-5250
KS Lenexa, A & M 913-888-0022
KY Indianapolis, Gen II 317-848-3083
MA Peabody, Orion Grp. 508-532-6266
MI Troy, C.B. Jensen 313-643-0506
MN Eden Prairie, Comtek 612-941-7181
NM Albuquerque, Moss Mktg. 505-292-7505
NC Raleigh, Zucker Assocs. 919-782-8433
OH Dayton, Midwest Mktg. 513-433-2511
OH Lyndhurst, Midwest Mktg. 216-381-8575
OR Beaverton, ATMI 503-643-8307
PA W. Conshohocken, Eastern Comp. 215-825-8610
WA Redmond, ATMI 206-882-4565
WI Milwaukee, Coombs Assocs. 414-351-6123
WI Watertown, Deaken Tech 414-261-7600
Can Mississauga, Ont., CMT 416-612-0900
Can Pointe Claire, Que., CMT 514-694-6088

Local Distributors

AZ Scottsdale, Added Value 602-951-9788, FAX:602-951-4182
CA
CA Laguna Hills, Jaco/Distel, Inc. 714-837-8966, FAX:714-837-8974
CA San Diego, Added Value 619-558-8890, FAX:619-558-3018
CA San Jose, JACO/DISTEL INC. 408-432-9290, FAX:408-432-9298
CA Tustin, Added Value 714-259-8258:FAX:714-259-0828
CA Visalia, Added Value 209-734-8861, FAX:209-734-8865
CA Westlake, JACO/DISTEL 805-495-9998, FAX:805-494-3864
CA Westlake Village, Added Value 818-889-2861, FAX:818-889-2472
CO Wheat Ridge, Added Value 303-422-1701, FAX:303-422-2529
CT Meriden, JACO Elctrns, Inc. 203-235-1422, FAX:203-634-4884
CT Wallingford, Green Shaw
FL Tampa, JACO/Q.C. 813-628-4665, FAX:813-626-8185
GA Norcross, JACO/Q.C. 404-449-9508, FAX:404-449-0275
IL Hoffman Estates, IEC 312-843-2040, FAX:312-843-2320
MD Columbia, JACO ELCTRNS, INC. 301-995-6620, FAX:301-995-6032
MA Tewksbury, Jaco Elctrn. Inc. 508-640-0010, FAX:508-640-0755
NY Hauppauge, Jaco Elctrns.,Inc. 516-273-5500, FAX:516-273-5799
NY Rochester, Cam RPC Elctrns. 716-427-9999, FAX:716-427-7559
NC Raleigh, Jaco/Q.C. 919-876-7767, FAX:919-876-6964
OH Dayton, Cam RPC Elctrns. 513-898-1111, FAX:513-433-6792
OK Tusla, Jaco/Q.C. 918-664-8515, FAX:918-664-8812
OR Beaverton, IEC 503-641-1690,FAX:503-646-3737
PA Pittsburgh, Cam RPC Elctrns. 412-963-6202, FAX:412-963-6210
TX Addison, Jaco/Q.C. 214-733-4300, FAX:214-250-0216
TX Austin, Added Value 512-454-8845, FAX:512-459-8043
TX Austin, Jaco/Q.C. 512-835-0220, FAX:512-339-9252
TX Dallas, Added Value 214-404-1144, FAX:214-404-1194
TX Sugar Land, Jaco/Q.C. 713-240-2255, FAX:713-240-6988
UT West Valley City, Added Value 801-977-9750, FAX:801-975-1207
WA Redmond, Jaco/Distel, Inc. 206-881-9700, FAX:206-881-9777

S & EI MANUFACTURING, 18800 Parthenia St., Northridge, CA 91324, Tel: 818-349-4111, FAX: 818-349-4651; FSC No.: 24152; Empl.: 35; *Sls. Mgr.:* Howard Johnson, VP Mktg. Sls.

S & H INDS., 2257 North Penn Rd., Hatfield, PA 19440, Tel: 215-822-7211; Empl.: 50; *Sls. Mgr.:* Bob Keiser

FAX: 805-544-3109

S & S ASSOCIATES, INC., 863 Via Esteban, San Luis Obispo, CA 93401, Tel: 805-544-2500; *Sls. Mgr.:* Bob Priest; *Dist. Mgr.:* Bob Priest ..... **C•1094-1096**

SAN FERNANDO ELEC. MFG., See SFE Technlg.

SANFORD-MILLER CORP., 8 John St., Lynbrook, NY 11563, Tel: 516-593-2025, 800-645-5900; Empl.: 10

SANGAMO COMPONENTS DIV., See Cornell Dubilier Electronics

SANGAMO COMPONENTS DIVISION, Box 128, Pickens, SC 29671, Tel: 803-878-6311, FAX: 803-878-7257; FSC No.: 00853

SANLAR, INC. T/A, Harbison Industrial Products, 7205 Hibbs La., Levittown, PA 19057, Tel: 215-943-9000, FAX: 215-949-1518; Empl.: 40

SAN-O INDUSTRIAL CORP., 85 Orville Dr., Bohemia, NY 11716, Tel: 516-567-5556, TWX: 510-228-7701, FAX: 516-567-5128; Empl.: 50; *Sls. Mgr.:* S.Terry/P. Wernick/C. Bornholdt

SANTA FE TEXTILES, Barcel Wire & Cable, 16951 Murphy Ave., Irvine, CA 92714-5885, Tel: 714-251-1960, FAX: 714-251-9006; FSC No.: 31415; Empl.: 20; *Sls. Mgr.:* Gamble M. Baffert

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SANYO Energy (U.S.A.) Corporation

FAX: 619-661-6743

SANYO ENERGY CORP., 1201 Sanyo Ave., San Diego, CA 92073, Tel: 619-661-6620, FAX: 619-661-6743; Empl.: 500; *Sls. Mgr.:* Joseph A. Carcone ..... **D•1489**

Local Sales Offices & Reps

AZ Phoenix, Lynntronics 602-433-0288
CA Mountain View, Energy Sls. 415-969-0800
CO Denver, Car-Go Battery 303-296-8763
CO Denver, West Inc. 303-477-8180
NJ Teterboro, Engrd. Assemblies 201-288-4477
NY Farmingdale, Milgray Elctrns. 516-420-9800
NC Winston-Salem, Progressive Techngs. 919-761-1375

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WA Redmond, Energy Sls. 206-883-2343
WA Seattle, Rep West 206-283-8351

Local Distributors

CA Costa Mesa, Battery Specialists 714-755-0888
CA Escondido, Alexander Batteries 619-480-4445
CA Santa Clara, Cypress Elctrns. 408-980-8400
FL Altamonte Springs, TNR Tech. 800-346-0601

SANYO SEMICONDUCTOR CORP., 80 Commerce Dr., Allendale, NJ 07401, Tel: 201-825-8080; Empl.: 47; *Sls. Mgr.:* Yoshi Paulovich

Local Distributors

NJ Norwood, Sanyo Semiconductor Distbn. 201-784-0303

SAPHIKON, INC., 51 Powers St., Milford, NH 03055, Tel: 603-673-5831, FAX: 603-673-1256; Empl.: 75; *Sls. Mgr.:* Linda Berthiaume

..SaRonix.....

FAX: 415-856-4732

SARONIX, 151 Laura Lane, Palo Alto, CA 94303, Tel: 415-856-6900, TELEX: 348465; FSC No.: 61441; Empl.: 44; *Sls. Mgr.:* Dean Ransom; *Dist. Mgr.:* Dean Ransom ..... **A•1455-1459**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. Inc. 205-881-1096
CO Parker, Parker Webster Co. 303-841-4888
CT Torrington, Phoenix Sales 203-496-7709
FL Altamonte Springs, Sls. Engrg. Concepts 305-682-4800
FL Deerfield Beach, Sls. Engrg. Concepts 305-426-4601
GA Norcross, Interep 404-449-8680
IL Rolling Meadows, Phase II 708-806-1330
IN Indianapolis, EMCI 317-921-3450
MD Columbia, Genl. Radio Supp. 301-995-6744
MD Rockville, All American 301-251-1205
MA Norwell, Norris Assocs. Inc. 617-659-7988
MA Wakefield, All American 617-246-2300
MI Jenisen, R. C. Nordstrom & Co. 616-457-5762
MI Southfield, R. C. Nordstrom & Co. 313-559-7373
MN St. Paul, Innovate 612-225-9772
NV Reno, Galena Technlg. Grp. 702-746-0642
NJ Englewood, Harold Gray Assocs. 201-894-0894
NY Buffalo, Lynn Assocs. 716-631-0054
NC Raleigh, J & B Sls. 919-783-9440
OH Dayton, J. C. Hofstetter 513-459-1239
OH Medina, J. C. Hofstetter 216-241-4880
OR Beaverton, Pacific Mktg. Specialists Inc. 503-641-9373
TN Greenville, Interep 615-639-3491
TX Dallas, J.Y. Schoonmaker Co. 214-349-1650
TX Richardson, All American 214-231-5300
UT Murray, Parker Webster Co. 801-266-9939
WA Redmond, Pacific Mktg. Specialists ... 206-882-3144
WI Wauwatosa, Phase II 414-771-9986
EXP CA, Palo Alto, SaRonix 415-856-6900

Local Distributors

CA Anaheim, Deco Elctrns. 714-630-8252
CA Manhattan Bch., Prime Electro Prods. 213-379-3642
CA Manhattan Beach, Prime Electro Prods. 213-379-3642
CA San Diego, Deco Elctrns. 619-693-1595
CA Sherman Oaks, Delay Line Dists., Inc. 818-986-9455
CA Sunnyvale, Target Elctrns. 408-733-0384
CO Englewood, Indelco 303-795-3431
FL Melbourne, Genl. Radio Supp. Co. 407-242-8151
FL Miami, All American 305-621-8282
IL Palantine, Technlg. Sls. Inc. 708-991-6600
MA Wilmington, Northstar Elctrns. 508-657-5155
MN Eden Prairie, All American 612-944-2151
NJ Camden, General Radio Supp. Co. 609-964-8560
NJ Whippany, ADI 201-428-0510
NY Mt. Vernon, All American 914-699-2224
NY Stonybrook, Dove Elctrn. Comps. 516-689-7733
OR Portland, Radar Elec. Co. 503-232-3404
TX Richardson, Ewing Elctrns., Inc. 214-231-6725
WA Seattle, Radar Elec. Co. 206-282-2511
WI Milwaukee, Technlg. Sls. Inc. 414-964-5015

SAS INDUSTRIES INC., Wading River Manor Rd., Manorville, NY 11949, Tel: 516-727-1441, 1-800-544-5238, FAX: 516-727-1387; FSC No.: 4L975; Empl.: 35; *Sls. Mgr.:* Steve Steckis

SAVOY ELECTRONICS, INC., P.O. Box 5727, Ft. Lauderdale, FL 33310, Tel: 305-563-1333, 800-359-5400, FAX: 305-563-1378; FSC No.: 13075; Empl.: 50; *Sls. Mgr.:* Jean Marlowe

SAWTEK INC., P.O. Box 609501, Orlando, FL 32860-9501, Tel: 407-886-8860, FAX: 407-886-7061; FSC No.: 58068; Empl.: 150

SAYLOR ELECTRONICS INT'L, INC., 3680 Research Way, Carson City, NV 89706, Tel: 702-883-4184; Empl.: 7

SBE, 2400 Bisso La., Concord, CA 94520, Tel: 501-680-7722, 800-347-COMM, FAX: 501-680-1427; Empl.: 120; *Sls. Mgr.:* Bill Allen VP Sls.; *Dist. Mgr.:* Bill Allen VP Sls.

S. B. ELECTRONICS, INC., 131 South Main St., Barre, VT 05641, Tel: 802-476-4146, FAX: 802-476-4149; FSC No.: 49588; Empl.: 40; *Sls. Mgr.:* Mark Browning

SCANBE
UNIT OF ZERO CORPORATION

FAX: 818-444-3953

SCANBE, Unit of Zero Corporation, 3445 Fletcher Ave., El Monte, CA 91731, Tel: 619-452-9333, TWX: 910-587-3437; Empl.: 125; *Dist. Mgr.:* Reggie Streicher ..... **C•1098-1099**

Local Distributors

AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AZ Phoenix, Force Elctrns. 602-437-1060
AZ Phoenix, Hall-Mark Elctrns. 602-437-1200
CA San Diego, Force Elctrns. 619-569-9661
CA Chatsworth, Hall-Mark Elctrns. 818-773-4500
CA El Segundo, Force Elctrns. 213-772-1324
CA Irvine, Hall-Mark Elctrns. 714-727-6000
CA Rocklin, Hall Mark Elctrns. 386-624-9181
CA San Diego, Hall-Mark Elctrns. 619-268-1201
CA San Jose, Hall-Mark Elctrns. 408-432-4000
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Clara, Force Elctrns. 408-748-1324
CO Englewood, Hall-Mark 303-790-1662
CT Cheshire, Hall-Mark Elctrns. 203-271-2844
CT Danbury, Heilind Elctrns. 203-797-8600
CT Danbury, Pilgram Elctrns. 203-792-7274
CT So. Windsor, Car-Lac Elctrns. 203-282-0631
CT Wallingford, Greene-Shaw Co. 203-265-3333
FL Casselberry, Hall-Mark Elctrns. 407-830-5855
FL Largo, Hall-Mark Elctrns. 813-541-7440
FL Melbourne, Greene-Shaw Co. 407-951-3636
FL Pompano Bch., Hall-Mark Elctrns. 305-971-9280
GA Norcross, Hall-Mark Elctrns. 404-447-8000
IL Rosemont, Advent Elctrns. 708-297-6200
IL Woodale, Hall-Mark Elctrns. 312-860-3800
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Chelsea Elctrns. 317-253-9065
IN Indianapolis, Hall-Mark Elctrns. 317-872-8875
IA Cedar Rapids, Advent Elctrns. 319-363-0221
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
KS Overland Pk., Olive Elctrns. 913-362-1923
MD Columbia, Hall-Mark Elctrns. 301-988-9800
MD Jessup, Treeko Sls. 301-470-3300
MA Billerica, Hall-Mark Elctrns. 617-935-9777
MD Columbia, Peerless Radio 301-997-1717
MA Newton, Greene-Shaw 800-678-6876
MA Wilmington, Heilind Elctrns. 508-657-4870
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Livonia, Hall-Mark Elctrns. 313-462-1205
MI Livonia, R.S. Elctrns. 313-525-1155
MN Eden Prairie, Hall-Mark Elctrns. 612-941-2600
MO Earth City, Hall-Mark Elctrns. 314-291-5350
MO Maryland Hts., Olive Elctrns. 314-997-7709
NJ Cranford, Garden State Elctrns. 201-272-6400
NJ Fairfield, Hall-Mark Elctrns. 201-575-4415
NJ Mt. Laurel, Hall-Mark Elctrns. 609-235-1900
NM Albuquerque, International Elctrns. 505-291-9951
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Buffalo, Summit Elctrns. 716-887-2800
NY Fairport, Hall-Mark Elctrns. 716-425-3300
NY Lynbrook, Peerless Radio 516-593-2121
NY Rochester, Summit Elctrns. 716-334-8110
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
OH Solon, Hall-Mark Elctrns. 216-349-4632
OH Worthington, Hall-Mark Elctrns. 614-888-3313
OK Tulsa, Hall-Mark Elctrns. 918-254-6110
OR Beaverton, Rose Elec. Distr. Co. 503-629-9288
PA Essington, Tri-Com 215-521-3080
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Dallas, Hall-Mark Elctrns. 214-553-4300
TX El Paso, International Elctrns. 915-598-3406
TX Farmers Branch, Force ELctrns. 214-247-9955
TX Houston, Force Elctrns. 512-476-2104
TX Houston, Hall-Mark Elctrns. 713-781-6100
UT West valley City, Hall-Mark Elctrns. 801-972-1008
WA Seattle, Hall-Mark Elctrns. 206-547-0415
WI New Berlin, Hall-Mark Elctrns. 414-797-7844
WI Milwaukee, Marsh Elctrns. 414-475-6000

SCANNING DEVICES, INC., 108 Elm St., Waltham, MA 02154, Tel: 617-891-8991, FAX: 617-899-2235; Empl.: 16; *Sls. Mgr.:* David Chanoux

SCHAEFER, INC., Schaefer GmBH, 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-879-8658, ESYLNK: 510-100-3630, FAX: 508-879-8669; Empl.: 60; *Sls. Mgr.:* Richard Sakakeeny

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
AZ Scottsdale, Power Up Elctrn. Sls. 602-955-1105
CA LaHabra, West Coast Reps 213-690-9960
FL Palm Bch. Gdns., Graham Assocs. 407-622-4049
IL Arlington Hgts., Phoenix Elctrn. Sls. ... 708-394-4422
KS Olathe, Tech. Sls. Assocs. 913-829-2800
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MA Whitinsville, Power Factor & Assoc. ... 508-234-6415
NY Wantagh, Bytec 516-781-7400
NC Winston-Salem, Murcota 919-722-9445
TX Richardson, Jim Gray and Assoc. 214-699-9976
UT Ogden, Taylor Mktg. 801-546-9570

SCHAFFNER EMC, INC., 825 Lehigh Avenue, Union, NJ 07083, Tel: 908-851-0664, 800-367-5566, FAX: 908-851-0116; *Sls. Mgr.:* Steve Cogger ..... **A•1634-1637**

Local Sales Offices & Reps

AL Huntsville, Beacon Electronics 205-881-5031
AZ Scottsdale, BSE, Inc. 602-483-0373
CA Auburn, Ewing-Foley, Inc. 916-885-6591
CA Fallbrook, Gary Chilcote Assoc. 619-728-7678
CA Irvine, Groh Assocs. 714-837-9871
CA Los Altos, Ewing-Foley, Inc. 415-941-4525
CO Englewood, Delltron Co. 303-741-2122
FL Maitland, Hutto Hawkins Assoc. 407-831-2474
FL Pompano Beach, Hutto Hawkins Assoc., Inc. 305-979-0330
GA Atlanta, Beacon Electronics 404-256-9640
IL Chicago, BNI Elctrns. 312-775-1717
IA Marion, A.E.M. Inc. 319-377-1129
KS Lenexa, A.E.M. Inc. 913-888-0022
MD Randallstown, Beacon North 703-478-2480
NH Hopkinton, Selmark Assocs. 508-376-2914
MI Livonia, Electro Mktg. Grp. 313-421-7590
MI Muskegon, Electro Mktg. Grp. 616-798-1912
MN Mendota Hgts., G-II Sls. 612-454-3086
MO St. Louis, A.E.M. Inc. 314-298-9900
NM Albuquerque, BSE Inc. 505-293-2582
NY Great Neck, F & F Metro 516-482-4080
NY Rochester, H. C. Johnson Agys. 716-586-0777
NC Raleigh, Beacon Elctrns. 919-787-8431
OH N. Royalton, Electro Mktg. Grp. 216-582-0075
OH Vandalia, Electro Mktg. Grp. 513-890-8322
OK Tulsa, D.J. Sls. 918-663-8155
OR Beaverton, Harry Levinson Co. 503-690-1312
PA Pittsburgh, Electro Mktg. Grp. 412-823-5400
SC Greenville, Beacon Electronics 803-297-7830
TN Knoxville, Beacon Electronics 615-524-8325
TX Austin, D.J. Sls. 512-258-3002
TX Dallas, D.J. Sls. 214-783-8876
UT American Folk, Delltron 801-263-9413
UT Sandy, Delltron Co. 801-942-4678
VA Sterling, Beacon North 703-478-2480
WA Seattle, Harry Levinson Co. 206-382-1300
PR Bayamon, Selmark Assoc. 809-787-2096
Can Ontario, Calibrooke Mktg. 519-848-3810

Local Distributors

AL Huntsville, Comp. Distrs. 205-851-7800
AL Huntsville, Cypress 205-533-0783
AZ Tempe, Acacia/Deanco 602-894-2874
AZ Tempe, Cypress 602-966-2256
CA Buena Pk., Cypress/RPS 714-521-5230
CA Fremont, Acacia/Deanco 415-623-7500
CA Gardena, Cal Switch 213-770-2330
CA Irvine, Acacia/Deanco 714-660-0834
CA Manhattan Bch., Prime Electro Prods. 213-379-3642
CA San Diego, Acacia 619-597-0577
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Southland Comps. 619-673-3800
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Woodland Hills, Cypress 818-710-7780
CO Denver, IEC 303-292-6121
CO Englewood, Cypress 303-792-5829
CO Lakewood, Acacia/Deanco 303-232-2882
CT Wallingford, Sager Elctrns. 203-265-4600
FL Orlando, Sager Elctrns. 407-240-3114
IL Bensenville, Cypress 312-350-2005

IL Hoffman Estates, IEC 312-843-2040
IL Schaumburg, QPS Elctrns. 708-884-6620
MD Columbia, D.K. Elctrns. 301-995-1950
MD Columbia, Sager Elctrns. 301-995-6580
MA Canton, Impact Sls. 617-821-1500
MA Hingham, Sager Elctrns. 617-749-6700
MA Marlboro, Now Elctrns. 508-460-0187
MI SE Grand Rapids, RM Elctrns. 616-531-9300
MN Eden Prairie, Cypress Elctrns. 612-934-2104
MN New Brighton, Chris Elctrns. 612-631-2647
MO St. Charles, Finnigan Elctrns. 314-946-6201
MO St. Charles, Heartland 314-928-6010
NV Rancho Cordova, Acacia/VWR Elctrns. 916-638-1861
NH Salem, Sager Electrns. 603-898-1348
NJ Moorestown, Marlac 609-234-4200
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Rochester, Masline Elctrns. 716-546-5373
NC Raleigh, Comp. Dists. 919-859-3391
NC Raleigh, Sager Elctrns. 919-850-9550
OR Beaverton, Cypress 503-223-8900
PA Mars, Sager Elctrns. 412-772-2233
PA McKean, Advacom 814-476-7774
PA Philadelphia, Sager Elctrns. 215-464-4336
TX Dallas, Comp. Distrs. 214-644-0373
TX Dallas, Cypress 214-255-0065
TX Richardson, Comp. Tech. Corp. 214-437-2211
UT Salt Lake City, IEC 801-977-9750
WA Blaine, Memco 604-590-1553
WA Bothell, Cypress 206-483-1144
WA Redmond, Acacia/Deanco 206-881-5566
WA Seattle, Kam Elctrns. 206-382-1300
WV McKean, Advacom 814-476-7774
Can Burlington, Ont., Alternate Source Comp. 416-335-6385

SCHAFFNER EMC, INC., 825 Lehigh Avenue, Union, NJ 07083, Tel: 908-851-0644, 800-367-5566, FAX: 908-851-0116; *Sls. Mgr.:* Mark Lazar ..... **D•1321**

Local Sales Offices & Reps
AZ Phoenix, Barnhill Assoc. 602-955-2955
CA Concord, Microwave Meas. 415-846-0377
CA Pleasanton, Microwave Meas. 415-846-0377
CA San Diego, Amasco 619-292-7666
CA Torrance, Amasco 213-781-9494
CO Englewood, Barnhill Assoc. 303-792-9500
FL Clearwater, BMI 813-796-2378
FL Satellite Bch., BMI 407-777-6303
GA Atlanta, BMI 404-449-8464
GA Sylvester, BMI 912-776-4100
IL Willowbrook, PVA Corp. 708-655-3355
IN Fishers, Carter Technlg. 317-842-9277
KS Lenexa, Midtec 913-541-0505
MA Burlington, Intersell 617-273-3844
MI Farmington Hills, Carter Technlg. 313-477-7700
MN Minneapolis, Loren F. Green/Minn. 612-571-6666
MO St. Louis, Midtec 314-275-8666
NM Albuquerque, Barnhill Assocs. 505-299-7658
NY Great Neck, RTI 516-829-3770
NY Syracuse, Labtronics 315-455-7314
NC Raleigh, BMI 919-787-0330
OH Englewood, Carter Technlg. 513-836-0951
OH Pauma, Carter Technlg. 216-348-0400
OR Wilsonville, Syntek 503-682-2750
PA Huntington Valley, Sci-Rep 215-322-6500
PA Pittsburgh, Carter Technlg. 412-826-3800
TX Austin, Barnhill Assocs. 512-343-6448
TX Houston, Barnhill Assocs. 713-266-2666
TX Houston, Barnhill Assocs. 713-776-2382
TX Richardson, Barnhill Assocs. 214-231-2573
UT Orem, Barnhill Assocs. 801-226-1239
VA Fairfax, Sci-Rep, Inc. 703-385-0600
WA Bellevue, Syntek 206-462-7700
WA Bellevue, Syntek 509-466-0451
Can B.C., Jerome & Francis Co. 604-986-1286
Can Ontario, Calbrooke Mktg. 519-848-3810
Can Ontario, Webster Instr. 416-625-0600

SCHAUER MANUFACTURING, 4500 Alpine Ave., Cincinnati, OH 45242, Tel: 513-791-3030, FAX: 513-791-7192; Empl.: 195; *Sls. Mgr.:* A. A. Groenewold; *Dist. Mgr.:* Dan Shaw

SCHELL INC., P.O. Box 12689, 2600 22nd St. N., St. Petersburg, FL 33733, Tel: 813-822-2600, 800-237-2600, FAX: 813-822-8800; Empl.: 50; *Sls. Mgr.:* Tom Enneking; *Dist. Mgr.:* Steve Hahn

SCHENCK PEGASUS CORP., 2890 John R, Troy, MI 48083, Tel: 313-689-9000, TWX: 810-232-1529, FAX: 313-689-8578; Empl.: 130; *Sls. Mgr.:* David Sallberg

SCHLEGEL CORP., P.O. Box 23197, Rochester, NY 14692, Tel: 716-427-7200, TELEX: 6854121, FAX: 716-427-9993; Empl.: 500; *Sls. Mgr.:* Duncan Tyrrel

SCHLEUNIGER USA INC., 150 Dow St. Tower Four, Manchester, MI 03101, Tel: 603-668-8117, FAX: 603-668-8119; Empl.: 11; *Sls. Mgr.:* Charles C. S. Burns

SCHLUMBERGER INDUSTRIES, Tranducers Div., 11321 Richmond, M-102, Houston, TX 77082, Tel: 713-558-2587, TELEX: 791209, FAX: 713-558-8954; *Sls. Mgr.:* Robinson Ord

SCHLUMBERGER INSTRUMENTS, Schlumberger Technlgs., 829 Middlesex Turnpike, Billerica, MA 01821, Tel: 508-671-9700, 1-800-225-5765, FAX: 508-671-9704; Empl.: 70

SCHLUMBERGER INSTRUMENTS, Schlumberger Technologies, 20 North Avenue, Burlington, MA 01803, Tel: 617-229-4825, FAX: 617-229-4885; FSC No.: 1T316; Empl.: 50; *Sls. Mgr.:* Michael Milona

SCHNEIDER CORP. OF AMERICA, 400 Crossways Park Drive, Woodbury, NY 11797, Tel: 516-496-8500, FAX: 516-496-8524; Empl.: 13; *Sls. Mgr.:* Dwight Lindsey; *Dist. Mgr.:* Dwight Lindsey

SCHONSTEDT INSTRUMENT CO., 1775 Wiehle Ave., Reston, VA 22090, Tel: 703-471-1050, FAX: 703-471-1795; Empl.: 45; *Sls. Mgr.:* O. K. Davis

SCHOTT CORP., 1000 Parkers Lk. Rd., Wayzata, MN 55391, Tel: 612-475-1173, FAX: 612-475-1786; FSC No.: 80023; Empl.: 325; *Sls. Mgr.:* A. Schmitt

Local Sales Offices & Reps
MA Needham, Hatch Assocs. 617-963-3306

SCHOTT ELECTRONICS, 42 Silvermine Road, Seymour, CT 06483, Tel: 203-881-0102, TWX: 710-451-8911, FAX: 203-881-0098; Empl.: 150; *Sls. Mgr.:* Ross Wieringa

SCHOTT GLASS TECHNOLOGIES, INC., 400 York Ave., Duryea, PA 18642, Tel: 717-457-7485, TWX: 510-671-4535, FAX: 717-457-6960; FSC No.: 23-169-1403; Empl.: 500; *Sls. Mgr.:* J. Nimmerfroh

SCHRACK NORTH AMERICA CORP., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, Tel: 516-737-0099, FAX: 516-737-2550; Empl.: 10; *Sls. Mgr.:* John Walsh; *Dist. Mgr.:* Christopher Meza ..... **B•1570-1576**

Local Sales Offices & Reps
AL Huntsville, DHR Mktg. 205-533-5165
AZ Phoenix, CPS Assoc. 602-246-1097
CA Arcadia, Van Gott & Assocs. 818-445-9728
CO Boulder, Stratford Grp. 303-530-3194
FL Miami, Omnitron 305-448-0050
FL Tampa, SRT Mktg. 813-884-4805
IN Mishawaka, Power Comp. 219-256-6630
MO Hazelwood, Acorn Elctrns. 314-731-2002
MD Hunt Valley, Eagle 301-666-3930
MA Swansea, Poisson & Assoc. 508-677-3655
MI Ypsilanti, Tech Rep 313-572-1950
MN Roseville, TLC 612-483-2226
NJ Lawrenceville, DVS Co. 609-896-1112
NJ Matawan, Sheppard 201-566-0095
NY Liverpool, Lynn 315-457-6859
NC Raleigh, Spears 919-790-7606
OH Highland Hts., KT/Depco 216-442-6200
PA Gibsonia, Lynn 412-443-3670
TX Dallas, Pro Sls. 214-387-0344
WA Bellevue, Caruso & Co. 206-454-1261
Can Ontario, Honeywell Ltd. 416-293-8111

Local Distributors
AL Birmingham, ACK Ind. 205-322-0588
AZ Tempe, Control Des. Supp. 602-829-7981
CA City of Industry, ITAL 818-968-8515
CA San Rafael, Elctrns. Plus 415-457-0466
CO Denver, CSID 303-292-9594
CT Middlefield, Control Des. Supp. 203-349-0200
FL Ft. Lauderdale, Southeastern Elctrns. 305-563-4131
GA Stone Mountain, Control Des. Supp. 404-979-3500
ID Boise, Bolen's Control House 208-363-5280
IL Carol Stream, Lectro Comps. 708-690-0520
IN Indianapolis, Control Des. Supp. 317-788-4559
IA Marion, Control Des. Supp. 319-373-2923
KS Kansas City, Control Des. Supp. 913-362-4248
ME Gray, Longhill Electro. Tech. 207-657-2183
MD Gaithersburg, Axis Elec. 301-840-9640
MA Norwood, Emtel 617-769-9500
MI Ypsilanti, Tech Rep 313-229-2961
MN Minneapolis, Control Des. Supp. 612-721-1628
MO St. Louis, Control Des. Supp. 314-426-3150
NJ Lodi, Nidisco 201-773-1771
NJ Paramus, Electro Control Supp. 201-836-2112
NJ Pennsauken, IMS Distbn. 609-662-1770
NY Newburgh, Electro 914-561-5330
NY Ronkonkoma, All American 516-981-3935
NC Charlotte, C.P.S. 704-588-4410
NC Pineville, Control Des. Supp. 704-588-4410
OR Portland, Dunn Elctrns. 503-285-0214
OR Portland, O4 Controls, Inc. 503-231-8058
PA Malvern, Control Des. Supp. 215-296-0150
TX Dallas, Control Des. Supp. 214-358-1441
TX Houston, Wofford Elec. 713-847-3583
WA Boseman, C.E.D. 509-535-8891
WA Seattle, Stusser Elec. Co. 206-624-8770
Can Scarborough, Honeywell 514-337-1104

SCHROFF INCORPORATED, 170 Commerce Dr., Warwick, RI 02886, Tel: 401-732-3770, FAX: 401-738-7988; Empl.: 120; *Sls. Mgr.:* William Bottis

SCHUMACHER ELECT. CORP., 7474 N. Rogers Ave., Chicago, IL 60626, Tel: 312-973-1600, FAX: 312-973-7781; Empl.: 700; *Sls. Mgr.:* Norman Patinka

SCHURTER

FAX: 707-778-6401

SCHURTER, INC., 1016 Clegg Ct., Petaluma, CA 94952, Tel: 707-778-6311; FSC No.: 61935; *Sls. Mgr.:* Bruno H. Schurter ... **A•1638-1639; B•1389, 1771; C•1516-1520**

Local Sales Offices & Reps
AL Madison, Benchmark Tech. Sls. Inc. ... 205-464-0033
AZ Scottsdale, JK & Assos. 602-990-8804
AR Little Rock, Doby Assoc. 501-221-0326
CA La Habra, Cygnus Sls. Engrg. Corp. ... 213-691-2993
CA San Jose, Arnold Tech. Sls., Inc. 408-954-0400
CO Broomfield, Summit West Mktg., Inc. .. 303-460-9600
FL Pompano Bch., IMR, Inc. 305-942-2449
IN Carmel, Newton & Assocs. 317-577-5895
GA Norcross, Benchmark Tech. Sls. Inc. .. 404-446-1711
IL Arlington Hgts., MJ Petersen & Assoc., Ltd. 708-577-8200
MN Shorewood, Frank Anthony Mktg. 612-474-2850
MS Jackson, Doby Assocs. 601-981-1138
MO St. Louis, Acorn Elctrns. Inc. 314-421-1751
NH Nashua, Bell Controls 603-882-6984
NJ Ho-Ho-Kus, D. J. Fisher Co. 201-652-0090
NJ Medford, Champion Elctrn. Sls. Co. 609-983-0932
NY Fairport, TAC Sls, Inc. 716-377-2250
NC Raleigh, Benchmark Tech. Sls. Inc. 919-850-0633
OH Beachwood, Electronic Salesmasters 216-831-9555
OR Hillsboro, Doran Sls. 503-640-4500
TX Dallas, Reese & Assocs. 214-224-1000
UT Salt Lake City, Prorep Mktg. 801-268-3434
WA Redmond, Doran Sls. 206-885-1885

Local Distributors
CA Irvine, Kensington Elctrns., Inc. 714-588-0575
CA Livermore, Quail Elctrns. 415-373-6700
CT Wallingford, Sager Elctrns. 203-265-4600
FL Orlando, Sager 407-240-3114
GA Norcross, NRC-Jarco Dixie, Inc. 404-729-0411
IL Elk Grove Village, Nu-Way Elctrn. Distrbs. Inc. 708-437-7120
MD Columbia, Sager Elctrns. 301-995-6580
MD Rockville, FIC Corp. 800-638-6594
MA Hingham, Sager Elctrns. 617-749-7600
MA Sandwich, JV ELctrns. 508-833-0700
MN Plymouth, Leeds Electro Comps., Inc. 612-557-1277
NH Salem, Sager Elctrns. 603-898-1348
NY Hauppauge, Sager Elctrns. 516-348-1300
NC Raleigh, Sager Elctrns. 919-850-9550
OH Strongsville, Fuse World 216-238-1330
OR Tualatin, Moore Elctrns., Inc. 503-692-5333
PA Harrisburg, Ad-Tech Elctrns., Inc. 717-561-9905
PA Mars, Sager Elctrns. 412-772-2233
PA McKean, Advacom 814-476-7774
PA Philadelphia, Sager Elctrns. 215-464-4336
TX Dallas, Fuses, Inc. 214-341-6407
WI Oconomowoc, GW Elctrns. Ltd. 414-567-9445
Can Markham, Ont., Birde Mktg. 416-477-7722

SSE

SCHUSTER ELECTRONICS, 8 Beattie Court, Huntington, NY 11530, Tel: 516-271-0590; *Sls. Mgr.:* Max Schuster

SCIENCE ACCESSORIES CORP., 200 Watson Blvd., Stratford, CT 06497, Tel: 203-386-9978, FAX: 203-381-9270; Empl.: 40; *Sls. Mgr.:* H. A. Cleveland

SCIENCE & ENGRG. CONSULTANTS, INC., 1820 Discovery St., Ste. 300, Reston, VA 22090, Tel: 703-471-1600, FAX: 703-281-9778; Empl.: 2; *Sls. Mgr.:* Dr. Joseph T. Siewick

SCIENCE/ELECTRONICS, P. O. Box 986, Dayton, OH 45401-0986, Tel: 513-859-5555, FAX: 513-859-7930; Empl.: 25; *Sls. Mgr.:* E. E. Pohl; *Dist. Mgr.:* J. Tanksley

SCIENTECH, INC., 5649 Arapahoe Ave., Boulder, CO 80303, Tel: 303-444-1361, 800-525-0522, TWX: 910-940-0994, FAX: 303-444-9229; Empl.: 35

SCIENTIFIC-ATLANTA, INC., See Optima Enclosures

SCIENTIFIC INSTRUMENTS, 4400 W. Tiffany Dr., West Palm Beach, FL 33407, Tel: 407-881-8500, FAX: 407-881-8556; FSC No.: 591197614; Empl.: 52; *Sls. Mgr.:* Mike Capers; *Dist. Mgr.:* Mike Capers

SCIENTIFIC RESEARCH CORP., See TRAK Microwave Corp.

STI®

FAX: 415-471-9752

SCIENTIFIC TECHNOLOGIES INC., Control Components Div., 31069 Genstar Rd., Hayward, CA 94544-7831, Tel: 415-471-9717, 800-221-7060; FSC No.: 52797; Empl.: 25; *Sls. Mgr.:* Paul N. Dreiseszun ..... **B•1578-1579**

SCIENTIFIC TECHNOLOGIES INC., Optical Sensor Div., 31069 Genstar Rd., Hayward, CA 94544, Tel: 415-471-9717, FAX: 415-471-9752; Empl.: 120

SCITEQ ELECTRONICS, INC., 8401 Aero Dr., San Diego, CA 92123, Tel: 619-292-0500, TELEX: 882008, FAX: 619-292-9120; FSC No.: 70561; Empl.: 40; *Sls. Mgr.:* Phil Feinberg

SCOPE INCORPORATED, 1860 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-5600, FAX: 703-471-1715; Empl.: 150; *Sls. Mgr.:* J. Tietge, Dir. PD

SC TECHNOLOGY, INC., 368 Earhart Way, Livermore, CA 94550, Tel: 415-373-9230, FAX: 415-373-9416; *Sls. Mgr.:* Susan L. Karl

SCREENPRINT DOW, See Dow Switch, Div. of Screenprint Dow

SEABOARD ELECTRONICS, 70 Church St., New Rochelle, NY 10805, Tel: 914-235-8073, TELEX: 646289; Empl.: 40; *Sls. Mgr.:* Bernie Klempner; *Dist. Mgr.:* Subhash Grandhi

SEACOR INC

FAX: 201-664-8544

SEACOR, INC., 123 Woodland Ave, Westwood, NJ 07675, Tel: 201-666-5600; Empl.: 20 ..... **A•1137**

Local Sales Offices & Reps

AL	Huntsville, Summit Mktg.	205-721-1701
AZ	Tempe, FP Sls.	602-894-5303
CA	San Jose, H. W. Assocs.	408-996-9940
CO	Denver, Hi-Level Mktg.	303-660-9685
FL	Melbourne, R-Rep Co.	407-242-9800
GA	Norcross, Summit Mktg. Assoc.	404-498-4530
IL	Inverness, Heartland Tech. Mktg.	708-358-6622
MD	Bel Air, Freedman/Malta Assoc.	301-879-3148
MA	Sudbury, KSA of New England	508-443-5881
MN	St. Paul, The Johnson Co.	612-641-1878
MO	St. Louis, Acorn Elctrns.	314-421-1751
NJ	Parlin, JMR Sls. Inc.	908-525-8000
NM	Albuquerque, FP Sls.	505-345-5553
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NC	New Hill, Tom Santel Assocs.	919-362-4091
OH	Powell, Val-Skol Sls.	614-889-0174
OH	Willoughby, Val-Skol Sls.	216-942-6021
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
TX	Richardson, Eagle Mktg.	214-238-5383
WI	Brookfield, Heartland Tech. Mktg.	414-792-0920

Local Distributors

CA	Garden Grove, Natl. Cap. Supp.	714-892-7744
CA	San Jose, Compass Comps.	408-432-7575
CT	Wallingford, Mid-State Elctrns.	203-265-9900
FL	Ft. Lauderdale, Brothers Elec.	305-561-6700
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
IL	Bensenville, Voyager Elec.	312-860-1300
IL	Schaumburg, Q.P.S.	312-884-6620
MA	Burlington, T.L.C.	617-273-0140
MA	Framingham, Now Elctrns.	617-235-9501
MA	N. Chelmsford, Pilgrim Elec.	617-454-9889
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	Fridley, Voyager Elctrns.	612-571-7766
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NJ	Rockaway, Tonar Inds.	201-586-9000
NY	Melville, S.A.I.	516-293-2710
NY	Ronkonkoma, Spectrum Comp.	516-737-6900
TX	Dallas, Off-the-Shelf Comps.	214-238-0808
TX	Ft. Worth, C & W Supp.	817-831-0395
WA	Seattle, Vesco Elctrns.	206-575-3607

SEAFAB, INC., 14648 N.E. 95th St., Redmond, WA 98052, Tel: 206-881-2778, FAX: 206-882-0707; Empl.: 80; *Sls. Mgr.:* Bruce Murray

SEALTRON, INC., 9705 Reading Road, Cincinnati, OH 45215, Tel: 513-733-8400, FAX: 513-733-0131; FSC No.: 3678; Empl.: 140; *Sls. Mgr.:* James Dawson

SEASTROM MANUFACTURING CO., INC., 701 Sonora Ave., Glendale, CA 91201, Tel: 213-245-9121, FAX: 818-246-6803; FSC No.: 86928; Empl.: 80; *Sls. Mgr.:* Dave Buddecke

SECMA, INC., Secme, 17752 Skypark Circle No. 200, Irvine, CA 92714, Tel: 714-261-0610, FAX: 714-261-8390; Empl.: 400

SECTOR MICROWAVE IND. INC., 999 Grand Blvd., Deer Park, NY 11729, Tel: 516-242-2300, TWX: 510-227-6075, FAX: 516-242-8158; Empl.: 45; *Sls. Mgr.:* Thomas Nelson

SECTOR SYSTEMS CO., INC., 416 Ocean Ave., Marblehead, MA 01945, Tel: 617-639-2625; Empl.: 10

SECURITY PLASTICS, INC., 14427 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-823-5440, FAX: 305-557-1431; Empl.: 400; *Sls. Mgr.:* Nelson Rodriguez

SEEQ TECHNOLOGY, 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-432-7400, 1-800-333-7706, TELEX: 296609, TWX: 9103382313, FAX: 408-432-9549; Empl.: 370; *Sls. Mgr.:* Phil Ortiz, V.P Worldwide Sls.; *Dist. Mgr.:* Pat Bringuel

Seiko Instruments

FAX: 213-517-7792

SEIKO INSTRUMENTS U.S.A., INC. ELECTRONIC COMPONENTS, 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7770; *Sls. Mgr.:* D. Brooks ..... **A•1461; B•1117; D•1108, 1490**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tucson, Fred Board Assocs.	602-299-1508
CA	Irvine, Groh Assoc.	714-837-9871
CA	San Diego, Groh Assocs.	619-673-4321
CA	San Jose, H-Technical Sls.	408-453-2111
CO	Aurora, Electrodyne	303-695-8903
CT	Madison, Focus Elctrn. Sls.	203-245-4314
FL	Plantation, Gallagher & Assocs.	305-473-2101
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Elk Grove Village, TriStar Grp., Inc.	708-593-0200
IN	Ft. Wayne, Electro Rep Inc.	219-489-8205
IN	Indianapolis, Electro Rep Inc.	317-842-7202
IA	Cedar Rapids, J.R. Sls. Engrg., Inc.	319-393-2232
KS	Overland Park, Electri-Rep	913-649-2168
MI	Grand Rapids, R.P. Urban & Assoc.	616-245-0511
MD	Burtonsville, Glasscock Assocs.	301-384-5213
MA	Taunton, Focus Elctrns. Sls.	508-824-3840
MI	Detroit, R.P. Urban & Assoc.	313-535-2355
MN	Eden Prairie, Stan Clothier Co.	612-944-3456
MO	St. Louis, Electri-Rep	314-993-4421
NJ	E. Brunswick, Shepard & Assoc.	908-254-5757
NY	E. Syracuse, Nycom, Inc.	315-437-8343
PA	Apollo, J.N. Bailey & Assoc.	412-568-1392
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4132
OH	Brunswick, J. N. Bailey & Assocs.	216-273-3798
OH	Columbus, J.N. Bailey & Assocs.	614-262-7274
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
OR	Tigard, Electronic Comp. Sls.	503-245-2342
PA	Frazer, Industrial Comps., Inc.	215-889-0650
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
Can	Markham, Ont., Birde Mktg.	416-477-7722
TX	Austin, TI Mktg. Inc.	512-837-7272
TX	Dallas, TL Mktg. Inc.	214-484-6800
TX	Houston, TL Mktg. Inc.	713-587-8100
UT	Salt Lake City, Electrodyne	801-264-8050
VA	Ashland, Glasscock Assocs.	804-798-2125
WA	Mercer Island, Electronic Comp. Sls.	206-232-9301
WA	Spokane, Electronic Comp. Sls.	509-456-0100
WI	Menomonee, TriStar Grp., Inc.	800-654-4105
Can	Kanata, Ontario, Birde Mktg.	613-592-5411
Can	St. Laurent, Quebec, Birde Mktg.	514-335-4050
Can	Vancouver, B.C., Birde Mktg.	604-431-0427

Local Distributors

AL	Huntsville, Cypress Elctrns.	205-533-0783
AZ	Phoenix, Aerospace S.W.	602-582-2779
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Buena Pk., Cypress Elctrns.	714-404-0445
CA	Chatsworth, Sterling Elctrns.	818-407-8850
MD	Columbia, Sterling Elctrns.	301-290-3800
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Sterling Elctrns.	619-560-8097
CA	San Jose, Electro Alliance, Inc.	408-280-0221
CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	Sunrise, All American	305-572-7999
CA	Tustin, OBI	714-258-1411
CA	Tustin, Sterling Elctrns.	714-259-0900
CA	Woodland Hills, Cypress Elctrns.	818-710-7780
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Melbourne, Greene-Shaw Co. Inc.	407-951-3636
GA	Norcross, Applied Power Inc.	404-263-0421
IL	Bensenville, Cypress Elctrns.	708-350-2005
IL	Bensenville, Goold Elctrns. Corp.	708-860-7171
IL	Northbrook, Classic Comps.	708-272-9650
IL	Rosemont, Advent Elctrns., Inc.(printers only)	708-297-6200
IN	Indianapolis, Advent Elctrns., Inc.(printers only)	317-872-4910
IN	Indianapolis, RM Elctrns.	317-843-9403
IA	Cedar Rapids, Advent Elctrns., Inc.(printers only)	319-363-0221
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
KS	Lenexa, Sterling Elctrns.	913-492-5406
LA	West Wego, Sterling Elctrns.	504-436-1418
MD	Middletown, Current Comps.	301-473-5333
MA	Norwood, Emtel	617-769-9500
MI	Southfield, RM Elctrns.	313-262-1582
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Farmington Hills, Advent Elctrns., Inc.(printers only)	313-477-1650
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Aerospace Computer Supps.	612-884-4725
MN	Minneapolis, Sterling Elctrns.	612-831-2666
NJ	Edison, Sterling Elctrns.	908-417-1000
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Hewlett, Metropolitan Sls.	516-599-7900
NY	Mt. Vernon, QAR Elctrns.	914-699-2224
NC	Raleigh, Century Elctrns.	919-782-2116
NY	Ronkonkoma, All American	516-981-3935
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Portland, Cypress Elctrns.	503-223-8900
OR	Tualatin, Moore Elctrns.	503-692-5333
OR	Beaverton, Micropower (Batteries Only)	503-626-7086
PA	Norristown, Century Elctrns.	215-631-5404
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Dallas, Cypress Elctrns.	214-869-1435
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-623-6600
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Kent, Moore Elctrns., Inc.	206-251-8090
WI	New Berlin, Classic Comps.	414-786-5300
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
Can	Burnaby, B.C., ITT/RAE Multicomps.	604-291-8866
Can	Concord, Ont., ITT Multicomps.	416-736-1144
Can	Markham, Ont., Semad Elctrns./DGW Elctrns.	416-475-8500
Can	Nepean, Ont., Carsten Elctrns. Ltd.	613-726-9250
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-7705

Can St. Laurent, Que., Carsten Elctrns. Ltd. 514-334-8321

SEIKO INSTS. USA, INC., Graphic Devices & Systems Div., 1130 Ringwood Ct, San Jose, CA 95131, Tel: 408-922-5800, FAX: 408-922-5840; *Sls. Mgr.:* Steve Dodds; *Dist. Mgr.:* Ralph Kosoff

SEIKO INSTRUMENTS U.S.A., INC., Robotics/Automation Div., 2990 W. Lomita Blvd, Torrance, CA 90505, Tel: 213-517-7850, FAX: 213-517-7793; Empl.: 250; *Sls. Mgr.:* K. Curtis; *Dist. Mgr.:* P. Simpson

SEKAI ELECTRONICS OF AMERICA, INC., 14700 E. Firestone Blvd, Suite 122, La Mirada, CA 90638, Tel: 714-670-1854, FAX: 714-670-1855; FSC No.: 8V398; Empl.: 6; *Sls. Mgr.:* Larry Klementowski

selco

FAX: 714-739-1507

SELCO PRODUCTS CO., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, Tel: 714-521-8673; Empl.: 18; *Sls. Mgr.:* Bill Wilkinson; *Dist. Mgr.:* Ray Anton ..... **B•1861; C•1594; D•1370-1371**

Local Sales Offices & Reps

AR	Hot Springs, ASI	501-767-5444
CA	Arcadia, HMC, Inc.	818-447-0958
CA	Mission Viejo, Summit Sls.	800-457-6525
CA	Sunnyvale, Pass Assocs.	408-735-9040
FL	Sarasota, Rep-USA	813-923-2897
IL	Downers Grove, Golten Assocs.	708-512-0093
IN	Indianapolis, S & M Sls. & Mktgs.	317-843-5519
MA	Andover, Crawford Assocs.	617-470-2122
MS	Horn Lake, ASI	601-342-4989
NY	Hauppauge, Sticom	516-366-4221
NY	Naples, LMS Sls. Assoc.	716-374-2626
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Hatboro, AQS	215-674-3562
TX	Dallas, Titan- Hill Co.	214-241-1398
WA	Bellevue, Luscombe Engrg.	206-223-1541

Local Distributors

CA	Arcadia, Parco	818-447-0958
FL	Largo, Elctrn. Precepts	813-544-3636
IL	Wheeling, Hawk Elctrns.	312-459-4091
MA	Sandwich, JV Elctrns.	508-833-0700
NY	New York City, Martin Audio/Video	212-541-5900

SELECO, INC., P.O. Box 68809, Indianapolis, IN 46268, Tel: 317-872-4181, FAX: 317-872-0248; Empl.: 30

SELECT CONTROLS INC., 350 I Central Ave., Bohemia, NY 11716, Tel: 516-467-8577, FAX: 516-567-9013; Empl.: 14

SEL-REX DIV., OMI Intl. Corp., 75 River Rd., Nutley, NJ 07110, Tel: 201-667-5200, TELEX: 133-320, TWX: 710-989-1423; Empl.: 250; *Sls. Mgr.:* R. Berg

SEMICOA, 333 McCormick Ave., Costa Mesa, CA 92626, Tel: 714-979-1900, TELEX: 678-315, TWX: 910-595-1961, FAX: 714-557-4541; FSC No.: 34156; Empl.: 85; *Sls. Mgr.:* Don Felder

SEMICONDUCTOR CIRCUITS, INC., Astec America, Inc., 49 Range Rd., Windham, NH 03087, Tel: 603-893-2330, FAX: 603-893-6280; Empl.: 1004; *Sls. Mgr.:* Dale Raveney, VP Mktg. & Sls.

SEMICONDUCTOR PACKAGING MATERIALS CO., 431 Fayette Ave., Mamaroneck, NY 10543, Tel: 914-698-5353, FAX: 914-698-5386; Empl.: 30; *Sls. Mgr.:* Ken Huth

SEMICONDUCTOR TECHNOLOGY, INC., 3131 S.E. Jay St., Stuart, FL 34997, Tel: 407-283-4500, FAX: 407-286-8914; FSC No.: 50891; Empl.: 45

Local Sales Offices & Reps

AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tucson, Fred Board Assocs.	602-299-1508
CA	Costa Mesa, Solid State Sls.	714-650-8414
CA	Mountain View, Leddy Assocs.	415-969-6313
CO	Englewood, Component Sls.	303-779-8060
FL	Singer Island, KDI	407-848-7313
IL	Downers Grove, Nextek	708-719-0099
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Park, Lorenz Sls.	913-469-1312
MD	Towson, Arbotek	301-825-0775
MA	Burlington, Conti-Younger	617-273-1582
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
MO	St. Louis, Lorenz Sls.	314-997-4558
NE	Lincoln, Lorenz Sls.	402-474-7094
NV	Henderson, Fred Board Assoc.	702-564-5528
NJ	Hasbrouck Heights, Comp Tech Sls.	201-288-7400
NM	Albuquerque, Q.A. Elctrns.	505-888-1121
NY	New Hyde Park, Comp Tech Sls.	516-593-2628
NY	Rochester, Electra Sls.	716-427-7860
NY	Syracuse, Electra Sls.	315-463-1248
OH	Tipp City, Cleary Sls.	513-667-7703
OR	Portland, Index Inc.	503-297-3364
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-Rep	713-988-7613
UT	Midvale, Arrowhead Sls.	801-561-5688
WA	Bellevue, Index Inc.	206-451-9635
Can	Montreal, Que., Solid State Engrg.	514-481-3313

SEMIKRON, INC., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066, Tel: 603-883-8102, 1-800-258-1308, FAX: 603-883-8021; FSC No.: 58687; Empl.: 74; *Sls. Mgr.:* Frank Haase; *Dist. Mgr.:* John Flannery

SEMTECH, 652 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-498-2111, TWX: 910-336-1264; FSC No.: 14099;Multiple; Empl.: 200; *Sls. Mgr.:* Bud Hultz; *Dist. Mgr.:* Bud Hultz

SEMTECH CORPUS CHRISTI, Semtech Corporation, 121 International Dr., Corpus Christi, TX 78410, Tel: 512-289-0403, FAX: 512-289-0472; Empl.: 200

SEMTRONICS CORP., 211 Prospect Pk., P.O. Box 2248, Peachtree City, GA 30269, Tel: 404-487-6681, FAX: 404-487-1128; Empl.: 30; *Sls. Mgr.:* Art Cowart

SENCORE, 3200 Sencore Dr., Sioux Falls, SD 57107, Tel: 1-800-736-2673, 605-339-0100, FAX: 605-339-0317; FSC No.: 33347; Empl.: 230; *Sls. Mgr.:* George Gonds

SENIOR INDS., INC., 610 Pond Dr., Wood Dale, IL 60191, Tel: 312-350-1600, FAX: 312-350-1654

SENSIDYNE, INC., 16333 Bay Vista Drive, Clearwater, FL 34620, Tel: 813-530-3602, 1-800-451-9444; Empl.: 70; *Sls. Mgr.:* Joe Gilberti; *Dist. Mgr.:* Bob Bottini

SENSITEK CORPORATION, See Biddle Instruments

SENSITIVE RESEARCH INSTRUMENTS, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1322-1324**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-494-0790
CO	Commerce City, Williams Assocs.	303-289-5647
IL	Lincolnwood, Saffro & Assocs.	708-677-9722
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-550-0506
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Columbus, Comtel Instrs. Co.	614-876-8305
OH	Dayton, Comtel Instrs. Co.	513-426-5310
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-954-5020
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WI	Lake Mills, Saffro & Assocs.	1-800-327-0312
Can	Baconsfield, Que., Mesurina Ltee /Ltd.	514-630-5990

SENSITRON SEMICONDUCTOR, RSM Electron Power Div., 221 W. Industry Ct., Deer Park, NY 11729, Tel: 516-586-7600, FAX: 516-242-9798; FSC No.: 13409; Empl.: 150; *Sls. Mgr.:* Bryan Rogers; *Dist. Mgr.:* Bryan Rogers

SENSORAY CORP., 44160 Old Warm Springs Blvd., Fremont, CA 94538, Tel: 415-657-7290; Empl.: 6; *Sls. Mgr.:* Richard Soundy

SENSOR CORP., Box 140, Scottdale, PA 15683, Tel: 412-887-4080, FAX: 412-887-0383; Empl.: 6

SENSOR DEVELOPMENTS INC., PO Box 290, Lake Orion, MI 48361, Tel: 313-391-3000, FAX: 313-391-0107; Empl.: 45; *Sls. Mgr.:* James J. Babiarz

SENSOR PRODUCTS, INC., 71 W 23rd St., Ste. 1500, New York, NY 10010, Tel: 212-675-0201, FAX: 212-645-8436; Empl.: 2

Sensor Scientific, inc.

FAX: 201-227-8063

SENSOR SCIENTIFIC, INC., 6 Kingsbridge Rd., Fairfield, NJ 07006, Tel: 201-227-7790, 800-524-1610; FSC No.: 0AES7; Empl.: 125; *Sls. Mgr.:* Donna Caputo ..... **B•1862-1863**

Local Sales Offices & Reps

CA	Irvine, Vale Elctrn. Assoc.	714-551-4004
CA	Mountain View, Shaw Tech Inc.	415-961-4775
CA	Van Nuys, Vale Elctrns.	818-705-0283
CO	Ft. Collins, Rep. Sls.	303-226-1504
FL	Boca Raton, Tech Sls. Spec.	407-391-3718
IL	Des Plaines, ESCO Assocs.	312-298-5310
KS	Overland Pk, Markline Technlgs.	913-681-8880
MA	Lexington, Jodan Technlg.	617-863-8898
NY	Syracuse, ADCON	315-432-4409
NY	Williamsville, CEF Tech. Sls.	716-633-7324
OH	Medina, J.C. Hofstetter	216-241-4880
PA	Harlysville, Thomas Jackson Assoc.	215-256-8877
TX	Dallas, Allied Comps. Inc.	214-238-0408
TX	Houston, Allied Comps. Inc.	713-988-1600

SENSOR SYSTEMS, INC., 8929 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-341-5366, TELEX: 69-1583, FAX: 818-341-9059; *Sls. Mgr.:* E. Schneider

SENSOTEC, INC., 1200 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-7723, TWX: 810-482-1188, FAX: 614-486-0506; FSC No.: 29927; *Sls. Mgr.:* Jack Feil

SENSYM, INC., 1255 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-1500, FAX: 408-734-0407; FSC No.: 5955; Empl.: 150; *Sls. Mgr.:* Fred Jones; *Dist. Mgr.:* Fred Jones

SENTECH, INC., 518 Ryers Ave., Cheltenham, PA 19012, Tel: 215-663-0422, FAX: 215-663-0461; Empl.: 4

SENTRY MANUFACTURING COMPANY, Crystal Park, Chickasha, OK 73018, Tel: 405-224-6780, FAX: 405-224-8808; FSC No.: 5955; Empl.: 30; *Sls. Mgr.:* Barbara Maberry

SERCO PRODUCTS DIVISION:SERCO MOLD, INC., 612 Commercial Ave., Covina, CA 91723, Tel: 818-331-0517, 800-843-8172(Calif.), FAX: 818-331-8584; Empl.: 45; *Sls. Mgr.:* Neil Reckon ..... **C•1100-1101**

Local Sales Offices & Reps

CA	Covina, Serco Prods.	818-331-0517
CA	Valencia, Lessing & Assocs.	805-295-0225
GA	Norcross, Hollingsworth & Still, Inc.	404-447-1700
IL	Cary, Ellinger Sls. Corp.	708-639-1850
MA	Burlington, Gerber Sls. Corp.	617-229-1150
MO	Florissant, Delltron Co., Inc.	314-839-0033
NY	Latham, L-Tron Corp.	518-785-5032
NY	Pt. Washington, Ashtec, Inc.	516-767-0336
PA	Ft. Washington, Simon Mktg. Consultants	215-628-3394
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447
Can	Ontario, Avotronics Ltd.	416-475-2024

Local Distributors

AL	Montgomery, Handey's Elctrn. Ctr. Inc.	205-262-4885
AZ	Phoenix, Capital Elctrns.	602-252-5897
AZ	Phoenix, Elctrn. Emporium Inc.	602-437-8633
AZ	Tucson, Electronic City	602-622-1173
CA	Canoga Park, Sandy's Elctrns.	818-346-0510
CA	Costa Mesa, Mar Vac Elctrns.	714-650-2001
CA	Cucamonga, Abletronics	714-944-4952
CA	Culver City, DOW Elctrns.	213-391-6763
CA	El Monte, Marshall Ind.	800-522-0084
CA	Fremont, Fry's Elctrns.	415-770-3797
CA	Goleta, DOW Elctrns.	805-968-7272
CA	Hawiian Gardens, DOW Elctrns.	213-421-3786
CA	Hollywood, Pacific Radio Exchange	213-462-1393
CA	Inglewood, Inglewood Elctrns.	213-674-2366
CA	Oxnard, DOW Elctrns.	805-486-6353
CA	Palo Alto, Fry's Elctrns.	415-496-6100
CA	Pasadena, DOW Elctrns.	818-793-1195
CA	Pomona, DOW Elctrns.	818-966-8461
CA	Sacramento, Mar Vac California Radio	916-922-6531
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Maria, Elctrn. Parts Supermart	805-925-8604
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Orlando, Atlantic Comps. FL	407-354-0435
FL	Tampa, Sunex Elctrn. Supp. Inc.	813-885-4074

FL West Palm Beach, Dolphin Elctrn. Supp. Inc. 305-659-7166
IL So. Holland, Union Elctrns. Dist. 312-333-4100
MA Burlington, Atlantic Comps. 617-270-0051
MA Lynn, Land Elctrns. Inc. 617-592-2220
MI Detroit, Elctrn. Parts Co. 313-891-7400
MN S. Minneapolis, Tortec Corp. 612-866-3662
NV Las Vegas, Sandy's Elctrns. 702-383-8353
NJ Lodi, Nidisco Inc. 201-773-1771
NY Woodside, Switches Unlimited 718-478-5000
NC Durham, Southeastern Elctrns. 919-638-8204
NC Greensboro, Guilford Elctrn. Supp. Inc. 919-275-1385
NC Raleigh, Southeastern Elctrns. 919-828-2311
NC Winston-Salem, Elctrn. Distrbg. Inc. ... 919-723-1097
TN Clarksville, Randolph, Hale & Matthews Inc. 615-647-2325
TX Austin, Electrotex, Inc. 512-454-0318
TX Dallas, Electrotex, Inc. 214-234-0433
TX Ft. Worth, Allied Elctrns. 800-433-5700
TX Houston, Electrotex, Inc. 713-526-3456
WI Fond du Lac, Fedco Elctrns. Inc. 414-922-6490
WI Milwaukee, Marsh Elctrns. Inc. 414-475-6000
Can Kingston, Ont., Electronic Packaging Sys. Ltd. 613-384-1142
Can Markham, Ont., Arma Elctrns. 416-475-1858
Can Montreal, Future Elctrns. 800-388-8731

SERIAL LAB PRODS., INC., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752, Tel: 617-481-1684, TELEX: 955318 Attn: SERIAL LAB; Empl.: 12; *Sls. Mgr.:* R. L. Wiedeman; *Dist. Mgr.:* D. Kreck

SERVOBYTE INC., P.O. Box 112, Millbury, MA 01527, Tel: 508-865-0225, FAX: 508-865-0295; Empl.: 5; *Sls. Mgr.:* C. Harris

servo
SERVO CORPORATION OF AMERICA

FAX: 516-938-9644

SERVO CORPORATION OF AMERICA, 111 New South Rd., Hicksville, NY 11802-9907, Tel: 516-938-9700; FSC No.: 92110 & 05627; Empl.: 220; *Sls. Mgr.:* G. Immerso ..... **A•1827; D•1077**

Local Sales Offices & Reps
CA Dana Point, EBA Microwave 714-240-8181
CA Del Mar, Servo Western Reg. Off. 619-792-8672
CA Los Angeles, EBA Microwave 213-822-7510

Local Distributors
VA Fairfax, Servo Eastern Reg. Off. 703-591-4331

SERVOMEX COMPANY, 90 Kerry Pl, Norwood, MA 02062, Tel: 617-769-7710, TELEX: 4430161, FAX: 617-769-2834

SERVO-TEK®

FAX: 201-427-4249

SERVO-TEK PRODUCTS CO., 1086 Goffle Rd., Hawthorne, NJ 07506, Tel: 201-427-3100; Empl.: 60; *Sls. Mgr.:* T. J. Daly ..... **B•1310**

SESCOM, INC., 2100 Ward Dr., Henderson, NV 89015-4249, Tel: 702-565-3400, FAX: 702-565-4828; FSC No.: 7Z174; Empl.: 12; *Sls. Mgr.:* Franklin J. Miller ... **C•1102**

SETRA SYSTEMS, INC., 45 Nagog Park, Acton, MA 01720, Tel: 508-263-1400, 1-800-25-SETRA, TELEX: 4430243, FAX: 508-264-0292; FSC No.: 53367; Empl.: 110; *Sls. Mgr.:* Ed Cope ..... **B•1948-1949**

Local Sales Offices & Reps
AL Huntsville, Burnette Techno Metrics .. 205-830-2832
AK Anchorage, Unit Process 907-522-1010
CA Concord, QCon, Inc. 415-682-2020
CA Downey, Dynasales Co. 213-806-1400
CO Westminster, RMS Sls. 303-429-1111
FL Tampa, Quantum Measurements Corp. 813-933-8078
GA Atlanta, Craft Assocs. 404-256-0420
HI Honolulu, Unit Process 808-834-7195
IL Carpentersville, Precision Meas. Prods. 708-426-4446
IN Ft. Wayne, Domino, Inc. 219-456-5512
IN Indianapolis, Domino, Inc. 317-841-6159
KY Louisville, Domino, Inc. 502-425-2848
MD Columbia, Stein Instrs. 301-596-3748
MA Ashland, NEDT, Inc. 508-881-3265
MI Hazel Park, Tiby Co. 313-547-3550
MN Minneapolis, The Mark Co. 612-933-3026
MO St. Louis, Adelphi, Inc. 314-821-1232
MT Billings, Unit Process 406-252-0455
NJ Little Falls, KLS Assocs. 201-785-4450
NM Albuquerque, TMA, Inc. 505-345-8921
NY Rochester, Ritec Entprs., Inc. 716-271-3170
OH Cleveland, Tiby Co. 216-371-5335
OH Dayton, Tiby Co. 513-277-3822
OK Tulsa, Inotek Corp. 918-627-1500
PA Cheltenham, Stein Instrm. 215-379-1990
TX Richardson, ADI Instrs. 214-680-2222
WA Kirkland, Unit Process 206-827-0433
WI Waukesha, Ray Knitter Assocs. 414-544-1976
Can Ontario, Alpha Controls & Instr. 416-477-2133

SEVEN MOUNTAINS SCI. INC., P.O. Box 650, Boalsburg, PA 16827, Tel: 814-466-6559, FAX: 814-466-6559; Empl.: 4; *Sls. Mgr.:* Josephine Chesworth

SFE TECHNOLOGIES, 1501 1st St, San Fernando, CA 91340, Tel: 818-365-9411, TWX: 910-496-1535, FAX: 818-365-5117; FSC No.: 96733; Empl.: 800; *Sls. Mgr.:* Michael Rosenberg

S. F. PRODUCTS CORPORATION, 1021 Parker Road, Chester, NJ 07930, Tel: 201-271-4009; Empl.: 8; *Sls. Mgr.:* Norman W. Johanson; *Dist. Mgr.:* R. S. Johanson

SGS-THOMSON MICROELECTRONICS, INC., 1310 Electronics, Carrollton, TX 75006, Tel: 214-466-6000, FAX: 214-466-7602; FSC No.: 7X328; Empl.: 1700; *Sls. Mgr.:* Garth Nash; *Dist. Mgr.:* Jack Dauber

Shallco

FAX: 919-934-3298

SHALLCO, INC., Box 1089, Smithfield, NC 27577, Tel: 919-934-3135, 1-800-876-3135; Empl.: 35; *Sls. Mgr.:* M. D. Sutton ..... **B•1772-1777**

Local Sales Offices & Reps
MN St. Paul, Kencotronics, Inc. 612-645-7717

SHALLTRONIX

FAX: 919-965-6620

SHALLTRONIX CORP., Preston St, P.O. Box 235, Selma, NC 27576, Tel: 919-965-6346; FSC No.: 58258; *Sls. Mgr.:* Joe Deans ..... **D•1325**

Local Sales Offices & Reps
TX Arlington, Electronic Prod. Reps. 817-467-0377

SHAMROCK PLASTICS & RUBBER, INC., 5330 E. 25th St., Indianapolis, IN 46218, Tel: 317-543-3540, 800-382-4635, FAX: 317-543-3553; Empl.: 25; *Sls. Mgr.:* Bill Crispen

SHAPE ELECTRONICS, INC., 901 DuPage Ave., Lombard, IL 60148, Tel: 708-620-8394, FAX: 708-620-0784; Empl.: 110; *Sls. Mgr.:* Judy M. Ardolino; *Dist. Mgr.:* Judy M. Ardolino

SHAPIRO SCIENTIFIC INST., 3500 E. Coast Hwy., Corona del Mar, CA 92625, Tel: 714-675-1024, FAX: 714-675-9063; Empl.: 7

SHARP

FAX: 206-834-8903

SHARP ELECTRONICS CORP., Microelectronics Grp., 5700 NW Pacific Rim Blvd., Ste.20, Camas, WA 98706, Tel: 206-834-2500; *Sls. Mgr.:* Terry Manton; *Dist. Mgr.:* Dave Mathews ..... **A•1743-1745; B•1119-1121, 1184, 1339-1341, 1581**

Local Sales Offices & Reps
AL Daphne, Interep Assocs. 205-621-1036
AL Huntsville, Interep Assocs. 205-881-1096
AZ Tempe, Electronic Tech. Sls. 602-921-7122
CA Newport Bch., Plustronics 714-476-8009
CA San Diego, Mesa Comps. 619-278-8021
CA San Jose, Sharp Elctrns. Corp. 408-436-4900, FAX:408-436-0924
CA Sherman Oaks, Plustronics 818-995-8908
CO Denver, Seale & Assocs., Inc. 303-695-1980
FL Orlando, Component Design Mktg. Co. 407-240-3903
GA Norcross, Interep Assocs. 404-449-8680
IL Glendale Hgts., Synergistic Sls. 708-858-8686
IN Leo, Mohrfield Mktg. 219-627-5355
KS Wichita, Baka Corp. 316-682-8411
MD Towson, Advanced Technlg. Sls., Inc. 301-296-9360
MA Burlington, Sharp Elctrns. Corp. 617-270-7979, FAX:617-229-9117
MI Madison Hgts., DEM Sls., Inc. 313-583-1500
MN Minneapolis, Reptek 612-331-1212
NJ Allendale, Eastec Assocs. 201-934-7135
NY N. Syracuse, Micro-Tech Mktg. Inc. ... 315-458-5254
NY Rochester, Micro-Tech Mktg. Inc. 716-426-0808
NC Raleigh, WLA & Assocs. 919-231-9939
OH Dayton, Five Star Elctrns., Inc. 513-299-1718
OH Solon, Five Star Elctrns., Inc. 216-349-1611
OR Beaverton, Blair Hirsh 503-641-1875
PA Erdenheim, Omni Sls. 215-233-4600
TN Greenville, Interep Assocs. 615-639-3491
TX Dallas, Sharp Elctrns. Corp. 214-991-5185
VA Richmond, Advanced Technlgy. Sls. .. 804-320-8756
WA Lynwood, Blair Hirsh 206-774-8151
WI Brookfield, Synergistic Sls. 414-821-1516
Can Dollard des Ormeaux, Indigo Elctrns. Ltd. 514-696-6104
Can Kanata, Ont., Indigo Elctrns. Ltd. 613-831-3106
Can Mississauga, Ont., Indigo Elctrns. Ltd. 416-670-0284
Can Richmond, BC, Enerlec Sls. 604-273-0882

Local Distributors
CA El Monte, Marshall Inds. 818-459-5574
CA Saratoga, Western Micro Technlgy. ... 408-725-1660
CA Tustin, Added Value Elctrns. 714-259-8259
NY Farmingdale, Milgray 516-420-9800
Can Montreal, Que., Space Elctrns. 514-694-7710

SHATTUCK INDUSTRIES, 238 Eleana Dr., Ben Lomond, CA 95005, Tel: 408-336-5145, FAX: 408-336-3376; *Sls. Mgr.:* Bruce Shattuck

SHELDAHL, INC., 1150 Sheldahl Rd., Northfield, MN 55057, Tel: 507-663-8000, TWX: 910-565-2180, FAX: 507-663-8545; Empl.: 1,257; *Sls. Mgr.:* Ed Lundstrom

SHELLY

FAX: 714-669-1081

SHELLY ASSOCIATES, INC., 14811 Myford Rd., Tustin, CA 92680, Tel: 714-669-9850, TELEX: 85-2263; FSC No.: 00303; Empl.: 30 ..... **B•1122-1124, 1185**

Local Sales Offices & Reps
AZ Tempe, Spectrum Assocs., S.W. 602-966-1788
CA Mountain View, Leddy Assocs. 415-969-6313
CA San Diego, O'Donnell Assocs., Inc. 619-578-1645
CA Torrance, O'Donnell Assocs., Inc. 213-539-9664
CO Englewood, Romulus Elec., Inc. 303-770-4888
FL Charlotte, Q Rep, Inc. 813-379-8431
GA Norcross, Intronics 404-973-6605
IL Skokie, Electro Tech Mktg. 312-676-3151
IN Ft. Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. Inc. 317-841-0010
MA Sudbury, KSA of New England 508-443-5881
MI Ypsilanti, Techrep, Inc. 313-572-1950
MN Hopkins, Steve Forsythe & Assocs. ... 612-933-8267
MO Grandview, R. R. Burton & Assocs. 816-763-5385
MO Kirkwood, R. R. Burton & Assocs. 314-965-0451
NJ Boonton, TMA 201-263-2946
NJ Cherry Hill, Metz Benham Assocs., Inc. 609-424-0404
NY N. Syracuse, R. F. Roux Co. 315-458-9169
NY Port Washington, TMA 516-883-2432
NC Charlotte, Hollingsworth & Still, Inc. ... 800-241-5712
NC Kernersville, Hollingsworth & Still, Inc. 800-241-5712
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. Inc. 216-473-5050
OH Kettering, Scott Elctrns., Inc. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281

OR Beaverton, Luscombe Engrg. Co. 503-636-6664
OR Portland, Temper Tech. Mktg. 503-292-8201
PA Pittsburgh, Scott Elctrns. 412-963-6116
TX Dallas, de Forest Sls. Co. 214-349-3290
WA Bellevue, Luscombe Engrg. Co. 206-223-1541
WI Brookfield, Electro-Tech Mktg. Assocs. 414-785-9554
Can Scarborough, Ont., Banke Elctrns. 416-292-5152

Local Distributors

AR Ft. Smith, Radio, Inc. 501-646-5200
CA Anaheim, Bisco Inds. Inc. 714-635-0380
CA Fremont, VIC/TAL Sls. 415-651-6420
CA San Jose, Bisco Inds. Inc. 408-435-8980
CT Wallingford, Midstate Elctrns. Co. 203-265-9900
IL Franklin Park, Bisco Inds. Inc. 312-451-1230
IA Cedar Rapids, Iowa Radio Supp. Co. .. 319-393-4510
IA Cedar Rapids, Iowa Radio Supp. Co. .. 313-393-4510
MA Woburn, Bisco Inds. 617-938-8590
NJ Cranford, Garden State Indl. Elctrns. .. 201-272-6400
NJ Fair Lawn, Relay Specialties 201-797-3313
NJ Oakland, Relay Specialties 201-337-1000
NY Elmsford, White Plains Elctrl. 914-592-9555
NY Huntington, Energy Elctrl. Supp. 516-549-2722
NC Raleigh, Svc. Plus Elctrns. 919-850-9550
OH Strongsville, Roberts Elctrns. Co., Inc. 216-238-1711
OH Twinsburg, Advacom, Inc. 216-425-8477
OK Tulsa, Radio, Inc. 918-587-9123
PA McKean, Advacom 814-476-7774
TX Arlington, Bisco Inds. 817-640-7046
TX Austin, Wofford Elctrns. 512-339-1131
TX Houston, Wofford Elctrns. 713-847-3583
TX Midland, ESI Supp. 915-694-9657
WI Mequon, Lakeview Elctrns. 414-377-8250
Can Calgary, Alberta, Memco 403-258-3399
Can Surrey, B.C., Memco 604-590-1553

SKC

FAX: 818-764-6845

SHINANO KENSHI CORP. (SKC), 7525 Ethel Ave., N. Hollywood, CA 91605, Tel: 818-764-4266; Empl.: 7; *Sls. Mgr.:* Dale Dowis ..... **B•1311**

Local Sales Offices & Reps

AL Madison, Benchmark 205-464-0033
CA Cupertino, PEI Sls. Assoc. 408-253-1960
CA North Hollywood, Shinano Kenshi Corp. 818-764-4266
CO Denver, Tech Rep Sls. Co. 303-758-7031
CT Bloomfield, SIR Assocs. 203-243-9343
FL Melbourne, Phoenix Comps. 407-723-4414
GA Norcross, Benchmark 404-446-1711
MA Westford, SIR Assocs. 508-692-2500
MI Brighton, A.P. Assoc. 313-229-6550
NY Albertson, DOL Engrg. 516-747-3944
NY Pittsford, KLM Garner 716-381-8350
NC Raleigh, Benchmark 919-850-0633
OH Columbus, A.P. Assocs. 614-882-1110
OR Portland, Intertech Sls. 503-775-7885
TX Dallas, Theodore Borek Assoc. 214-985-7702
UT Salt Lake City, Sierra Tech Sls. 801-566-9719

Local Distributors

CA N. Hollywood, Digilog Devices Inc. 818-764-9777

Shindengen America, Inc.

FAX: 805-373-3710

SHINDENGEN AMERICA INC., 2649 Townsgate Road, Ste. 200, Westlake Vl., CA 91361, Tel: 800-634-3654; Empl.: 10; *Sls. Mgr.:* Peter Gajewski; *Dist. Mgr.:* Peter Gajewski ..... **D•2034-2035**

Local Sales Offices & Reps

AZ Phoenix, Hartland Sls. 602-492-0012
CA Murrieta, Mil-Com Sls., Inc. 714-677-2097
CA San Diego, Power Assocs. 619-275-0641
CA Santa Clara, Integrated Tech. Sls. 408-727-3408
CO Arvada, Arrowhead/CSI 303-423-5597
FL Land O' Lakes, A.J.'s Power Source, Inc. 813-996-2583
GA Duluth, AJ's Power Source 404-441-7927
IL Rolling Meadows, Eagle Tech. Sls., Inc. 312-991-0700
AZ Scottsdale, Bill Earl Assocs. 602-994-3813
KS Lenexa, Midtec Assocs. 913-541-0505
MD Baltimore, Chesapeake Indl. Mktg. 301-653-0476
MI Lathrup Vl., R. C. Nordstrom & Co. 313-559-7373
MO St. Louis, Midtec Assocs. 314-275-8666
NH Nashua, Bell Controls, Inc. 603-882-6984
NY Hauppauge, Aurora-Schmitt 516-434-1313
NY Pittsford, Franklin Sls. Corp. 716-248-8251
OR Beaverton, Olsen Tech. Sls. Corp. 503-643-9488
PA Blue Bell, Delatronics Inc. 215-641-9930
MN Mancata, E. I. Sls. 507-345-5786
TX Richardson, Jim Gray & Assocs. 214-699-9976
TX Richmond, Jim Gray & Assocs. 713-342-1710
UT Midvale, Arrowhead/CSI 801-561-5688
WA Bellevue, Olsen Tech. Sls. Corp. 206-883-7792
WI Waukesha, Eagle Tech. Sls. 414-549-3622
Can Mississauga, Ont., Techrep 416-890-2903
Can Nepean, Ont., Techrep 613-225-9186
Can St. Laubert, Que., Techrep 514-337-6046

Local Distributors

AZ Phoenix, Dalis Elctrn. Supply 602-275-2626
AZ Tucson, Dalis Elctrn Supply 602-294-2628
CO Littleton, Dusplays Plus, Inc. 303-730-7333
CT Danbury, Aved Elctrn. Dist., Inc. 203-744-7838
IL Schaumburg, QPS Elctrns. 312-884-6620
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Andover, Aved Elctrn. Dist., Inc. 508-688-3800
MI St. Clair Shores, Spemco 313-771-2700
NJ Pennsauken, Alta Elctrns. 609-488-1442
NM Albuquerque, Summit Elec. Supp. Co. 505-884-4400
NM Albuquerque, Walker Elctrn. Supply ... 505-883-2992
OH Cleveland, Major Elctrns. 216-442-6200
TX Austin, Wofford Elctrns. 512-339-1131
TX Dallas, Wofford Elctrns. 214-320-0294
TX El Paso, Midland Wintronic Co. 915-779-8391
TX Houston, Wofford Elctrns. 713-847-3583

ShinEtsu

FAX: 415-475-0613

SHIN-ETSU POLYMER AMERICA, INC., 34135 7th St., Union City, CA 94587, Tel: 415-475-9000, TWX: 910-338-2229; *Sls. Mgr.:* Doug Hall ..... **C•1521**

Local Sales Offices & Reps

FL Clearwater, Tech-Rep Assocs. 813-572-9900
IL Crystal Lake, Mid America Reps. 815-455-5310
IN Carmel, Technology Mktg. Corp. 317-844-8462
MA Lexington, Jodan Technlg. 617-863-8898
MO St. Louis, G.M. Brown & Assocs. 314-741-4424
NJ Matawan, SP America, Inc. 201-583-7070
NJ Princeton, Siemens Comps., Inc. 609-987-0083
NM Albuquerque, F-P Sls. 505-345-5553
NY Liverpool, Gen-Tech 315-451-3480
NC Smithfield, ADI, Inc. 919-934-8136
OH Columbus, Siemens Comps., Inc. 614-433-7500
OH Strongfield, Dolfuss-Root & Co., Inc. 216-238-0300
PA Bridgeville, Dolfuss Root & Co. 412-221-4420
PA Broomall, TCA Assoc. 215-353-2022
PA Westchester, TCA Assocs. 215-692-6853
TN Greenville, Interep 615-639-3491
TN Greenville, Lamons Sls. Co. 615-639-8711
TX Arlington, CompTech Sls., Inc. 817-265-6007
TX Austin, CompTech Sls., Inc. 512-331-8922
TX Dallas, THT Sls. 214-783-1501
CA Irvine, Interconn Tech. Mktg. 714-733-1879
UT Salt Lake City, Lange Sls. 801-487-0843
UT Salt Lake City, Lange Sls., Inc. 801-487-0843
WA Bellevue, Micro Sls. 206-451-0568
PR Rio Piedras, Klamco Elec. 809-752-6169

Local Distributors

MI Farmington Hills, J.L. Montgomery Assoc., Inc. 313-489-0099

SHOGYO

FAX: 516-466-0922

SHOGYO INTERNATIONAL CORP., 287 Northern Blvd., Great Neck, NY 11021, Tel: 516-466-0911, TELEX: 4758024, TWX: 12218 ..... **A•2391; B•1186, 1778; C•1523-1525, 1820-1821; D•1058-1059, 1491, 2037**

SHOKAI

FAX: 914-736-3656

SHOKAI FAR EAST LTD., 9 Elena Court, Peekskill, NY 10566, Tel: 914-736-3500, TELEX: 224219; Empl.: 362; *Sls. Mgr.:* Shirlee Serber; *Dist. Mgr.:* Robert Craig ..... **A•2069; B•1187; D•1060**

SHURE BROTHERS INC., 222 Hartrey Ave., Evanston, IL 60202-3696, Tel: 708-866-2200, TELEX: 4330191, FAX: 708-886-2279; *Sls. Mgr.:* L.Z. Morgan, VP Sls.

SHURITE METERS, A Prime Technology Co., P.O. Box 185, Twin Lakes Rd., North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 82239; Empl.: 15; *Sls. Mgr.:* James L. Jamieson ..... **D•1373**

Local Sales Offices & Reps

AK Please Consult Factory, Please Consult Factory 203-481-5721
CA Burbank, Modco Co. 818-848-2215
CA San Diego, Qualtronics 619-873-0118
CA So. San Francisco, Carelli-EMA 415-873-3365
CO Denver, Nelson Co. Inc. 303-295-1017
CT Gilman, Adams McGregor Inc. 203-537-3033
FL Lakeland, Munday Sls. Co. 813-858-5606
IL Cary, Bob Burns Assocs. 708-516-3322
IN Indianapolis, John Sukup Inc. 317-253-5501
IA Des Moines, The Beams Co. 515-255-1148
KS Shawnee Mission, The Beams Co. 913-631-0300
MI E. Detroit, Jack M. Thorpe Co. 313-779-6363
MO St. Louis, The Beams Co. 314-434-8448
NJ Franklin, D. F. Tobias & Co. 201-751-8680
NJ Lawrenceville, DVS Co. 609-896-1112
NY Rochester, D. F. Tobias 201-751-8680
NC Raleigh, B.T. Funderburk Inc. 919-846-2373
OH Cleveland, John Olsen Co. 216-838-0510
PA Glenshaw, DVS Co. 609-896-1112
SC Landrum, B.T. Funderburk Inc. 919-846-2373
TX Dallas, The Crockett Sls. Co. 214-350-3377
Can Thornhill, Ont., R. C. Kahnert Sls. Ltd. 416-764-2596
Can Winnipeg, Manitoba, Smith-Patterson & Assocs. 204-885-1376

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AL Birmingham, ACK Radio Supply 205-322-0588
AZ Phoenix, Capital Elctrns. Supp. 602-252-5897
AR Little Rock, Carlton-Bates 501-562-9100
CA San Francisco, Zack Elctrns. 415-624-1444
CA San Jose, Quements Elctrns. 408-998-5900
CA San Rafael, Electronics Plus 415-457-0466
CO Denver, Fistells Elec. Supp. 303-629-1312
CT New Haven, Hatry Elctrns. 203-787-5921
IN East Chicago, Acro Elctrns. 219-397-8681
IA Des Moines, Radio Trade Supp. 515-288-7237
KY Louisville, Peerless Elctrn.Eqpt. 502-637-7677
LA Baton Rouge, Ralph's Elctrn. Supp. ... 504-344-3761
MO Kansas City, Elctrn. Supp. Co. 816-931-0250
MO Kansas City, Walters Indl. Elect. Inc. 1-800-821-5248
NM Los Cruces, Elctrn. Parts Co. 505-523-4578
OH Akron, Akron Elctrn. Supp. 216-762-8818
OH Lima, Hutch & Sons 419-229-8751
OK Tulsa, Radio Inc. 918-587-9123
PA Reading, Barbey Elctrns. Corp. 215-376-7451
RI Pawtucket, Jabbour Elctrns. 401-728-4600
TX Fort Worth, Allied Elctrns. 1-800-433-5700
TX Houston, City Elctrns. Supp. 713-621-1060
TX Houston, Elctrn. Prts. Outlet 713-784-0140
WI Milwaukee, E.M. Instrs. Inc. 414-272-7799
Can Willowdale, Ontario, Electro Sonic Inc. 416-494-1666

SIEMENS-B C L MAGNETICS, Siemens Automotive Ltd., 5045 North Service Rd., Burlington, Ont., Canada L7L 5H6, Tel: 416-335-2530, FAX: 416-335-8474; Empl.: 160; *Sls. Mgr.:* Dave Dore

SIEMENS COMPONENTS, INC., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014, Tel: 408-257-7910, TELEX: 352084, TWX: 910-338-0022; FSC No.: 50579; Empl.: 1100; *Sls. Mgr.:* Chuck Berghoff; *Dist. Mgr.:* Regina Walls

SIEMENS COMPONENTS, INC., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, Tel: 201-321-3400, TWX: 710-998-0588/0529, FAX: 201-321-3961; Empl.: 800; *Sls. Mgr.:* Curt Hozian; *Dist. Mgr.:* Dick Robert

SIERRACIN/MAGNEDYNE, 2258 Rutherford Rd., Carlsbad, CA 92008, Tel: 619-438-3321, FAX: 619-438-4987; Empl.: 150

SIERRACIN POWER SYSTEMS, See Sierra Power Systems

SIERRA MONITOR CORP., 1991 Tarob Ct., Milpitas, CA 95035, Tel: 408-262-6611, TELEX: 17-1618; FSC No.: MSGSNDR; Empl.: 23; *Sls. Mgr.:* Robert Dunkle; *Dist. Mgr.:* Gordon Arnold

SIERRA POWER SYSTEMS, See Valor Power Sys. Div., Valor Elctrns.

SIERRA SEMICONDUCTOR CORP., 2075 N. Capitol Ave., San Jose, CA 95132, Tel: 408-263-9300, FAX: 408-263-3337

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AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Irvine, Strong & Assocs.	714-261-7233
CA	Mountain View, Brooks Tech. Grp.	415-960-3880
CA	San Diego, Pathfinder Elctrns. Reps.	619-578-2555
CO	Wheat Ridge, Wescom Mktg.	303-422-8957
CT	Woodbury, Lindco Assocs., Inc.	203-266-0728
FL	Altamonte Springs, Sls. Engrg. Concepts	407-830-8444
FL	Deerfield Bch., Sls. Engrg. Concepts	305-426-4601
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
ID	Boise, Wescom Mktg., Inc.	208-226-6654
IL	Rolling Meadows, Eagle Tech. Sls.	708-991-0700
IN	Indianapolis, Elctrn. Sls. & Engineering	317-849-4260
MD	Columbia, Chesapeake Technlg.	301-236-0530
MA	Burlington, New Tech Solutions	617-229-8888
MI	Farmington, Tri-Tech Sls., Inc.	313-442-1200
MN	Minneapolis, P.S.I.	612-944-8545
NJ	E. Hanover, Emtec Sls., Inc.	201-428-0600
NJ	Medford, The McCoy Grp., Inc.	609-953-0770
NM	Albuquerque, Summit Sls.	505-345-5003
NY	Syracuse, PI'Tronics (Upstate)	315-455-7346
NC	Raleigh, Montgomery Mktg.	919-851-0010
OH	Cleveland, Arthur Baier Co.	216-461-6161
OR	Beaverton, L-Squared	503-629-8555
PA	Exton (East), The McCoy Grp.	215-363-0350
PA	Pittsburgh (West), Arthur Baier Co.	412-367-7799
TX	Houston, Logic 1 Sls.	713-444-7594
TX	Richardson, Logic 1 Sls.	214-234-0765
UT	Salt Lake City, Wescom Mktg., Inc.	801-269-0419
WA	Kirkland, L-Squared, Ltd.	206-827-8555
WI	Waukesha, Eagle Tech. Sls.	414-896-0633
Can	Ottawa, Ont., Cantec Reps.	613-725-3704

Local Distributors

CA	Irvine, ITT Multicomponents	714-727-4001
CA	San Jose, ITT Multicomponents	408-453-1404
CO	Westminster, ITT Multicomponents	303-451-8740
CT	Milford, Milgray	203-878-5538
FL	Winter Pk., Milgray	305-647-5747
GA	Norcross, Milgray	404-446-9777
IL	Arlington Hgts., Milgray	312-253-1212
KS	Overland Pk., Milgray	913-236-8800
MD	Columbia, Milgray	301-621-8169
MA	Wilmington, Milgray	508-657-5900
NJ	Marlton, Milgray	609-983-5010
NY	Farmingdale, Milgray	516-391-3000
NY	N. Lindenhurst, Phase 1 Technlg.	516-957-4900
NY	Pittsford (Upstate), Milgray	716-381-9700
OH	Cleveland, Milgray	216-447-1520
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SIGMAPOWER, INC., 20790 Leapwood Ave., Carson, CA 90746, Tel: 213-32-Sigma, FAX: 213-769-0172; FSC No.: 55196; Empl.: 145; *Sls. Mgr.:* Carl J. Marquardt

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CA	Albany, B/P Assocs.	415-525-7605
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CA	San Carlos, Electronic Engrg. Assocs.	415-593-2189
IL	Elgin, R.K. Elctrns., Inc.	312-695-8552
IL	So. Elgin, RK Elctrns., Inc.	312-695-8552
MN	Edina, Dytec Instrs., Inc.	612-831-7169
NJ	Parsippany, Creative Tech. Sls.	201-335-7881
Intl	Palaiseau, France, Salies S.A.	920-40-10

SIGNAL PROCESSING TECHNOLOGIES, 1510 Quail Lake Loop, Colorado Springs, CO 80906, Tel: 719-540-3900, FAX: 719-540-3970; Empl.: 68; *Sls. Mgr.:* Rick Mintle

SIGNAL RESEARCH INC., River Road, P.O. Box 357, Titusville, NJ 08560, Tel: 609-737-1917 ..... **D•1109**

SIGNAL SYSTEMS INTERNATIONAL, P.O. Box 470, Lavalette, NJ 08735, Tel: 201-793-4668, FAX: 201-793-4679; Empl.: 7; *Sls. Mgr.:* W. Kinney ..... **B•1779**

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SIGNATEC, INC., 357 N. Sheridan-Ste. 119, Corona, CA 91720, Tel: 714-734-3001, FAX: 714-734-4356; Empl.: 4; *Sls. Mgr.:* Belinda Hunt

SIGNATRON, A Subsidiary of Meteor Communications Corp., 110 Hartwell Ave., Lexington, MA 02173, Tel: 617-861-1500, TELEX: 299551 (RCA GLOBCOM), FAX: 617-863-8039; FSC No.: 59371; Empl.: 25; *Sls. Mgr.:* Joseph T. McNamara

SIGNETICS COMPANY, Sub. of North American Philips, 811 E. Arques Ave., P.O. Box 3409, Sunnyvale, CA 94088-3409, Tel: 408-991-2000, FAX: 408-991-2311; FSC No.: 1CH66; Empl.: 7,000; *Sls. Mgr.:* Steve Pletcher; *Dist. Mgr.:* Vinnie Bonanno

SIGNUM, INC., 600 W. Cummings Park, Woburn, MA 01801, Tel: 617-933-4780, TELEX: 948263, FAX: 617-938-1757; *Sls. Mgr.:* Thomas DiGennaro

SIGNUM SYSTEMS CORP., 171 E. Thousand Oaks Blvd. No. 202, Thousand Oaks, CA 91360, Tel: 805-371-4608, TELEX: 36-24-39, FAX: 805-371-4610; Empl.: 12; *Sls. Mgr.:* Don Mull; *Dist. Mgr.:* K. Kristensen ... **D•1326**

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CA	San Jose, C.M.S.	415-487-2118

SIKAMA INTERNATIONAL, INC., 301 B Donaldson Place, Santa Barbara, CA 93117, Tel: 805-683-6379, FAX: 805-683-6740; Empl.: 25; *Sls. Mgr.:* Theresa Roberts; *Dist. Mgr.:* Theresa Roberts

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FAX: 805-484-9935

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Local Sales Offices & Reps

AL	Huntsville, Reynolds & Assocs., Inc.	407-259-7000, FAX:205-534-1015
CA	Santa Clara, Electec	408-496-0706, FAX:408-727-9617
CA	Tarzana, Royal Shillah	818-342-1848, FAX:818-342-2601
CO	Littleton, Simpson Assocs.	303-794-8381, FAX:303-794-2409
CT	Madison, Conti-Younger	203-245-1136
FL	New Port Richey, Reynolds & Assocs., Inc.	407-259-7000,FAX:813-372-7204
GA	Lilburn, Reynolds & Assocs., Inc.	407-259-7000, FAX:404-905-4116
IN	Fishers, Carter, McCormic & Pierce, Inc.	317-842-9277,FAX:317-577-2741
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505, FAX:913-541-1729
MD	Randallstown, Beacon North	703-478-2480
MA	Burlington, Conti-Younger	617-273-1582, FAX:617-270-0310
MI	Farmington Hills, Carter, McCormic & Pierce, Inc.	313-477-7700,FAX:313-477-4149
MN	Eden Prarie, Electronic Innovators, Inc.	612-922-2745,FAX:612-922-3914
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666, FAX:314-275-8859
NJ	Huwitt, Aurora Schmitt Assocs.	201-853-5253
NY	Albany, L-Tron Corp.	518-489-7810, FAX:518-489-7810
NY	Hauppauge, Aurora Schmitt Assocs.	516-434-1313,FAX:516-434-1572
NY	Pittsford, L-Tron Corp.	716-383-0050, FAX:716-383-0701
NC	Raleigh, Reynolds & Assocs., Inc.	407-259-7000
OH	Englewood, Carter, McCormic & Pierce, Inc.	513-836-0951,FAX:513-836-2358
OH	Parma, Carter, McCormic & Pierce, Inc.	216-398-0400,FAX:216-398-0766
OK	Tulsa, Advanced Tech. Sls.	918-664-0482, FAX:918-664-5467
OR	Portland, Venture Elctrns.	503-624-0617, FAX:503-620-4632
PA	Collegeville, Beacon North	703-478-2480
PA	Langhorne, Beacon North	215-752-4429
PA	Pittsburgh, Carter, McCormic & Pierce, Inc.	412-826-3800,FAX:412-826-3803
SC	Greenville, Reynolds & Assocs., Inc.	407-259-7000
TX	Austin, Advanced Tech. Sls.	512-467-9209, FAX:512-467-9405
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SILICON GENERAL, 11861 Western Ave., Garden Grove, CA 92641, Tel: 714-898-8121, TELEX: 692-411, TWX: 910-596-1804, FAX: 714-893-2570; FSC No.: 34333; Empl.: 250; *Sls. Mgr.:* Roger Holliday; *Dist. Mgr.:* Louise Toussaint

SILICONIX, INC., 2201 Laurelwood Rd., Santa Clara, CA 95054, Tel: 408-988-8000, TWX: 910-338-0227; Empl.: 2300; *Sls. Mgr.:* Walter Senges, VP of Sls.; *Dist. Mgr.:* Richard O Tuska, Dist. Sls. Dir.



FAX: 213-630-5338

SILICON POWER CUBE CORP., 6015 Obispo Ave., Long Beach, CA 90805, Tel: 213-634-9390, TELEX: 297340; Empl.: 350 ..... **B•1582-1583**

Local Distributors

AL	Huntsville, Hamilton/Avnet	205-837-7210
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CA	Costa Mesa, Hamilton/Avnet	714-641-4100
CA	Gardena, Hamilton/Avnet	213-516-8600
CA	Long Beach, Amps Abundant	213-634-0187
CA	Sacramento, Hamilton/Avnet	916-925-2216
CA	San Diego, Hamilton/Avnet	619-571-1900
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CA	Woodland Hills, Hamilton/Avnet	818-594-0404
CO	Englewood, Hamilton Avnet	303-799-7800
CT	Danbury, Hamilton/Avnet	203-748-6077
FL	Ft. Lauderdale, Hamilton/Avnet	305-767-6377
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FL	Winter Pk., Hamilton/Avnet	407-657-3300
IL	Bensenville, Hamilton/Avnet	708-860-7700
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MI	Grand Rapids, Hamilton/Avnet	616-243-8805
MI	Livonia, Hamilton/Avnet	313-347-4270
MN	Minnetonka, Hamilton/Avnet	612-932-0600
MO	Earth City, Hamilton/Avnet	314-537-1600
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NJ	Fairfield, Hamilton/Avnet	201-575-3390
NM	Albuquerque, Hamilton/Avnet	505-345-0001
NY	Hauppauge, Hamilton/Avnet	516-231-9800
NY	Rochester, Hamilton/Avnet	716-292-0810
NY	Syracuse, Hamilton/Avnet	315-437-2641
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SILONEX INC., 331 Cornelia St., Plattsburgh, NY 12901, Tel: 518-561-3160, FAX: 514-747-3906; Empl.: 110; *Sls. Mgr.:* Carol Larsen ..... **B•1345**

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MA	Wakefield, Instr. Dynamics Inc.	617-245-5100
NY	F & F Metro Inc.	516-482-4080
TX	Dallas, Southwest Elctrn. Ind. Inc.	214-690-9881
WI	Wauwatosa, Larsen Assocs. Inc.	414-258-0529
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

SIMCO CO., 2257 North Penn Rd., Hatfield, PA 19440, Tel: 215-822-2171, FAX: 215-822-3795; Empl.: 150; *Sls. Mgr.:* Bob Heacock

SIMMONDS PRECISION ENGINE SYSTEMS, BF Goodrich Aerospace, P.O. Box 310, Norwich, NY 13815, Tel: 607-335-5000, TWX: 510-261-7776; Empl.: 650; *Sls. Mgr.:* G. D. Cummings

SIMPSON ELECTRIC CO., 853 Dundee Ave., Elgin, IL 60120, Tel: 708-697-2260, TELEX: 72-2416, FAX: 708-697-2272; Empl.: 550; *Dist. Mgr.:* George Oskandy, Sls. Admin. Mgr.

SIMTEK CORP., 1465 Kelly Johnson Blvd., Colorado Springs, CO 80920, Tel: 719-531-9444, FAX: 719-531-9481; Empl.: 40; *Sls. Mgr.:* David Bowers; *Dist. Mgr.:* David Bowers

SIMULASER CORP., 15251 E. Don Julian Rd., City of Industry, CA 91746, Tel: 818-369-1355, FAX: 818-336-8694; FSC No.: 8T239; Empl.: 26

SIMULEX CORPORATION, 2832-C Walnut Avenue, Tustin, CA 92680, Tel: 714-730-1500, FAX: 714-730-7176; *Sls. Mgr.:* Dave Guss

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FAX: 708-860-3672

SINGER DATA PRODUCTS, INC., 790 Maple Lane, Bensenville, IL 60106, Tel: 708-860-6500, TELEX: 210-230; Empl.: 40; *Sls. Mgr.:* Ken Krohmer ..... **D•1111**

Local Sales Offices & Reps

NJ	Haddonfield, Singer Data	609-429-6927

SINOTECH, Technology Communications Group, Inc., 23590 Stafford Hill Drive, West Linn, OR 97068, Tel: 503-638-1000, FAX: 503-638-1002; Empl.: 45; *Sls. Mgr.:* John Vezmar

SIPEX CORP., Custom Monolithic Prods. Div., Six Fortune Dr., Billerica, MA 01821, Tel: 508-667-8700, FAX: 508-670-9001; Empl.: 90; *Sls. Mgr.:* Bill Dennehy

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IL	Elk Grove, Anxiter	800-554-5368
MN	St. Paul, D.F. Coutryman	800-328-6820
NY	Wharton, Anxiter	516-293-7788
OK	Tulsa, Tulsat Corp./DRK Entrps.	918-836-8348
TX	Bedford, Spectrum	817-267-2288
WA	Redmond, Glade Comms.	206-869-4116

S.I. TECH, 901 N. Batavia Ave., Batavia, IL 60510, Tel: 708-232-8640, FAX: 708-232-8677; Empl.: 17; *Sls. Mgr.:* Ramesh Sheth; *Dist. Mgr.:* Kay Brabec ..... **B•1231**

Local Sales Offices & Reps

MA	Holliston, Olson Mktg.	508-429-8066
MN	Hibbing, Minntech Ec.	218-262-5228
NJ	E. Brunswick, EAC Assocs.	908-254-6624
NM	Albuquerque, Fry-Gates Co.	505-262-1525
TN	Memphis, Professional Technlg.	901-458-1228
TX	Ingram, Davis-Hallmark Prods.	512-367-4919
WA	Bellevue, Interconnect Tech.	206-462-9508

Local Distributors

AL	Birmingham, Newark Ec.	205-942-4044
AK	Anchorage, Potelcom Supp.	907-274-8525
AR	Little Rock, Carlton Bates	817-293-5558
CA	Los Angeles, Anixter	213-625-7828
CA	San Francisco, Anixter	415-543-6070
CO	Denver, Newark Ec.	303-373-4540
FL	Miami, Newark Ec.	800-631-4608
IL	Chicago, Newark	312-792-8233
IL	Skokie, Anixter	800-243-8344
LA	Baton Rouge, Anixter	504-922-7755
MA	Boston, Anixter	508-682-8870
MI	Detroit, Anixter	313-478-3900
MO	St. Louis, Newark Ec.	314-821-7466
NY	Hauppauge, Manchester Equip. Co.	516-294-5351
OH	Columbus, Hughes-Peters	614-294-6215
PA	Pittsburgh, South-Mills Ec.	800-245-6215
TN	Chattanooga, Horizon Ec.	615-899-8585
TN	Clarksville, Randolph, Hale, Matthews	615-647-2325
TX	Houston, Anixter	713-460-9473
VA	Chantilly, Newark Ec.	703-471-7447
WA	Bellevue, Newark Ec.	206-641-9800
WI	Milwaukee, Anixter	414-355-0222
Can	London, Newark Ec.	519-685-4280
Can	Toronto, Anixter	416-568-8999

SIVERS IMA AB, 11520 Jefferson Blvd., Culver City, CA 90230, Tel: 213-306-4248, FAX: 213-390-4350; Empl.: 300; *Sls. Mgr.:* Marshall Cleland

SJOBERG, C., & SON, INC., 415 Station St., P.O. Box 3583, Cranston, RI 02910, Tel: 401-461-8220, FAX: 401-467-5446; Empl.: 20

SKB COPORATION, 434 W. Levers Place, Orange, CA 92667, Tel: 714-637-1252, FAX: 714-637-0491; FSC No.: 61302; Empl.: 170; *Sls. Mgr.:* Allan Evavold

SKF CONDITION MONITORING, 4141 Ruffin Rd., San Diego, CA 92123-1841, Tel: 619-496-3400, FAX: 619-496-3546; Empl.: 150; *Sls. Mgr.:* Rich Gabel

SKO-DIE, INC., 8050 Austin Ave., Morton Grove, IL 60053, Tel: 708-965-1130, FAX: 708-966-0322; FSC No.: 7P145; Empl.: 50; *Sls. Mgr.:* Ralph H. Hoffmann

SKY COMPUTER, INC., 27 Industrial Ave., Chelmsford, MA 01824, Tel: 508-250-1920, TELEX: 499-1331, FAX: 508-250-0036

SKYDYNE DIV., AAR MFG., 21 River Rd., Port Jervis, NY 12771, Tel: 914-856-6655, 800-428-CASE, FAX: 914-856-8378; Empl.: 110; *Sls. Mgr.:* M. Timney ..... **C•1106-1107**

SKYNET ELECTRONICS, 1474 Gladding Ct., Milpitas, CA 95035, Tel: 408-945-6355, FAX: 408-945-6357; Empl.: 20

SKYWAY MAGNETICS, 35372 Hwy 79, Warner Springs, CA 92086, Tel: 619-782-3342; FSC No.: 3612; Empl.: 12; *Sls. Mgr.:* John Grudziadz

SLAUGHTER CO., 801 Hailey St, P.O. Box 1805, Ardmore, OK 73402, Tel: 405-223-4773, TELEX: 697-5577, FAX: 405-226-5757; FSC No.: 05611; *Sls. Mgr.:* T. Medrick ..... **D•1327**

SL CORPORATION, 240 Tamal Vista Blvd. No. 110, Corte Madera, CA 94925, Tel: 415-927-1724, FAX: 415-927-2931; Empl.: 26; *Sls. Mgr.:* Christopher Wilson; *Dist. Mgr.:* Christopher Wilson

The Sloan Company
"THE TOUCH OF BRILLIANCE IN PANEL DESIGN"

FAX: 818-768-8326

SLOAN CO., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, Tel: 213-875-1123, TWX: 910-498-2250; FSC No.: 08717; Empl.: 25 ..... **B•1188-1195**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
CA	Montrose, Signal Entprs. Inc.	818-957-0640
CA	Mtn. View, Francisco & Assocs.	415-962-1717
RI	Warwick, Schumacher & Yarrington	401-884-5671
IL	Wheaton, CS Tech Sls.	708-653-8126
MD	Glen Burnie, Macrotech Assoc.	301-766-1111
MN	Minneapolis, Loren Green Assoc. of Minn.	612-571-6666
MO	Shawnee Mission, Microtronics	913-262-1444
NJ	Cherry Hill, Quality Comps.	609-428-6226
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NY	Rochester, Tech. Comps.	716-342-2406
OH	Cleveland, Allan Scraga	216-232-4946
TX	Dallas, IBL Engrg. & Sls.	214-363-2921
WA	Bellevue, Olson Tech Sls.	206-883-7792

Local Distributors

AL	Huntsville, Powell Elctrns.	205-529-2731
CA	Anaheim, Deco Elctrns.	714-630-8252

CA	Canoga Park, AMC Radio Hardware	818-998-2584
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Torrance, Kent Elctrns.	213-320-2700
CT	W. Hartford, Signal Ctr. Inc.	203-236-6005
FL	Ft. Lauderdale, Peerless Radio Corp.	305-973-4141
FL	Ft. Lauderdale, Powell Elctrns.	305-979-5000
CA	Los Angeles, Trebor Elctrns.	213-641-8304
FL	Pompano Beach, Peerless Radio	305-973-4141
KS	Wichita, Lee Prods.	316-264-2172
MD	Annapolis, Powell Elctrns.	301-880-3355
IL	Arlington, Mar'Lyn Elctrns.	312-364-7880
MA	Westborough, Powell Elctrns.	617-366-6100
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NJ	Englewood, Powell Elctrns.	201-568-5600
OH	Cleveland, Acorn Inds.	216-289-2531
OH	Dayton, D & D Packaging Co., Inc.	513-233-8585
OH	Solon, Repco	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
PA	Philadelphia, Powell Elctrns.	215-365-1900
TN	Memphis, GFI Sls.	901-683-6252
TX	Austin, The Altair Co.	512-837-4490
NC	Cary, Powell Elctrns.	919-467-1212
TX	Houston, Altair Co.	713-462-3029
TX	Irving, Powell Elctrns.	214-258-6841
TX	Richardson, Altair Co.	214-231-5166

SLOAN TECHNOLOGY CORPORATION, Veeco Instruments Inc., 602 E. Montecito St., Santa Barbara, CA 93103, Tel: 805-963-4431, TWX: 910-334-4901, FAX: 805-965-0522; Empl.: 75; *Sls. Mgr.:* Mel Lipton

SL WABER, INC., 520 Fellowship Rd. Ste. 306, Mt. Laurel, NJ 08054, Tel: 609-866-8888, 800-257-8384, FAX: 609-866-1945; Empl.: 125; *Sls. Mgr.:* Scott Hammill

SMERT COMPTER AIDED DESIGN & PROTOTYPE, DIV. OF SME (MONACO), P.O. Box 13280, Kanata, Ont., Canada K2K 1X4, Tel: 613-839-5588, FAX: 613-839-5582; Empl.: 14; *Sls. Mgr.:* Raymond Fourastier

H H SMITH, NT-T Inc., 632 Arch St., Meadville, PA 16335, Tel: 814-724-6440, FAX: 814-333-1912; Empl.: 300; *Sls. Mgr.:* Larry Zeiser; *Dist. Mgr.:* Larry Zeiser

BRILL ELECTRONICS
(415) 834-5888
610 E. 10th St., Oakland, CA 94606
HHSMITH
(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

BRILL ELECTRONICS
(415) 834-5888
610 E. 10th St., Oakland, CA 94606
A UNIT OF GENERAL SIGNAL
SOLA ELECTRIC
(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

SMK ELECTRONICS CORPORATION, U.S.A., 1901 Nancita Cir., Placentia, CA 92670, Tel: 714-996-0960, TELEX: 18-3081, FAX: 714-779-2790; FSC No.: 637-7400; Empl.: 219; *Sls. Mgr.:* Gary Redman/ T. Klymenko

SMT EAST CORPORATION, 378 Page St., Deerfield Corp. Ctr., Stoughton, MA 02072-1141, Tel: 800-888-SMT1, FAX: 617-344-0480; Empl.: 50

SNAPTITE/ALLIED, 6424 W. Ridge Rd., P.O. Box 8550, Erie, PA 16505, Tel: 814-833-6131, FAX: 814-838-7503; Empl.: 75

SOFREL, INC., 7685 Commerce Way No. 105, Eden Prairie, MN 55344, Tel: 612-937-8835, 1-800-8-SOFREL, FAX: 612-937-9086; Empl.: 8; *Sls. Mgr.:* Scott Henstein; *Dist. Mgr.:* Scott Henstein

SOFTAID, INC., 8930 Route 108, Columbia, MD 21045, Tel: 301-964-8455, FAX: 301-596-1852; Empl.: 9; *Sls. Mgr.:* Tammie Adams

SOFTWARE COMPONENTS GROUP, 1731 Technology Dr., San Jose, CA 95110, Tel: 408-437-0700, FAX: 408-437-0711; Empl.: 35; *Sls. Mgr.:* Dennis O Donel

THE SOFTWARE LINK, INC., 3577 Parkway Lane, Norcross, GA 30092, Tel: 404-448-5465, TELEX: 4996147SWLINK, FAX: 404-263-6474; Empl.: 55

SOHIO ENGINEERED MATERIALS CO., See Standard Engineered Materials Co.

SOKOL CRYSTAL PRODUCTS, INC., 121 Water St., Mineral Point, WI 53565, Tel: 608-987-3363, FAX: 608-987-3882; FSC No.: 56187; Empl.: 150; *Sls. Mgr.:* Steven M. Sokol

SOLA, A Unit of General Sign., 1717 Busse Rd., Elk Grove Village, IL 60007-5666, Tel: 708-439-2800, TELEX: 6871106 SOLAE, FAX: 800-626-6269; *Sls. Mgr.:* James Kimball; *Dist. Mgr.:* Brian Crowe

SOLARCOM TECHNOLOGY, INC., P.O. Box 4715, Hayward, CA 94544, Tel: 415-489-3141; Empl.: 9; *Sls. Mgr.:* Rose Ferguson

SOLAR ELECTRONICS CO., A. T. Parker, Inc., 901 N. Highland, Hollywood, CA 90038, Tel: 213-462-0806, TWX: 910-997-1921, FAX: 213-462-3721; FSC No.: 13222; Empl.: 17; *Sls. Mgr.:* Roy Talley

SOLATRON ENTERPRISES, 421 E. Beach Ave., Inglewood, CA 90302, Tel: 213-678-4981; Empl.: 20

SOLDER ABSORBING TECHNOLOGY (SAT), A Spirig Co., 144 Oakland St., Springfield, MA 01108, Tel: 800-628-8862, FAX: 413-788-0490; Empl.: 8; *Sls. Mgr.:* Joyce White

SOLDER REMOVAL, P.O. Box 1678, Covina, CA 91722, Tel: 818-967-3681, TWX: 910-584-1820; FSC No.: 34605; Empl.: 57

SOLID STATE, INC., 46 Farrand St., Bloomfield, NJ 07003, Tel: 201-429-8700, FAX: 201-429-8683; Empl.: 110; *Sls. Mgr.:* T. King

SOLID STATE DEVICES, 14830 Valley View Ave., La Mirada, CA 90638, Tel: 213-921-9660, FAX: 213-921-2396; FSC No.: 30043; Empl.: 200

SOLID STATE ELECTRONICS CORP., 18646 Parthenia St., Northridge, CA 91324, Tel: 818-993-8257, FAX: 818-993-8259; FSC No.: 11911; Empl.: 15

SOLID STATE RELAYS, 71 Regent, Oak Brook, IL 60521, Tel: 708-932-1660, FAX: 708-887-9522

SOLID STATE SYSTEMS, 1300 Shiloh Rd., N.W., Kennesaw, GA 30144, Tel: 404-423-2200, FAX: 404-423-2228; Empl.: 150; *Sls. Mgr.:* Max Biller; *Dist. Mgr.:* Max Biller

SOLID STATE TESTING, INC., 56 Middlesex Tpke., Burlington, MA 01803, Tel: 617-272-0972, FAX: 617-273-4896; Empl.: 150; *Sls. Mgr.:* James Roberts; *Dist. Mgr.:* James DiGiacomo

SOLITRON DEVICES, INC., Semiconductor Group, 1177 Blue Heron Blvd., Bldg. No.1, Riviera Beach, FL 33404-9978, Tel: 407-848-4311, 800-888-8763, FAX: 407-863-5946; FSC No.: 21845; Empl.: 800; *Sls. Mgr.:* Margaret McNutt; *Dist. Mgr.:* Abe Lincoln

SOLITRON/MICROWAVE, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk.,Bldg. No. 2, Riviera Bch., FL 33404-9978, Tel: 407-848-4311, 800-888-8763, FAX: 407-848-4311, Ext.116; FSC No.: 95077; Empl.: 200; *Sls. Mgr.:* Ray Sulzer; *Dist. Mgr.:* Deloris Martinez

SOLTEC CORP., 12977 Arroyo Street, San Fernando, CA 91340-1597, Tel: 818-365-0800, 800-423-2344, TELEX: 365-7089, FAX: 818-365-7839; Empl.: 80; *Sls. Mgr.:* Byron G. McIntire

SONICALL, INC., 3288 E. Willow Street, Signal Hill, CA 90806, Tel: 213-490-2143, FAX: 213-490-2145; *Sls. Mgr.:* Frank Handler **D•1061**

Local Sales Offices & Reps

CA	Mountain View, Francisco & Assocs.	415-962-1717
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Park Ridge, Synmark Sls., Inc.	708-390-9696
FL	Margate, EPM, Inc.	305-977-0331
MD	Severna, Jenco Sls.	301-544-8652
MI	Lathrup Vlg., R.C. Nordstrom	313-559-7373
MN	St. Louis Park, Elctrn. Innovators	612-922-2945
NY	E. Syracuse, Nycom, Inc.	315-437-8343
NY	Great Neck, F&F Metro Inc.	516-482-4080
NC	Raleigh, Micro Sls. Inc.	919-881-0007
OH	Centerville, EMA, Inc.	513-433-3147
OR	Hillsboro, TAC Assocs.	503-648-6110
PA	West Chester, TCA Inc.	215-692-6853
RI	Warwick, Ertronics, Inc.	401-732-3567
TX	Dallas, REM Comps. Corp.	214-234-1069

Local Distributors

MA	Sharon, ADCOUR	800-232-3557

SONICOR INSTRUMENT CORP., 100 Wartburg Ave., Copiague, NY 11726, Tel: 516-842-3344, TELEX: 649494, FAX: 516-842-3389; FSC No.: 31605; *Sls. Mgr.:* Arthur Liers; *Dist. Mgr.:* Arthur Liers

SONNENSCHEIN BATTERIES INC., See East Penn Manufacturing

SONOBOND ULTRASONICS INC., Inductotherm Industries, 887 S. Matlack St., West Chester, PA 19382, Tel: 215-696-4710, 800-323-1269, FAX: 215-692-0674; FSC No.: 15882; Empl.: 35; *Sls. Mgr.:* P. C. Krause

SONY COMPONENT PRODUCTS CO, Semiconductor Division, 108333 Valley View St., Cypress, CA 90630, Tel: 714-229-4197, FAX: 714-229-4271; Empl.: 120; *Sls. Mgr.:* Chuck Schouw, V.P.; *Dist. Mgr.:* Mark Marrietta

SOPHIA SYSTEMS & TECHNOLOGY, 777 California Avenue, Palo Alto, CA 94304, Tel: 415-493-6700, 800-824-9294, FAX: 415-493-4648

Sorensen

FAX: 312-792-2129

SORENSEN COMPANY, 5555 N. Elston Ave., Chicago, IL 60630, Tel: 312-775-0843, 1-800-525-2024; Empl.: 200; *Sls. Mgr.:* Ed Larrabee **D•2038-2046**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier, Inc.	205-536-1506,FAX:205-551-0558
AZ	Tempe, Trembly Assocs.	602-967-2058, FAX:602-967-2878
CA	Cupertino, Costar	408-446-9339, FAX:408-446-4885
CA	LaCanada Flintridge, Trimarco Synertek	818-952-7106,FAX:818-952-8859
CA	Los Altos, Jay Stone & Assocs.	415-948-4563, FAX:415-948-2714
CA	San Jose, Jay Stone & Assocs.	408-435-1010
CO	Wheat Ridge, Trembly Assocs.	303-421-8900, FAX:303-421-1020
FL	Melbourne, Currie, Peak & Frazier, Inc.	407-724-6795,FAX:407-951-9717
FL	Orlando, Currie, Peak & Frazier, Inc.	407-855-0843, FAX:407-851-1464
FL	Pensacola, Currie, Peak & Frazier, Inc.	904-994-0599
FL	Tampa, Currie, Peak & Frazier, Inc.	813-963-1076, FAX:813-968-2480
GA	Duluth, Currie, Peak & Frazier, Inc.	404-497-9404, FAX:404-497-9412
IL	Arlington Heights, Dytec/Midwest, Inc.	708-255-3200,FAX:708-394-0270

IL Palatine, Vine Sls., Inc. 708-934-5476, FAX:708-934-1290
IN Indianapolis, Dytec/Midwest, Inc. 317-297-5988, FAX:317-297-0355
KS Lenexa, Dytec/South, Inc. 913-888-0215, FAX:913-894-1039
KS Wichita, Dytec/South, Inc. 316-263-7090, FAX:316-262-3189
LA Lafayette, Kemp Instruments, Inc. 318-269-9452, FAX:318-269-1073
MD Baltimore, Sci-Rep, Inc. 410-321-1411
MA Westford, ICS Assocs. 508-692-3545, FAX:508-692-0227
MI Southfield, Comtel Instruments Co. 313-358-2505, FAX:313-352-2324
MN Edina, Dytec Instruments, Inc. 612-831-7169, FAX:612-831-5114
MO Maryland Heights, Dytec/South, Inc. 314-739-0665,FAX:314-739-1405
NV Las Vegas, Trembly Assocs. 702-739-9770, FAX:702-739-0331
NH Salem, Advanced Elctrn. Sls. 603-894-6414, FAX:603-894-7111
NJ Cherry Hill, Sci-Rep, Inc. 609-662-5222
NM Albuquerque, Trembly Assocs. 505-266-8616, FAX:505-255-0635
NY Elmont, Crane & Egert Corp. 516-872-0800, FAX:516-872-9074
NY Rochester, TAE-REP, Inc. 716-586-8710, FAX:716-586-8719
NY Whitney Point, TAE-REP, Inc. 607-692-3705, FAX:607-692-3709
NC Charlotte, Currie, Peak & Frazier, Inc. 704-846-1702
NC Greensboro, Currie, Peak & Frazier, Inc. 919-373-0380,FAX:919-273-6308
OH Cleveland, Comtel Instrument Co. 216-442-8080, FAX:216-442-6009
OH Columbus, Comtel Instruments Co. 614-876-8305, FAX:614-876-1445
OH Dayton, Comtel Instruments Co. 513-426-5310, FAX:513-426-1048
OK Tulsa, Kemp Instruments, Inc. 918-663-4501, FAX:918-665-7362
OR Beaverton, Northwest Test & Measurement, Inc. 503-645-9000,FAX:503-645-5186
PA Huntingdon Valley, Sci-Rep, Inc. 215-322-6500, FAX:215-322-9907
PA Pittsburgh, Comtel Instruments Co. 412-922-5720, FAX:412-922-8454
TN Smyrna, Currie, Peak & Frazier, Inc. 615-459-0743
TX Austin, Kemp Instruments, Inc. 512-263-3322, FAX:512-263-9700
TX Dallas, Kemp Instruments, Inc. 214-931-7100, FAX:214-250-2493
TX Houston, Kemp Instruments, Inc. 713-466-1465, FAX:713-466-7821
UT No. Salt Lake, Trembly Assocs. 801-295-4703, FAX:801-295-8676
VA Fairfax, Sci-Rep, Inc. 703-385-0660, FAX:703-359-7341
VA Newport News, Sci-Rep, Inc. 301-321-0200
VA Richmond, Sci-Rep, Inc. 804-282-0220
WA Redmond, Northwest Test & Measurement, Inc. 206-881-8857,206-867-0742
WI Brookfield, Dytec/Midwest, Inc. 414-792-0320, FAX:414-792-0311
Can Mississauga, Ont., Allan Crawford Assocs., Ltd. 416-890-2010,FAX:416-890-1959
Can No. Vancouver, BC, Allan Crawford Assocs., Ltd. 604-988-2195,FAX:604-980-5892
Can Ottawa, Ont., Allan Crawford Assocs., Ltd. 613-596-9300,FAX:613-596-3081
Can St. Laurent, Quebec, Allan Crawford Assocs., Ltd. 514-747-7878,FAX:514-747-5673

SoLiCo/mec

FAX: 1-800-331-1184

FAX: 203-527-6047

SORENSON LIGHTED CONTROLS, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092, 1-800-243-0240; Empl.: 100; *Sls. Mgr.:* Ted Ogorzalek ..... **B•1787**

Local Sales Offices & Reps

CA Tustin, Schoenbachler-Dobson Co. ... 714-544-1888
AZ Scottsdale, Advent Comp. Corp. 602-481-0044
CA San Rafael, Wright Assocs. 415-457-9940
CO Boulder, The Stratford Grp. 303-530-3194
FL Deerfield Bch., Jack Krutek & Assoc. .. 305-427-4202
IL Schiller Park, W.R.B. Inc. 708-678-7888
IN Fort Wayne, Menze Sls. 219-747-5616
KS Shawnee Mission, The Mertens Co. ... 913-432-9323
MD Gaithersburg, Naudian Assoc. Southern, Inc. 301-258-5040
MA Hopkinton, Berkshire Elctrns. 508-435-9356
MI Dearborn, Pitcher-Poulin, Inc. 313-582-5450
MN Minneapolis, Tech. Comps. Grp. 612-536-9512
MO Clayton, Mertens Co. 314-993-6600
NJ Burlington, VDE Elctrns. 609-387-9331
NJ Eatontown, Pacent Engrg. 201-389-1409
NY Great Neck, Pacent Eng. Co. 516-482-4678
NC Siler City, Crossroads Elctrns. 919-742-2372
WA Bothell, Evergreen Mktg. Grp. 206-485-8063
WI Mequon, WM Bolles Assoc., Inc. 414-241-3320

Local Distributors

AZ Phoenix, Minarik Elec. Co. 602-233-3000
CA Anaheim, Electro Comps. Dist. 213-628-2844
CA Covina, Selecta Switch 818-967-4123
CA Freemont, KEA Elctrns. 415-651-2600
CA Gardena, California Switch & Signal .. 213-538-9830
CA Glendale, Minarik Elec. Co. 818-507-6445
CA Irvin, J & J Elctrns. 714-455-0104
CA Los Angeles, Electric Switches 213-660-1310
CA San Diego, Minarik Elec. Co. 619-560-6632
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CA Tustin, Western Switches 714-259-8144
CA Van Nuys, Wes-Garde Comps. Grp. ... 818-786-3724
CO Commerce City, Minarik Elec. Co. 303-289-5800
CT Hartford, Wes-Garde Comp. Grp. 203-527-7705
FL Lakeland, Wes-Garde Comp. Grp. 813-644-7564
GA Tucker, CID, Inc. 404-491-3143
IL Carol Stream, Wes-Garde Comp. Grp. 708-653-1460
KS Overland Pk., Wes-Garde Comps. 913-262-2718
MA Canton, Xenell 617-828-2948
MI St. Clair Shores, Specialities Mfg. 313-771-2700
MN Minneapolis, Carl Bergquist 612-835-2322
MO St. Louis, Wes-Garde Comp. Grp. 314-567-7776
NH Nashua, Wes-Garde Comp. Grp. 603-880-1971
NJ Mt. Laurel, Wes-Garde Comp. Grp. 609-778-8190
NY Woodside, Switches Unltd. 718-478-5000
OH Westerville, Wes-Garde Comps. Grp. 614-885-0319
OR Portland, Minarik Elec. 503-253-3402
SC Columbia, Dixie Elctrns. 803-779-5332
TX Dallas, Wes-Garde Comp. Grp. 214-357-1768
TX San Antonio, Minarik Elec. 512-822-7097
WI Grafton, Lake-View Elctrns. 414-377-8250
WI Milwaukee, Progressive Image 414-321-4722
Can Edmonton, Deskin Sls. 403-466-2106
Can Montreal, Deskin Sls. 514-331-2860
Can Ottawa, Deskin Sls. 613-228-1201
Can Richmond, Vancouver, Deskin Sls. 604-324-8343
Can Toronto, Deskin Sls. 416-475-1412
Can Winnipeg, Deskin Sls. 403-466-2106

SOR, INC., 14685 W. 105th St., Lenexa, KS 66215, Tel: 913-888-2630, TELEX: 4992783, FAX: 913-888-0767; Empl.: 200; *Sls. Mgr.:* Steve Speiman

SOSHIN ELECTRIC CO., LTD., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, Japan, Tel: (03) 3775-9111, TELEX: 246-6377, FAX: (03) 3775-7092; Empl.: 1150; *Sls. Mgr.:* Z. Uehara, Overseas Dept. ..... **A•1655-1657**

Local Sales Offices & Reps

CA Chatsworth, Arco Elctrns. 818-882-8707

SOUNDCOAT CO., INC., 1 Burt Dr., Deer Park, NY 11729-5701, Tel: 516-242-2200, TELEX: 12-5514, FAX: 516-242-2246; Empl.: 100; *Sls. Mgr.:* Mr. Carl Wolaver

SOURIAU, INC., 28309 N. Avenue Crocker, Valencia, CA 91355, Tel: 805-257-4830, TELEX: 4720328, TWX: 910-336-1553, FAX: 805-257-2383; Empl.: 79; *Sls. Mgr.:* Keith L. Olsen

SOUTH AMERICAN DEVELOPMENT CORP., 29 Noxon Rd., Poughkeepsie, NY 12590, Tel: 914-452-1305, FAX: 914-452-2526; Empl.: 80; *Sls. Mgr.:* C. Healy

SOUTHCO, INC., 210 N. Brinton Lake Rd., Concordville, PA 19331, Tel: 215-459-4000, FAX: 215-459-4012; *Sls. Mgr.:* R. W. Dougherty

SOUTHERN COMPUTER CORP., 141 W. Wieuca Rd., Ste. 300-B, Atlanta, GA 30342, Tel: 404-252-3340, FAX: 404-252-8929; *Sls. Mgr.:* Ray Manley

SOUTHERN ELECTRONICS, F-Dyne, 726 So. Flower St., Burbank, CA 91502, Tel: 818-845-2458, FAX: 818-845-6348; Empl.: 100; *Sls. Mgr.:* Wayne Melvin

SOUTHTRONICS, INC., 1265 Kennestone Circle, Marietta, GA 30066-6029, Tel: 404-429-1000, FAX: 404-424-2000

SOUTHWESTERN NAMEPLATE & MFG. CO., INC., P.O. Box 35, Fourth St., Anna, TX 75003, Tel: 214-231-6663, 214-924-3289, 1-800-331-6600, FAX: 214-924-3090; Empl.: 14

SPACE ELECTRONICS, INC., 81 Fuller Way, Berlin, CT 06037, Tel: 203-829-0001, FAX: 203-829-0005; Empl.: 26; *Sls. Mgr.:* Richard Boynton

SPECIAL ELECTRIC CO., INC., 3628 W. Pierce St., Milwaukee, WI 53215, Tel: 414-383-6370, TELEX: 910-262-3106, FAX: 414-383-6725; Empl.: 40; *Sls. Mgr.:* F. James Heider

SPECIALIZED PRODUCTS COMPANY, 3131 Premier Dr., Irving, TX 75063, Tel: 214-550-1923, TELEX: 732764, FAX: 214-550-1386; Empl.: 39; *Sls. Mgr.:* Paul Jones

SPECIALTY CABLE CORPORATION, P.O. Box 50, Wallingford, CT 06492, Tel: 800-456-SPEC, FAX: 203-269-5293; Empl.: 72

SPECIALTY CONNECTOR CO., 2100 Earlywood Dr., Franklin, IN 46131, Tel: 317-738-2800, TELEX: 217084, FAX: 317-738-2858; *Sls. Mgr.:* Thomas L. Lynn; *Dist. Mgr.:* 234

SPECIALITY ELECTRONICS, INC., 19200 Asheville Hwy., Landrum, SC 29356, Tel: 803-457-3824, FAX: 803-457-2535; Empl.: 30; *Sls. Mgr.:* John Galli ..... **C•1526-1532**

SPECO DIV., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757, Tel: 516-957-8700, 800-645-5516, TELEX: 96-7754, FAX: 516-957-9142; FSC No.: 516-957-9142; Empl.: 29; *Sls. Mgr.:* Eric Forman; *Dist. Mgr.:* Mel Hulkower

SPECTRACOM CORPORATION, 101 Despatch Drive, East Rochester, NY 14445-1484, Tel: 716-381-4827, TELEX: 9103509587, FAX: 716-381-4998; *Sls. Mgr.:* Edward F. O'Connor

SPECTRAGRAPHICS CORP., 9125 Rehco Rd., San Diego, CA 92121, Tel: 619-450-0611, TELEX: 295439; Empl.: 250; *Sls. Mgr.:* Ray Barger, VP Sls.; *Dist. Mgr.:* Elliot Shev

SPECTRAL INNOVATIONS, 4633 Old Ironsides Dr., Ste. 401, Santa Clara, CA 95054-1807, Tel: 408-727-1314, FAX: 408-727-1423

Local Sales Offices & Reps

OH Columbus, ACQsys Solutions 614-486-6401

SPECTRA LUX CORP., 11825 120th Ave. NE, Kirkland, WA 98034, Tel: 206-747-0560, FAX: 206-821-3193; FSC No.: 51896; Empl.: 120; *Sls. Mgr.:* Woody Hertzog

SPECTRAN CORP., 50 Hall Road, Sturbridge, MA 01566, Tel: 508-347-2261, FAX: 508-347-2747; FSC No.: 6V569; Empl.: 80

SPECTRA-PHYSICS LASERS INC., 1330 Terra Bella Ave.,P.O. Box 7013, Mountain View, CA 94039-7013, Tel: 415-961-2550, 800-227-8054, TELEX: 348-488, FAX: 415-969-4084; *Sls. Mgr.:* Bob Turcotte

SPECTRASCAN, INC., 1110A Elkton Drive, Colorado Springs, CO 80907, Tel: 719-599-9254, FAX: 719-599-0815; Empl.: 15; *Sls. Mgr.:* Jim Stathis

SPECTRA SONICS, 3750 Airport Rd., Ogden, UT 84405, Tel: 801-392-7531; Empl.: 35

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FAX: 714-923-6765

SPECTROL ELECTRONICS CORP., 4051 Greystone Dr., Ontario, CA 91761, Tel: 714-923-3313; FSC No.: 02111; Empl.: 200; *Sls. Mgr.:* Joseph L. Lucia; *Dist. Mgr.:* Gene Stauffer, Mgr. OEM Prods. ..... **A•2066-2068**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-722-0440
AZ	Phoenix, Deskin Sls.	602-268-2121
AZ	Scottsdale, JK Assocs.	602-990-8804
CA	San Diego, Hadden & Assoc.	619-565-9444
CA	San Jose, Silicon Valley	408-432-1967
CO	Denver, West, Inc.	303-477-8180
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, DHR Mktg.	407-331-1199
IL	Naperville, Lancastle Sls.	708-717-9494
IA	Cedar Rapids, Lowell-Kangas	319-362-9290
KS	Shawnee Mission, Lowell-Kangas	913-631-3515
GA	Duluth, DHR Mktg.	404-564-0529
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, Lowell-Kangas	314-821-4050
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NM	Scottsdale, AZ, J.K. Assocs.	602-990-8804
NY	Commack, E.R.A.	516-543-0510
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, DHR Mktg.	919-829-2510
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Luebbe Sls.	513-294-0426
OR	Beaverton, Westmark Elctrn., Inc.	503-641-8780
PA	Pittsburgh, Luebbe Sls.	412-364-0490
TX	Richardson, Pro Comp. Sls. Co.	214-669-1500
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Lancastle, Lancastle	414-796-2723

Local Distributors

AL	Mobile, Newark Elctrns.	205-471-6500
AZ	Phoenix, Newark Elctrs.	602-864-9905
AZ	Phoenix, Sterling Elctrns.	602-268-2121
AZ	Tempe, Shelley-Ragon	602-894-2058
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Fountain Valley, Component Center	714-979-0433
CA	Orange, Newark Elctrs.	714-634-8224
CA	San Diego, Shelley/Ragon	619-453-7133
CA	San Jose, Shelley/Ragon	408-432-0600
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Shelley/Ragon	303-762-0670
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Wallingford, Cronin Elctrns.	203-265-3134
GA	Norcross, Newark Elctrns.	404-448-1300
IL	Bensenville, Voyager	312-860-1300
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Ft. Wayne, Newark Elctrns.	219-484-0766
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Lenexa, Sterling Elctrns.	913-492-5406
MD	Columbia, Newark Elctrns.	301-964-4482
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Waltham, Newark Elctrns.	617-894-8050
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Farmington Hills, Advent Elctrns.	313-967-0600
MI	Oakpark, Newark Elctrns.	313-967-0957
MN	Bloomington, Sterling Elctrns.	612-831-2666
MN	Fridley, Voyager	612-571-7766
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	St. Paul, Shelley/Ragon	612-642-2828
MN	St.Paul, Gopher Elctrns.	612-483-3322
MO	Independence, Newark Elctrns.	816-478-0561
MO	Maryland Heights, Chelsea Inds.	314-997-7709
NJ	South Plainfield, Sterling Elctrns.	201-769-7000
NJ	Union, Newark Elctrns	201-851-2290
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Buffalo, Summit Distrs.	716-887-2800
NC	Charlotte, Newark Elctrns.	704-535-5650
OH	Akron, Akron Elctrns. Supp.	216-762-8818
OH	Cincinnati, Newark Elctrns.	513-722-8181
OH	Columbus, Electronics Mktg.	614-299-4161
OK	Tulsa, Altair	918-252-5781
OR	Portland, Radar Elec.	503-232-3401
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	Philadelphia, Shap Elctrns.	215-969-3300
PA	Pittsburg, Newark Elctrns.	412-367-2790
SC	Columbia, Dixie Elctrns.	803-779-5332
TN	Knoxville, Newark Elctrns.	615-588-6493
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-623-6600
TX	Mansfield, Mouser Elctrns.	817-483-0165
TX	Richardson, Altair	214-231-5166
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Newark Elctrns.	206-641-9800
WA	Redmond, Shelley/Ragon	206-883-2220
WA	Seattle, Radar Electrns.	206-282-2511
WV	Charleston, Newark Elctrns.	304-744-9022
WI	Milwaukee, Newark Elctrns.	414-453-9100

SPECTRON GLASS & ELECTRONICS, INC., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788, Tel: 516-582-5600, TELEX: 968296; FSC No.: 57349; Empl.: 70; *Sls. Mgr.:* Bob Marshall

SPECTRONICS CORP., 956 Brush Hollow Rd., Westbury, NY 11590, Tel: 516-333-4840/1-800-274-8888, TWX: 510-222-5877, FAX: 516-333-4859; Empl.: 125; *Sls. Mgr.:* Gary Naftaly

SPECTRUM CONTROL, INC., 2185 W. 8th St., Erie, PA 16505, Tel: 814-455-0966, FAX: 814-455-2550; FSC No.: 33095;5733; Empl.: 450; *Sls. Mgr.:* D. Reynolds; *Dist. Mgr.:* D. Zaday

SPECTRUM CORP., 10048 Easthaven, Houston, TX 77075, Tel: 713-944-6200, 1-800-392-5050(Sls), FAX: 713-944-1290; Empl.: 35; *Sls. Mgr.:* Gary W. Liddell; *Dist. Mgr.:* Jim B. Bishop

SPECTRUM DEVICES, 13706 Larkway Dr., Sugar Land, TX 77478-2420, Tel: 713-242-6417, FAX: 713-242-6415; Empl.: 7; *Sls. Mgr.:* Sajid Rafique

SPECTRUM SIGNAL PROC., 250 H st., P.O. Box 8110-25, Blaine, WA 98230, Tel: 1-800-663-8986 (US), 604-438-7266 (Can.), FAX: 604-438-3046; Empl.: 25; *Sls. Mgr.:* Rod Jensen; *Dist. Mgr.:* Al Rana

Local Distributors

CA	Mountainview, Thorson West	415-964-9300
CA	Riverside, Innovation Prods.	714-682-8570

SPECTRUM TECHNOLOGY, INC., DATUM, Incorporated, 749 Ward Drive, Santa Barbara, CA 93111, Tel: 805-964-7791, TWX: 910-334-1163, FAX: 805-683-3481; FSC No.: 32464; Empl.: 90; *Sls. Mgr.:* Manny Fernandez, Jr. ..... **A•1462-1467**

Local Sales Offices & Reps

AZ	Phoenix, Sedco Sls.	602-461-9069
CA	Los Angeles, The Thorson Co.	213-595-0361
CA	San Diego, Thorson Co.	619-292-8525
CA	San Francisco, Frequency Control	408-252-5250
HI	Santa Barbara, Spectrum Technlg.	805-964-7791
CA	Santa Barbara, Thorson Co.	805-964-8751
CO	Englewood, Advanced Technology Mktg.	303-789-2606
FL	Ocala, Felcomp	904-288-2365
FL	Orlando, Felcomp	407-282-3554
IL	Elgin, R.K. Elctrns.	312-695-8552
MA	Needham Hgts., Todino Engrg. Sls.	617-444-7925
PA	Glenside, Kobert Assocs.	215-887-2310
TX	Dallas, Caton Sls.	214-243-4716
TX	Dallas, Caton Sls.	214-350-1612

Local Distributors

MD	Kensington, Koebert Assocs.	301-493-8924

SPEEDY CIRCUITS, PJC Technologies, Inc., 5332 Commerical Dr., Huntington Bch., CA 92649, Tel: 714-898-4901, FAX: 714-891-0607; Empl.: 36; *Sls. Mgr.:* Jon P. Herkins

Spellman
High Voltage Electronics Corp

FAX: 516-349-8699

SPELLMAN HIGH VOLTAGE ELCTRNS. CORP., 7 Fairchild Ave., Plainview, NY 11803, Tel: 516-349-8686, TWX: 510-221-2155; Empl.: 150; *Sls. Mgr.:* Eric Marko; *Dist. Mgr.:* Eric Marko ..... **D•2047-2055**

Local Sales Offices & Reps

WA	Kirkland, Syntek	206-488-0394
Can	British Columbia, Broman Engrg.	604-254-6311

SPEMCO SWITCHES, 23425 Harper, Box 386, St. Clair Shores, MI 48080, Tel: 800-482-2828, FAX: 313-771-3491; Empl.: 12; *Sls. Mgr.:* Andrew Richardson

SPERRY, A. W. INSTRUMENTS, P.O. Box 9300, Smithtown, NY 11787, Tel: 516-231-7050, 800-645-5398, TELEX: 645104, FAX: 516-434-3128; Empl.: 50; *Sls. Mgr.:* Dennis W. Carroll

SPIRA MANUFACTURING CORP., 12721 Saticoy Street South, North Hollywood, CA 91605, Tel: 818-764-8222, FAX: 818-764-9880; FSC No.: 60050; Empl.: 18; *Sls. Mgr.:* Lisa A Panzich

SPIRICON, INC., 2600 North Main, Logan, UT 84321, Tel: 801-753-3729, TELEX: 296-465 SPIR UR, FAX: 801-735-5231; Empl.: 15; *Sls. Mgr.:* Ed Danahy

SPRAGUE ELECTRIC COMPANY, Sprague Technologies, Inc., 4 Stamford Forum P.O. Box 120007, Stamford, CT 06901-0007, Tel: 203-964-8600, FAX: 203-964-8668; Empl.: 5,500

SPRAGUE ELECTRIC COMPANY, Distribution Division, 41 Hampden Rd. P.O. Box 9102, Mansfield, MA 02048-9102, Tel: 508-339-8900, FAX: 508-339-5063 ..... **A•1138**

SPRAGUE ELECTRIC COMPANY, Solid Tantalum Capacitors, Lower Main St., P.O. Box 231, Sanford, ME 04073-0231, Tel: 207-324-4140, FAX: 207-324-7223

SPRAGUE ELECTRIC COMPANY, Aluminum Capacitors, 9800 Kincey Ave., Suite 100, Huntersville, NC 28078, Tel: 704-875-8070, FAX: 704-875-8541

SPRAGUE ELECTRIC COMPANY, Wet & Foil Tantalum Capacitors, MIL Filters, 1600 Curran Hwy., North Adams, MA 01247-3987, Tel: 413-664-4431, FAX: 413-663-5079

SPRAGUE ELECTRIC COMPANY, Film Capacitors, 1221 W. Hwy 17/92, Longwood, FL 32750, Tel: 407-695-6562, FAX: 407-695-6889

SPRAGUE ELECTRIC COMPANY, Thick Film Networks and Hybrids Div., 267 Lowell Rd., Hudson, NH 03051, Tel: 603-881-7200, 603-883-9774 (Mktg), FAX: 603-880-1910

SPRAGUE FIL-MAG, 4787 Cardin Street, San Diego, CA 92111-1416, Tel: 619-569-6577, FAX: 619-569-6073; Empl.: 500; *Sls. Mgr.:* Linda Sorrentino

SPRAGUE GOODMAN

FAX: 516-746-1396

SPRAGUE-GOODMAN ELCTRNS., INC., 134 Fulton Ave., Garden City Pk., NY 11040, Tel: 516-746-1385, TELEX: 14-4533; FSC No.: 52769; Empl.: 80; *Sls. Mgr.:* Martin D. Markson ..... **A•1140-1141**

Local Sales Offices & Reps

AL	Huntsville, Electramark Inc.	205-830-4400
AZ	Mesa, System Sls. of Arizona	602-464-9989
CA	Cupertino, Dura Elctrn. Sls.	408-255-2084
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
CO	Denver, West Inc.	303-477-8180
CT	Milford, KSA Connecticut	203-524-5849
FL	Orlando, TMA	407-857-3760
GA	Norcross, Electramark Inc.	404-446-7915
ID	Meridian, WEST Inc.	208-888-6227
IL	Chicago, B.N.I. Elctrns.	312-775-1717
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665
IA	Marion, M.S.B. Assocs.	319-377-6261
KS	Shawnee Mission, M.S.B. Assocs.	913-432-2131
MD	Monkton, Imagitron Sls.	301-374-5600
MA	Sudbury, KSA of New England	508-443-5881
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Eden Prairie, Electro Mark Inc.	612-944-5850
MO	St. Charles, M.S.B. Assocs.	314-946-5577
NJ	Monkton, Imagitron Sls. Co., Inc.	800-638-3592
NM	Albuquerque, SSA of New Mexico	505-889-2901
NY	Melville, R F Elctrns. Sls. Co. Inc.	516-420-8890
NY	Utica, Upstate Engrg. Sls.	315-797-6721
NC	Raleigh, Micro Sls. Inc.	919-881-0007
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OR	Portland, Harry Levinson Co.	503-690-1312
PA	Maple Glen, Imagitron/Pennsylvania	800-638-3592
TX	Seagoville, Delta Comps.	214-287-6333
UT	Centerville, West/Utah	801-292-8787
WA	Seattle, Harry Levinson Co.	206-382-1300
PR	Rio Piedras, Elctrn. Sls. Assocs.	809-762-6459
Can	Toronto, Ont., Norgay Entprs.	416-259-9663

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Garden Grove, Natl. Elctrns.	714-892-7749
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Milpitas, TTI, Inc.	408-946-5577
CA	Mission Hills, TTI, Inc.	818-892-4669
CA	Mission Hills, TTI, Inc.	818-891-8850
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Projections Unltd.	619-453-7900

CA San Diego, TTI, Inc. 619-748-2025
CA Santa Ana, TTI, Inc. 714-641-9393
CA Tustin, Projections Unltd. 714-544-2700
CO Denver, TTI, Inc. 303-429-6806
CT Wallingford, TTI, Inc. 203-284-7474
FL Ft. Lauderdale, Bros. Elctrns. of FL 305-561-6700
FL Melbourne, New Yorker Elctrns. 407-727-0955
FL Orlando, TTI, Inc. 407-859-1000
GA Norcross, TTI, Inc. 404-662-0911
MD Columbia, TTI, Inc. 301-995-1331
MD Savage, Pyttronic Inds. 301-953-9650
MA Wilmington, TTI, Inc. 508-658-4700
MN Eden Prairie, TTI, Inc. 612-944-5080
NJ Fairfield, Tri Start Elctrns. 201-227-3500
NJ Mt. Laurel, TTI, Inc. 609-234-6400
NY Mamaroneck, New Yorker Elctrns. 914-698-7600
NY Ronkonkoma, Tri-Start Elctrns. 516-737-2200
NY Ronkonkoma, TTI, Inc. 516-737-2000
NC Charlotte, TTI, Inc. 704-522-0277
OH Columbus, TTI, Inc. 614-848-5770
PA Harrisburg, Adtech 717-561-9905
PA Montgomeryville, Pyttronic Inds. 215-855-0925
TX Ft. Worth, TTI, Inc. 817-595-3100
TX Garland, J & S Elctrns. Inc. 214-487-8808
WA Redmond, TTI, Inc. 206-882-0291
WA Seattle, Kam Elctrns. 206-382-1300
Can Toronto, Ont., Norgay Entprs. Ltd. 416-234-8966

S-PRODUCTS INC., 35 Kings Highway East, Fairfield, CT 06430, Tel: 203-331-9546, FAX: 203-335-2723; Empl.: 4

SPS SOFTWARE PRODUCTS & SERVICES, INC., 14 E. 38th Street, 14th Fl, New York, NY 10016, Tel: 212-686-3790, TELEX: 852616, FAX: 212-481-7464; *Sls. Mgr.:* Peter Voletsky

SQUARE D CO., Executive Plaza, Palatine, IL 60067, Tel: 708-397-2600, FAX: 708-397-8814; Empl.: 19,000; *Sls. Mgr.:* J. Glore, VP Sls.; *Dist. Mgr.:* E.P. Mazzetta

SQUARE D. COMPANY, Control Products, Hwy 64 East, Knightdale, NC 27545, Tel: 919-266-3671, FAX: 919-266-8393; Empl.: 900

SQUARE D CO. POWER PROTECTION SYSTEMS, 9192 Topaz Way, San Diego, CA 92123-1165, Tel: 619-279-0831, TWX: 910-335-1556, FAX: 619-569-8427; FSC No.: 06049; Empl.: 200; *Sls. Mgr.:* Dan Mathews, Dir. of Sls.; *Dist. Mgr.:* Dan Mathews, Dir. of Sls.

Please refer to Topaz' sales representatives for distributor information.

SQUARE D. DATA ENTRY PRODUCTS FORMERLY K.B. DENVER, See MGR Industries

SR ENGINEERING, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643, Tel: 714-554-4200, TELEX: 364412INTR-871, FAX: 714-265-0856; FSC No.: 21441; *Sls. Mgr.:* Mel Hitchcock

SSAC INCORPORATED, P.O. Box 1000, Baldwinsville, NY 13027, Tel: 315-638-1300, FAX: 315-638-0333; FSC No.: 16-0985719; Empl.: 250; *Sls. Mgr.:* D. Carroll

S SQUARED ELECTRONICS, formerly ComTech Systems, Inc., 10 Halyard Rd., Valley Stream, NY 11581-2813, Tel: 516-791-1175; Empl.: 10

STACKBIN CORP., Albion Road, P.O. Box 397, Lincoln, RI 02865, Tel: 401-333-1600, 800-333-1603, FAX: 401-333-1952; Empl.: 50; *Sls. Mgr.:* Valerie Baxter; *Dist. Mgr.:* Timothy J. O'Leary

STACKPOLE CARBON COMPANY, 201 Stackpole St, St. Marys, PA 15857, Tel: 814-781-1234, FAX: 814-781-8570; *Sls. Mgr.:* R.A. Williams

STACKPOLE COMPONENTS CO., See Ark-les Special Products Grp., Div. of Stackpole Switches

STACKPOLE, MAGNET DIV., 700 Elk Ave., Kane, PA 16735, Tel: 814-837-0272, FAX: 814-837-0277; *Sls. Mgr.:* G.A. Olson, Mgr. Sls. & Mktg.

STACO, INC., See Staco Transpower

STACO ENERGY PRODUCTS CO.

FAX: 513-253-1723

STACO ENERGY PRODUCTS CO., 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191, TELEX: 288-032; FSC No.: 83008; Empl.: 146; *Sls. Mgr.:* Robert Simpson ..... **A•2412-2413**

Local Sales Offices & Reps

CA Laguna Hills, South Rep 714-951-1084
CO Wheat Ridge, Cluff 303-425-6604
FL Maitland, H & H 305-831-2474
GA Atlanta, Millar 404-634-3350
IL Chicago, Saffro 312-677-9720
IN Indianapolis, EMCI 317-921-3452
MA Lexington, Hathaway 617-861-1010
MI Detroit, Shalco 313-547-4771
MN St. Paul, Kencotronics 612-645-7717
MO St. Louis, Dowell 314-849-4234
NM Albuquerque, Carlberg 505-836-1448
NY Northport, LSC 516-266-5020
NC Raleigh, Millar 919-828-8840
OH Cleveland, Rockford 216-725-3705
OR Hillsboro, Turn-A-Round 503-640-4661
PA Philadelphia, ECSC 215-825-8610
TX Dallas, B & R 214-985-0028
Can Scarborough, Decade 416-439-9921

Local Distributors

AL Birmingham, JLS 205-322-2486
CO Arvada, Denver Beta Wintronics 303-431-7161
CO San Francisco, Stevens Engrg. 415-588-9200
CT Wallingford, Sager Elctrns. 203-265-4600
FL Miami, Elctrn. Equip. 305-871-3500
GA Atlanta, Cleveland Elec. 404-696-4550
HI Honolulu, Victor Kim 808-841-6266
IL Chicago, Newark Elctrns. 312-784-5100
IN Indianapolis, Bell Elctrns. 317-875-8200
KY Louisville, Peerless 502-637-7674
LA Lafayette, Ralph's 318-234-4507
MA Somerville, Electro Sls. 617-666-0500
MI Madison Hgts., Galco 313-542-9090
MN Minneapolis, Elctrn. Center 612-378-2442
MS Jackson, Ellington Elctrns. 601-355-0561
MO St. Louis, Chelsea Elctrns. 314-997-7709
NJ Kenilworth, Federated Purchaser 201-272-0505
NY Hauppauge, Broadline Elctrns. 516-231-4100
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Dayton, Stotts Friedman Elctrns. 513-298-5555
PA Drexel Hill, Kass Elctrns. 215-449-2300
SC Charleston, Wholesale Elctrns. 803-722-2634
TN Knoxville, Indl. Elctrns. 615-573-7135
TX Ft. Worth, Allied Elctrns. 817-336-5401
VA Charlottesville, VA Elctrns. 804-296-4184
WA Seattle, Radar Elec. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Scarborough, Decade Elctrns. 416-439-9921

STACOSWITCH, 1139 Baker St., Costa Mesa, CA 92626, Tel: 714-549-3041, TWX: 910-595-1507, FAX: 714-549-0930; FSC No.: 12522;Multiple; Empl.: 115; *Sls. Mgr.:* D. Sugg

STACO TRANSPOWER, Components Corp. of America, 610 W. 6th St., Mt. Carmel, IL 62863, Tel: 618-262-5555, FAX: 618-263-3150; FSC No.: 83008; Empl.: 75; *Sls. Mgr.:* Bill Chidester

STAFFALL INC., 1468 Elmwood Ave., Cranston, RI 02910, Tel: 401-461-5554, TWX: 710-381-6964; Empl.: 25

STAG MICROSYSTEMS INC., 1600 Wyatt Drive, Santa Clara, CA 95054, Tel: 408-988-1118, 1-800-227-8836, FAX: 408-988-1232; Empl.: 150; *Sls. Mgr.:* Phil Holden; *Dist. Mgr.:* Phil Holden

STAINLESS, INC., 210 S. 3rd St., N. Wales, PA 19454, Tel: 215-699-4871, TWX: 510-661-8097, FAX: 215-699-9597; Empl.: 80; *Sls. Mgr.:* Owen F. Ulmer

STANCOR

FAX: 219-722-5189

STANCOR, White-Rodgers, 131 Godfrey St, Logansport, IN 46947, Tel: 219-722-2244; FSC No.: 80089; Empl.: 400; *Sls. Mgr.:* Steve Fisher; *Dist. Mgr.:* Stephanie Starbuck, Prod. Mgr. ..... **A•2414-2419; B•1584-1587**

Local Sales Offices & Reps

AL Athens, E.M.F. 205-233-2947
AZ Contact Factory 219-722-2244
CA Campbell, Shur Sls. 408-374-5577
CA Irvine, Groh Assocs. 714-837-9871
CO Denver, West, Inc. 303-477-8180
CT Waterbury, Cannon Assocs. 203-597-0240
FL Tampa, Uni-Rep 813-831-6083
GA Atlanta, E.M.F. 404-944-9216
IL Chicago, Joel Wasserman Assocs. 708-256-3566
IN Ft. Wayne, K & D Sls. 219-436-2221
KS Shawnee, Lowell Kangas 913-631-3515
MD Sykesville, D.J.C. 301-795-7020
MA Chelmsford, Cannon Assocs., Inc. 508-649-3809
MN Bloomington, Murnco 612-854-4161
MO St. Louis, Lowell Kangas 314-821-4050
NM Contact Factory 219-722-2244
NY Rochester, A.J. Electromarketing 716-426-3598
NC Raleigh, E.M.F. 919-867-6221
OH Beachwood, Elctrn. SalesMasters 216-831-9555
OR Portland, Temper Tech. 503-292-8201
PA Philadelphia, D.J.C. 215-334-4533
RI Warwick, Cannon Assocs. 401-732-1570
TX Richardson, Pro-Comp Sls. 214-669-1500
VT Isle La Motte, Cannon Assocs. 802-928-3041

STANDARD CONDENSER CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 708-675-3133, FAX: 708-675-3709; FSC No.: 97419; *Sls. Mgr.:* B. P. McLean

STANDARD CRYSTAL CORPORATION, 9940 E. Baldwin Pl., El Monte, CA 91731, Tel: 818-443-2121, TELEX: 4998755, FAX: 818-443-9049; FSC No.: 30149; *Sls. Mgr.:* Tom Valasek/Gus Jimenez; *Dist. Mgr.:* Betty Longwell ..... **A•1469**

Local Sales Offices & Reps

AZ Phoenix, CPS Assocs., Inc. 602-246-1097
AZ Scottsdale, Az Tech-CPS Inc. 602-991-6300
CA Milpitas, Ward Elctrn. Packaging Sls. .. 408-945-0420
GA Norcross, Spar Tech Assocs. 404-446-7300
IL Berkeley, ESA Tech. Mktg. 312-544-0120
IL Northbrook, Allied Comp. Reps., Inc. .. 312-498-6658
MI Grand Rapids, R.P. Urban & Assocs. .. 616-245-0511
MA Sherborn, Barlow Engrg. Assoc., Inc. .. 508-655-6751
TX Dallas, Allied Comps., Inc. 214-238-0408
UT Salt Lake City, Sage Sls. 801-467-5451
WA Bellevue, Caruso and Company 206-455-8811

STANDARD ENVIRONMENTAL SYSTEMS, INC., 383 Minnisink Rd., Totowa, NJ 07512, Tel: 201-256-2200, FAX: 201-256-2820; Empl.: 42

STANDARD GRIGSBY, INC., FLINT INDUSTRIES, See OakGrigsby, Inc.

STANDARD GRIGSBY INC., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, West Germany, Tel: 0911-65521, TELEX: 622351, FAX: 0911/6552-239

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STANDARD INSERT CO., Penn Engrg. & Mfg. Corp., 419 Sargon Way, Horsham, PA 19044, Tel: 215-956-0350, FAX: 215-956-0366; Empl.: 7; *Sls. Mgr.:* Christopher O'Connell

STANDARD MAGNETIC CORP., 3000 E. Coronado St., Anaheim, CA 92806, Tel: 714-630-9751, FAX: 714-630-1601; Empl.: 15; *Sls. Mgr.:* Satish Jain

STANDARD MICROSYSTEMS, 35 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-3100, FAX: 516-273-3123; FSC No.: 53848; Empl.: 500

STANDARD REFERENCE LABS, INC., See Koep Precision Standards, Inc.

STANDARD WIRE & CABLE CO., 1959 E. Cashdan St., Rancho Dominguez, CA 90220, Tel: 213-609-1811, 800-326-0006, TELEX: 65-3423, ESYLNK: 62931655, FAX: 213-609-1862; Empl.: 50; *Sls. Mgr.:* Dan Varvais; *Dist. Mgr.:* Jerry Gaither

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STANDEX ELECTRONICS, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, Tel: 513-871-3777; FSC No.: 56402; Empl.: 450; *Sls. Mgr.:* Charles C. Johnson, VP Sls. .... **A•1262-1267; B•1782-1783**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-464-0792
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Cupertino, Codella Mktg. Grp., Inc.	408-257-2561
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
CO	Longmont, Butler Tech. Sls.	303-651-7703
FL	Boca Raton, R. W. Mitscher Co.	305-368-3841
FL	Tequesta, R.W. Mitscher Co.	407-575-4485
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Granger, Gregory Sls. Co.	219-272-9626
MD	Edina, Jay Borman Sls. Co.	612-922-5525
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MA	Sudbury, KSA of New England	617-443-5881
MI	Detroit, R.P. Urban & Assoc.	313-535-2355
MI	Grand Rapids, R.P. Urban & Assoc.	616-245-0511
MO	Kansas City, EPI Inc.	816-523-8911
MO	St. Louis, EPI Inc.	314-962-1411
NJ	Woodbridge, Jade Mktg.	201-750-2998
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	Red Hook, R. W. Mitscher Co., Inc.	914-758-8375
NY	Rochester, R. W. Mitscher Co., Inc.	716-227-0839
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Portland, Components Technlg.	503-292-1518
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Houston, B & R Elctrn. Sls. Corp.	713-682-5448
TX	Plano, B & R Elctrn. Sls. Corp.	214-985-0028
VA	Richmond, R. W. Mitscher Co., Inc.	804-320-7350
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940

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STANDISH INDUSTRIES, Hamlin LCD Div., W7514 Hwy V, Lake Mills, WI 53551, Tel: 414-648-1000, FAX: 414-648-1001; Empl.: 250; *Sls. Mgr.:* Richard D. Barbieri ..... **B•1125**

Local Sales Offices & Reps

AZ	Chandler, Lindberg Co.	602-786-9115
CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Boulder, R-G Entprs.	303-447-9211
CT	Branford, Coakley, Boyd & Abbett, Inc.	800-225-8402,203-481-2218
FL	Palm Harbor, Bob Dean, Inc.	813-789-1233
GA	Atlanta, Wallace Elctrn. Sls.	404-634-3159
IL	Skokie, Indl. Rep.	708-967-8430
IN	Carmel, TMC	317-844-8462
IN	Ft. Wayne, TMC	219-432-5553
KY	Louisville, TMC	502-893-1377
MD	Gaithersburg, Naudain Assocs. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, R-J, Inc.	612-866-3661
MO	Blue Springs, Palatine Sls.	816-229-4007
MO	Florissant, Palatine Sls.	314-839-0800
NJ	Hackensack, Coakley, Boyd, Abbett, Metro	201-440-4114
NJ	Marlton, Naudain Assoc.	609-983-5300
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Centerville, Bear Mktg.	513-436-2061
OH	Richfield, Bear Mktg.	216-659-3131
TX	Austin, Allied Comps.	512-331-4494
TX	Dallas, Allied Comps.	214-238-0408
TX	Hurst, Allied Comps.	817-589-0456
WI	Brookfield, Indl. Rep.	414-789-9393
Can	Mississauga, Ont., Indigo Elctrs. Ltd.	416-670-0284

Local Distributors

AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Buena Park, Cypress Elctrns.	213-744-0355
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-945-8400
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CO	Englewood, Indelco	303-694-9444
CT	Danbury, Heilind Elctrns.	203-797-8600
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrn.	407-849-6060
IL	Palatine, Ohm Elctrns.	708-359-5500
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Gaithersburg, Pioneer/Wash.	301-921-0660
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Fridley, Voyager Elctrns.	612-571-7766
NJ	W. Berlin, General Comps., Inc.	609-768-6767
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Distr.	716-887-2800
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rome, Rome Elctrns.	315-337-5400
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Dayton, Bell Inds.	513-435-8660
OH	Solon, Repco	216-248-8900
OH	Stow, Advacom	216-688-5311
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Radar Elec.	503-233-3404
PA	McKean, Advacom	814-476-7774
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Stafford, Harrison Equip.	713-879-2727
TX	Stafford, Southwest Elctrns.	713-240-4000
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Mequon, Taylor Elec.	414-241-4321
Can	Burnaby, B.C., Semad Elctrns.	604-420-9889
Can	Calgary, Alberta, ITT Multicomponents	403-273-2780
Can	Concord, Ont., ITT Multicomponents	416-736-1144
Can	Edmonton, Alberta, ITT Multicomponents	403-436-9555
Can	Markham, Ont., Semad Elctrns.	416-475-8500
Can	Ottawa, Ont., Semad Elctrns.	613-727-8325
Can	Surrey, B.C., Memco Elctrn. Mkts.	604-590-1553
Can	Ville St. Laurent, Quebec, ITT Multicomponents	514-335-7697
Can	Winnipeg, Manitoba, ITT MultiComponents	204-697-2300
WA	Bellevue, Testco, Inc.	206-454-7422

STANFORD RESCH. SYS., INC., 1290 D. Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-9040, TELEX: 706891 SRS UD, FAX: 408-744-9049; *Sls. Mgr.:* Daniel R. Melick

STANFORD TELECOMMUNICATIONS, INC., 2421 Mission College Blvd., Santa Clara, CA 95056, Tel: 408-748-1010, TWX: 910-339-9531, FAX: 408-980-1066; FSC No.: 61362; Empl.: 900; *Sls. Mgr.:* Chuck Frank

STANGENES INDUSTRIES, INC., 1052 East Meadow Circle, Palo Alto, CA 94303, Tel: 415-493-0814, FAX: 415-855-9926; FSC No.: 62709; Empl.: 61; *Sls. Mgr.:* Magne Stangenes

STANLEY ELECTRONICS DIV., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000; FSC No.: 61544; Empl.: 12

STANLEY

FAX: 714-222-0777

I I STANLEY CO. INC., Stanley Electric Co. LTD., 2661 Gates Avenue, Suite 2000, Irvine, CA 92714, Tel: 1-800-LED-LCD1; Empl.: 390; *Sls. Mgr.:* Bill Roth; *Dist. Mgr.:* Al Kile ..... **B•1134, 1196-1201**

Local Sales Offices & Reps

AZ	Scottsdale, B.S.E.	602-483-0373
CA	Laguna Hills, Bart Budge Assoc.	714-582-8720
CO	Boulder, Stratford Grp.	303-530-3194
FL	Lighthouse Pt., Jack Krutek Assoc.	305-783-2501
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IN	Indianapolis, EMCI	317-921-3450
KS	Overland Park, Mink Assoc.	913-341-8309
MA	N. Reading, Alpha-Omega Sls.	508-664-1118
MN	Minneapolis, Holmgren Assoc.	612-574-9983
MO	Bridgeton, Mink Assoc.	314-291-5454
NY	Port Washington, ASHTEC	516-767-0336
OH	Dayton, K W Elctrns.	513-899-2150
PA	Horsham, Jacobsen Assoc.	215-674-2937
TX	Dallas, TESCO	214-553-1200
WA	Kirkland, Northwest Comp. Sls.	206-828-2104
WY	Jackson, TETONICS	307-733-1077
Can	Markham, Ontario, Deskin Sls.	416-475-1412

Local Distributors

AL	Huntsville, Future Elctrns.	205-830-2322
AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Littleton, Indelcc, Inc.	303-796-3461
CT	Hartford, Wesgarde Comps. Grp.	203-527-7705
FL	Lakeland, Wesgarde Comps. Grp.	813-644-7564
IL	Woodale, NEP Elctrns.	708-595-8500
IA	Cedar Rapids, DEE Elctrns. Inc.	319-365-7551
MD	Columbia, Future Elctrns.	301-290-0600
MA	Westborough, Future Elctrns.	508-366-2400
MI	Livonia, Future Elctrns.	313-261-5290
MN	New Brighton, CHRIS Elctrns.	612-631-2647
MO	St. Louis, Wesgarde Comps. Grp.	314-567-7776
NH	Nashua, Wesgarde Comps. Grp.	603-880-1971
NJ	Mt. Laurel, Wesgarde Comps. Grp.	609-778-8190
NY	Rochester, Future Elctrns.	716-272-1120
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Meafield Heights, Future Elctrns.	216-449-6996
PA	N. Versailles, CMD Elctrns.	412-678-6020
TX	Houston, Kent Elctrns.	713-780-7770
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	New Berlin, NEP Elctrns.	414-785-9100

STANLEY-VIDMAR, Stanley Works, 11 Grammes Rd., Allentown, PA 18103, Tel: 215-797-6600, TELEX: 847-345; Empl.: 5000; *Sls. Mgr.:* Ernie Gitlin, Vic Joliat; *Dist. Mgr.:* Frank Casey

STANPAT PRODS., 100 Goldstein Drive, Woonsocket, RI 02895, Tel: 401-766-8400, FAX: 401-767-0244; Empl.: 35; *Sls. Mgr.:* Mark Barbone

STANTON MAGNETICS, INC., Terminal Dr., Plainview, NY 11803-1511, Tel: 516-349-0235, TWX: 510-221-1845, FAX: 516-349-0230; Empl.: 300; *Dist. Mgr.:* Jack O'Donnell, Natl. Sls. Mgr.

STANTRON, Unit of Zero Corporation, 6900-6918 Beck Ave., P. O. Box 9156, N. Hollywood, CA 91605, Tel: 818-841-1825, FAX: 818-841-8892; FSC No.: 06514; Empl.: 125; *Sls. Mgr.:* G. A. Tessier

STAR CASE MANUFACTURING CO., INC., 648 Superior Avenue, Munster, IN 46321, Tel: 219-922-4440, 800-822-STAR (outside IN), 800-782-CASE (inside IN), FAX: 219-922-4442; Empl.: 75; *Sls. Mgr.:* Veronica Stadden ..... **C•1097**



FAX: 908-572-5095

STAR MICRONICS, INC., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854, Tel: 908-572-9512; Empl.: 120; *Sls. Mgr.:* Georgia Lombardi; *Dist. Mgr.:* Chris Duffy ..... **D•1062-1065, 1112-1115**

Local Sales Offices & Reps

CA	Irvine, Star Micronics	714-768-7203
IL	Itasca, Star Micronics	312-773-3717

Local Distributors

CA	Los Angeles, Elec. Switches, Inc.	213-660-1310
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Stanton, MS Cash Drawer	818-792-2111
CA	Sunnyvale, Penstock / Waltronics	408-730-0300
CO	Englewood, NEP Elctrns.	303-799-9898
FL	Davie, Arco Dist., Inc.	305-473-2550
GA	Norcross, Applied Power	404-263-0421
IL	Wood Dale, NEP Elctrns.	708-595-8500
IL	Wheeling, Hawk Elctrns.	708-459-4030
MD	Middletown, Current Comps.	301-473-5333
MA	Sharon, Adcour	617-784-8123
MI	Brighton, Applied Power	313-227-3604
MI	Grand Rapids, S. F. Elec. Supp., Inc.	616-459-0216
NJ	Sparta, Instrument & Equip.	201-729-4293
NY	Hewlett, Metropolitan Sls.	516-599-7900
OH	Cincinnati, U.R.I. Elctrns.	513-761-4030
TX	Channelview, R. T. Henry Elctrns.	713-452-4451
TX	Dallas, Foxfire	214-353-9543
CA	Tustin, OBI Dists.	714-250-9003
WI	New Berlin, NEP Elctrns.	414-785-9100
EXP	Markham, Ont., Birde Mktg.	416-477-7722

STAR PORCELAIN, 71 Muirhead Ave., Trenton, NJ 08638, Tel: 609-392-3154; Empl.: 70; *Sls. Mgr.:* Art Weigold

STAR-TRON CORPORATION, 58 Curtis St., Providence, RI 02909, Tel: 401-274-5090, FAX: 401-274-3936; Empl.: 50; *Sls. Mgr.:* Debra Chandronet-Christy



FAX: 714-997-1256

STATEK CORP., 512 N. Main St., Orange, CA 92668, Tel: 714-639-7810, TELEX: 67-8394; FSC No.: 51791; Empl.: 200; *Sls. Mgr.:* Bob Goodwin; *Dist. Mgr.:* S. Schaefer ..... **A•1470-1471**

Local Sales Offices & Reps

AL	Huntsville, L & D	205-837-1469
AZ	Phoenix, Eltron	602-266-2164
CA	Fallbrook, Chilcote Assoc.	619-728-7678
CA	Mission Viejo, Jay Mktg.	714-768-7519
CO	Englewood, Comp. Sls.	303-779-8060
FL	Palm Habor, Sigma Tech	813-789-5522
GA	Atlanta, L & D	404-395-7079
IL	Rolling Meadows, Eagle Tech. Sls.	312-991-0700
IN	Fort Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Greenwood, M/S Sls. & Assocs.	317-881-0110
IA	Des Moines, SPS Assocs.	515-225-0607
KS	Olathe, SPS Assocs.	913-764-4460
MA	Woburn, Radian Assocs.	617-933-7386
MI	Brighton, AP Assoc.	313-229-6550
MN	Bloomington, Murnco Inc.	612-854-4161
MO	Earth City, SPS Assocs.	314-291-0520
NJ	Bellmawr, TAI Corp.	609-778-5353
NY	New Rochelle, Robert Diamond Inc.	914-632-2828
NC	Charlotte, Prime Comps.	704-522-1150
NC	Raleigh, Prime Comps.	919-850-9866
OH	Centerville, Omega Sls. Inc.	513-434-5507
OH	Cleveland, Omega Sls. Inc.	216-360-9400
OR	Oregon City, Halbar Assoc.	503-656-3714
TX	Austin, Norcom	512-451-2757
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-778-0392
UT	Midvale, Comp. Sls.	801-561-5688
WA	Redmond, Halbar Assocs.	206-882-0990

Local Distributors

CA	Orange, Western Micro	714-637-0200
CA	San Diego, Western Micro	619-453-8430
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Littleton, Indelco	303-795-3431
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Reptron Elctrns.	404-446-1300
IL	Palatine, OHM Elctrns.	708-359-5500
IL	Schaumberg, Reptron Elctrns.	708-882-1700
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
MA	Woburn, First Frequency	617-935-3885
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Maryland Hgts., RS Elctrns.	314-997-7709
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Mt. Vernon, All American	914-699-2224
OH	Solon, Reptron Elctrns.	216-349-1415
OH	Worthington, Reptron Elctrns.	614-436-6675
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
WA	Redmond, Kent Elect	206-883-7200

STATE OF THE ART, INC., 2470 Fox Hill Rd., State College, PA 16803-1797, Tel: 814-355-8004, TELEX: 866633, FAX: 814-355-2714; Empl.: 100; *Sls. Mgr.:* Joseph J. Curcio ..... **A•1986-1991**

Local Sales Offices & Reps

AZ	Phoenix, Eltron, Inc.	602-266-2164
CA	La Miranda, Select Elctrns.	714-739-8891
CA	Saratoga, EMS	408-446-3833
CT	New Haven, Masten-Wright, Inc.	203-288-1638
FL	Melbourne, Graham Assoc., Inc.	407-773-6631
FL	Palm Bch. Gdns., Graham Assoc., Inc.	407-662-4049
IL	Glenview, Crimson Engrg. Sls., Inc.	312-470-0024
IN	Indianapolis, Hi-Tech Sls.	317-887-2564
MA	Newton, NormellAssocs,Inc.	617-969-5478
MN	Edina, Peterson Sls. & Assocs.	612-944-0030
NY	Huntington, Compar NY, Inc.	516-423-5660
NY	Lewistown, Watmet, Inc.	716-285-3595
PA	Colmar, E.L. Assocs.	215-822-2510
TX	Dallas, Merino Sls. Co.	214-233-6002
WA	Bellevue, Mars	206-747-3292
Can	Niagara Falls, Waters Metal Prods., Ltd.	416-356-4925

Local Distributors

CA	Los Alamitos, Semi Dice, Inc.	213-594-4631
FL	Tampa, Impala Elctrns.	813-885-4747
NJ	Fairfield, CHPS, Inc.	201-882-0997
NJ	Fairfield, Micross Comps.	201-227-8007
NY	Melville, Semi Dice	516-753-0050
NY	Port Chester, Zeus Comps.	914-937-7400



FAX: 516-666-8039

STAVER CO., INC., P.O. Box 220M 41 Saxon Ave., Bay Shore, NY 11706, Tel: 516-666-8000, TELEX: 6711657 STAVER; Empl.: 80; *Sls. Mgr.:* Arnold Lazarus ..... **B•1127-1131**

Local Sales Offices & Reps

CA	Ventura, R D Sls. Corp.	805-650-0111
IL	Wheaton, RMP McBride Corp.	708-462-2500
IN	Sugar Grove, The Manx Co.	708-466-4200
MI	Jackson, Jordan-Elliott Sls.	517-788-8353
MN	St. Paul, Proud Inds.	612-646-9428
NH	Hancock, Eisenbeis Sls.	603-525-4417
NY	East Northport, Levison Sls. Co.	516-266-5020
NC	New Hill, Tom G. Santel	919-362-4091
OK	Tulsa, Jerry Robison & Assocs.	918-665-3562
OR	Beaverton, Quest Mkgt.	503-641-7377
PA	Montgomeryville, Eastern Scientific Mktg.	215-368-4570
SC	Mauldin, Carl Hart Assocs.	803-288-2323
TX	Dallas, Innovative Tech. Sls.	214-669-3485
TX	Houston, Innovative Tech. Sls.	713-468-3882
WA	Bellevue, Quest Mkgt.	206-747-9424
WI	Colgate, RMP McBride Sls. Corp.	414-628-4016

STEMCO INSTRUMENTS, Colt Industries, P.O. Box 8047, Longview, TX 75607, Tel: 214-643-3236, TWX: 710-730-5236, FAX: 214-643-3339; FSC No.: 07446; Empl.: 100; *Sls. Mgr.:* Bob Halpin

STENNING INSTRMENTS, INC., 671 Enchanted Way, Pacific Palisades, CA 90272, Tel: 213-459-2930, FAX: 213-459-4983; *Sls. Mgr.:* Charles Stenning

STEP ENGINEERING, P.O. Box 3166, Sunnyvale, CA 94088, Tel: 408-733-7837, TWX: 910-339-9506, FAX: 408-773-1073; Empl.: 50; *Sls. Mgr.:* Robert C. Davi

STEPHENS ANALYTICAL, INC., 2750 Brabant-Marineau, Montreal, Que., CA H4S 1L1, Tel: 514-332-1230, FAX: 514-331-2084; Empl.: 8; *Sls. Mgr.:* Mr. Alan Lee

STERLING INSTRUMENTS, 2101 Jericho Turnpike, New Hyde Pk., NY 11040, Tel: 516-328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 150

STETCO, INC., 3344 Schierhorn Ct., Franklin Pk., IL 60131, Tel: 708-671-4208, FAX: 708-671-5270; FSC No.: 52763; Empl.: 41; *Sls. Mgr.:* Saul A. Gusaras

STETRON INTERNATIONAL, INC., 90 Broadway, Buffalo, NY 14203, Tel: 716-854-3443, FAX: 716-854-3448; Empl.: 70

STEVENS-ARNOLD DIV., Computer Prods./Stevens-Arnold, 7 Elkins St., So. Boston, MA 02127, Tel: 617-268-1170, TELEX: 95-1456 STEARCO, TWX: 710-339-0855, FAX: 617-268-0300; FSC No.: 80640; Empl.: 260; *Sls. Mgr.:* John T. Parent

Refer to Computer Products, Inc., Fremont, CA for sls. offices and reps. and for distrs. listings. Refer to Computer Products, Inc., Pompano Beach, FL for sls. offices and reps. and for distrs. listings.

STEVENS PRODUCTS, INC., 128 N. Park St., E. Orange, NJ 07019, Tel: 201-672-2140, FAX: 201-672-2837; Empl.: 50; *Sls. Mgr.:* Robert Cantilina

STEWARD, D. M., MFG. CO., E 36th st., P.O. Box 510, Chattanooga, TN 37401, Tel: 615-867-4100, FAX: 615-867-4102; Empl.: 250; *Sls. Mgr.:* Don Lepard

STEWART CONNECTOR SYS., INC., Insilco, R.D. No. 2 Box 2020, Glen Rock, PA 17327, Tel: 717-235-7512, TELEX: 4977105, FAX: 717-235-7954; Empl.: 187; *Sls. Mgr.:* Ed Cavanaugh; *Dist. Mgr.:* Ed Cavanaugh ..... **C•1533**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assoc., Inc.	205-533-9108
CA	Dana-Point, PCA	714-493-9822
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Boulder, Component Prod. Sls. Co., Inc.	303-530-2800
CT	Madison, Focus	203-245-4314
FL	Tamarac, Hughes Assoc., Inc.	305-720-1674
GA	Norcross, Hughes Assoc., Inc.	404-662-1561
IL	St. Charles, XYZ Mktg.	708-584-3001
IN	Columbus, Connect 21, Inc.	812-378-4361
KS	Parker, S.W. Assocs., Inc.	913-898-6552
KY	Louisville, Connect 21, Inc.	502-426-8955
MA	Tauton, Focus	508-824-3840
MI	Southfield, Carl H. Schmidt	313-353-6000
MN	Brooklin Center, Combined Sls.	612-566-2724
MS	Corinth, Hughes Assoc.	601-287-2915
NJ	Paramus, Atlantic Tech. Comps., Inc.	201-261-0542
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Charlotte, Quantum	704-523-8822
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J.C. Hofstetter	216-725-6422
OK	Tulsa, Blair Engrg., Inc.	918-622-3100
OR	Beaverton, Elctrns. Northwest,Inc.	503-629-9241
PA	Glen Rock, SCS	717-235-7512
TX	Dallas, Blaire Engrg., Inc.	214-241-5655
UT	Salt Lake City, Component Prod. Sls., Inc.	801-531-7672
WA	Redmond, Elctrns. Northwest, Inc.	206-883-1959
Can	Bellevue, Ont., Quest	206-747-9424
Can	Campden, Ont., Magden	416-563-5408

Local Distributors

CA	Irvine, Kensington Elctrns.	714-588-0575

STIMPSON COMPANY, INC., 900 Sylvan Ave., Bayport, NY 11705-1097, Tel: 516-472-2000, TELEX: ITT 4972370, FAX: 516-472-2425; Empl.: 900; *Sls. Mgr.:* Edward J. Dewalters


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ST MICROWAVE CORP., Sub. of Signal Technlg. Corp., 955 Benecia Ave., Sunnyvale, CA 94086, Tel: 408-730-6300, FAX: 408-245-3396,408-733-0254; FSC No.: 27338; Empl.: 237; *Sls. Mgr.:* Phillip B. Cox-VP

STOCK DRIVE PRODUCTS, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, Tel: 516-328-0200, 328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 228; *Sls. Mgr.:* Murray Ores ..... **B•1312**

Local Sales Offices & Reps

AL	Huntsville, Par Marketing, Inc.	205-859-5702
CA	Chatsworth, Western Comp. Sls.	818-882-6226
CA	San Carlos, SDP West	415-594-0700
CA	San Carlos, Western Comp. Sls. N.	415-594-1222
CO	Denver, Manufacturer's Mktg.	303-985-2008
CO	Wheatridge, Manufacturers Mktg.	303-425-9569
CT	Wethersfield, Underwood Sls.	203-563-3046
FL	Clearwater, Tech-Rep Assoc., Inc.	813-576-9900
IL	Downers Grove, Rockford Controls Co.	312-960-2046
IN	Indianapolis, Rockford Controls Ohio	317-251-2866
MD	Upperco, Imagitron Sls. Co.	301-374-5600
MA	Lowell, Underwood Sls.	617-256-8191
MA	Topsfield, Liberty Electro	508-887-6655
MI	Southfield, R.C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Northstar Motion & Control	612-770-5311
NJ	Paramus, Design Elctrns.	201-845-6224
NY	Clark Mills, KLM-Garner, Inc.	315-853-6126
NY	New Hyde Park, SDP	516-328-3300
NY	Pittsford, KLM-Garner	716-381-8350
OH	Euclid, Rockford Controls Ohio, Inc.	216-731-5250
OH	Medina, Rockford Controls Ohio	216-725-3705
TX	Houston, Zonk & Assoc.	713-579-7777
TX	Richardson, Zonk & Associates	214-238-7651
WA	Seattle, Northmar Inc.	206-524-5170
WI	Madison, Rockford Controls	608-233-8750

Local Distributors

CA	San Carlos, SDP West	415-594-1222

STOCK MODEL PARTS, Designatronics Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, Tel: 516-328-3300, FAX: 516-326-8827

STOCKO CONNECTORS, Stocko Corporation, 495 Industrial Road, Carlstadt, NJ 07072, Tel: 201-933-4452, FAX: 201-933-4522; Empl.: 34

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1220 Olympic Bl., Santa Monica, CA 90404

STOELTING CO., 620 Wheat Lane, Wood Dale, IL 60191, Tel: 708-860-9700, TELEX: 314176, FAX: 708-860-9775; Empl.: 50; *Sls. Mgr.:* Charles W. Scouten

STOLZBERG RESEARCH, INC., 3 Seabrook Court, Stony Brook, NY 11790, Tel: 516-751-4277, FAX: 516-689-6671; Empl.: 4; *Sls. Mgr.:* Bruce Davis; *Dist. Mgr.:* Bruce Davis

STORM PRODUCTS CO., 116 Shore Drive, Hinsdale, IL 60521, Tel: 708-323-9121, TWX: 910-651-0850, FAX: 708-323-9398; FSC No.: 57500; Empl.: 68; *Sls. Mgr.:* Brian J. Holland

STRATOS PRODUCT DEVELOPMENT GROUP, 2025 First Ave. 830 Market Pl. Tower, Seattle, WA 98121, Tel: 206-448-1388, FAX: 206-448-7830; Empl.: 14

STRAWBERRY TREE, INC., 160 S. Wolfe Rd., Sunnyvale, CA 94086, Tel: 408-736-8800, TELEX: 650 3172834 MCI, FAX: 408-736-1041; Empl.: 25

STREET ELECTRONICS CORP., 6420 Via Real, Carpinteria, CA 93013, Tel: 805-684-4593, FAX: 805-684-6628; *Dist. Mgr.:* Mark Pfeffer

ST RESEARCH CORPORATION, 8419 Terminal Road, Newington, VA 22122, Tel: 703-550-7000, FAX: 703-550-7470; FSC No.: 50406; Empl.: 160

STRONGBOX, P.O. Box 2726, Culver City, CA 90231-2726, Tel: 213-305-8288; FSC No.: 2T043; Empl.: 5; *Sls. Mgr.:* Larry Martinek ..... **C•1108-1109**

S-D

FAX: 609-589-2619

STRUTHERS-DUNN, INC. AND HI-G CO., INC., Lambs Rd., Pitman, NJ 08071-0901, Tel: 609-589-7500, ESYLNK: 622-87939; FSC No.: 78290; Empl.: 467 ..... **B•1588-1603**

Local Sales Offices & Reps

AZ	Scottsdale, BSE, Inc.	602-483-0373
CA	RD & D	
CA	Los Angeles, RD & D	213-666-1611
CA	Palo Alto, Innovative Sls.	415-961-0456
CO	Englewood, Omega	303-762-1921
CT	Bloomfield, Friedman	203-242-7781
FL	Orlando, Comp. Design Mktg.	407-352-5480
IL	Downers Grove, Bob Burns & Assoc.	312-960-2046
IN	Ft. Wayne, TX Sls.	219-423-3422
IA	Cedar Rapids, Pattison	319-365-3150
KS	Olathe, Advanced Tech. Sls.	913-782-8702
LA	Lafayette, Fralia	318-269-9452
MD	Columbia, Imagitron	301-381-0225
MI	Southfield, TX Sls.	313-353-8210
MN	Minneapolis, Jay Borman	612-888-2122
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	West Caldwell, Grimm, Siegel Assocs.	201-575-9300
NM	Albuquerque, B.S.E.	505-293-2582
NY	Buffalo, Tri-Tech	716-877-3677
OH	Cincinnati, Elctrn Comps.	513-729-1969
PA	Broomall, Imagitron Sls.	215-356-5300
PA	Pittsburgh, Elctrn. Comps.	412-242-9500
TX	Euless, W. Pat Fralia Co.	817-354-1144
WA	Bellevue, Eltech, Inc.	206-643-4330

Local Distributors

CA	Santa Ana, Norstan Elctrns., Inc.	714-540-4165
MO	Maryland Hgts., L Comp. Inc.	314-291-6200
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NY	Plainview, A.C.I. Elctrns.	516-293-6630
PA	Philadelphia, PEI/Genesis	215-673-0400
TX	Dallas, Associated Aircraft	214-331-4381

ST-SEMICONDUCTORS OF INDIANA, INC., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609, Tel: 812-332-1435, FAX: 812-331-8706; Empl.: 100; *Sls. Mgr.:* Jim Davis; *Dist. Mgr.:* Jim Davis

SUBMARINE SIGNAL DIVISION, Raytheon Company, 1847 W. Main Road, Portsmouth, RI 02871, Tel: 401-847-8000, TELEX: 71-6817111, FAX: 401-847-2364; Empl.: 2,300

SUCKLE CORP., 733 Davis St., Dept. EM, Scranton, PA 18505, Tel: 717-346-3871, FAX: 717-346-1612; Empl.: 220; *Sls. Mgr.:* James J. Castellino

SULLINS ELECTRONICS CORP., P.O. Box 189, 801 E. Mission Rd., San Marcos, CA 92069, Tel: 619-744-0125, TWX: 910-322-1472, ESYLNK: 62912413, FAX: 619-744-6081; Empl.: 75 ..... **C•1534-1535**

Local Sales Offices & Reps

AZ	Phoenix, TM Entprs.	602-759-5057
AL	Athens, Effective Mktg. Force	205-233-2947
CT	Bethel, Cycle Sls.	203-621-2131
CA	Newport Beach, Qual Conn	714-851-6465
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CO	Wheatridge, Cluff & Assocs.	303-425-6604
FL	Palm Harbor, Bob DEan, Inc.	813-789-1233
GA	Lithia Springs, Effective Mktg. Force	404-948-6023
IL	Mt. Prospect, Dombrow Co.	708-253-3326
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
IA	Marion, M-S-B Assocs.	319-377-6261
KS	Shawnee Mission, M-S-B Assoc.	913-432-2131
MD	Randallstown, Chesapeake Inds. Mktg.	301-653-0476
MA	Harvard, Cycle Sls.	617-456-6868
MI	Southfield, Comp. Assocs.	313-355-4110
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Louis, M-S-B Assocs., Inc.	314-772-2166
NJ	Medford, Comp. Consultants	609-654-5300
NY	E. Rockaway, HLJ Comp-Tech	516-599-2999
NC	Fayettville, Effective Mktg. Force	919-867-6221
OH	Centerville, Omega Sls., Inc.	513-434-5507
OH	Dublin, Sls. Plus	216-942-7811
PA	Ft. Washington, SMC Inc.	215-628-3394
TX	Allen, Bozman & Assocs.	214-727-3719
TX	Richardson, Comp. Partners	214-644-1288
TX	Richardson, Off The Shelf Comp.	214-238-0808
TX	Round Rock, Bozman & Assocs.	512-255-2444
WA	Chattaroy, Elctrn. Mktg. Grp.	509-922-2718
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WA	Vancouver, Elctrn. Mktg. Grp.	206-254-4572
WI	Oconomowoc, Artmor Ltd.	414-367-8789
Can	Carlsbad, QualConn	714-851-6465
Can	La Canada, KCP Entprs.	818-790-1365

Local Distributors

AL	Birmingham, American Elctrn. Supp.	205-942-4656
AL	Huntsville, Cypress Elctrns.	205-533-0783
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Buena Park, Cypress Elctrns.	213-404-0445
CA	Burbank, Atwater Elctrns.	818-841-9050
CA	City of Industry, Ital Elect Sls. Inc.	818-968-8515
CA	Pasadena, Empire Elctrns.	213-681-2711
CA	San Diego, Cypress/RPS Elect.	619-535-0011
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Sierra W. Elctrns.	408-435-7477
CA	Santa Ana, Sigma Elctrns.	714-558-8600
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Simi Valley, Lee Johnson Sls.	818-346-5412
CA	Woodland Hills, Cypress Elctrns.	818-710-7780
CO	Arvada, Denver Beta Wintronic	303-431-7161
CO	Engelwood, Cypress Elctrns.	303-792-5829
CO	Englewood, NEP Elect. of Co.	303-799-9898
CO	Littleton, Indelco Inc.	303-795-8298
CT	Bridgeport, Millenium Elctrn. Sls.	203-372-2037
FL	Davie, Arco Distrs., Inc.	305-473-2550
FL	Miami, Electronic Equip. Co.	305-871-3500
FL	Winter Park, Deanco	417-671-5100
GA	Duluth, Interface Elctrns.	404-623-1066
GA	Marietta, Deanco	404-429-0126
IL	Addison, Belford Elctrns.	312-691-1100
IL	Carol Stream, Lectro Comps.	708-690-0520
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Wheeling, Hawk Elctrns.	312-459-4030
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Evansville, Excalibur Elctrns.	812-464-0079
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Advent Elctrns.	312-872-4910
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
IA	Cedar Rapids, DEE Electrns.	319-365-7551
IA	Cedar Springs, Barton Digital	319-474-2247
MD	Beltsville, Petricko Sls.	301-937-4960
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MD	Gaithersburg, Deanco	301-948-5444
MD	Timonium, M X 4 Elctrns., Inc.	301-252-1192
MA	Canton, EPC Elctrns. Inc.	617-821-2111
MA	Canton, Richey/Impact Elect.	617-821-1500
MA	Wilmington, EPC Elctrns.	508-657-6523
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, Caider Elctrns.	616-698-7400
MI	St. Claire Shore, Spemco	313-771-2700
MN	Bloomington, Bergquist Co.	612-835-2322
MN	Eden Prarie, Cypress Elctrns.	612-934-2104
MN	St. Paul, Shelley Ragon Inc.	612-642-2828
MN	Thief River Fls., Digi-Key Corp.	218-681-6674
MO	Independence, Shelley-Ragon, Inc.	816-254-3410
NH	Atkinson, Astrum Elctrns.	603-898-3399
NH	Hampstead, Astrum Elctrns.	603-329-9640
NJ	Bellmawr, Mid-Atlantic Elect.	609-931-5303
NJ	Fairfield, Deanco	201-575-7960
NJ	Union, Meridian Supp.	201-687-6220
NM	Albuquerque, Electronic Parts	505-293-6161

NM Las Cruces, Electronic Parts 505-523-4578
NY Canandaigua, Advacom Technlg., Inc. 716-396-9050
NY E. Rockaway, Forejay Assocs. 516-599-2999
NY Ithaca, Deanco 607-257-4444
NC Greensboro, Southeastern Elctrns. 919-273-8675
NC Hickory, Southeastern Elctrns., Inc. 919-828-2311
OH Cincinnati, Schuster Elec. Co. 513-489-1400
OH Solon, REH Elctrns. 216-248-1636
OH Twinsburg, Schuster Elec. Co. 216-425-8134
OR Portland, Cypress Electrns. 503-641-2233
OR Portland, Dunn Elctrns. 503-285-0214
PA McKean, Advacom 814-476-7774
PA Wayne, Peak Elctrns. 215-293-9000
RI Warwick, Cal-Greg Comps., Inc. 401-738-6170
TN Knoxville, Indl. Elctrns., Inc. 615-573-7135
TN Nashville, Randolph & Rice 615-255-5601
TX Addison, Connec/Tek, Inc. 214-733-4411
TX Carrollton, Connec/Tek Inc. 214-245-1266
TX Corpus Christi, Douglas Elctrns. 512-883-5103
TX Dallas, Cypress Elctrns. 214-869-1435
TX Dallas, Off The Shelf 214-247-0052
TX Garland, J & S Elctrns. 214-487-8808
TX Pflugerville, RSI 512-251-1161
TX Plano, Tactic Elctrns. 214-867-2329
TX Richardson, Off The Shelf 214-238-0808
UT Salt Lake City, S.L.C. Wintronics 801-483-1882
UT Salt Lake City, Standard Supp. Co. 801-486-3371
UT W. Valley City, S.C.C. Beta Wintronics 801-966-0236
VA Annandale, Arcade Elect. Inc. 703-256-4610
VA Charlottesville, Virginia Radio Supp. 804-296-4184
VA Virginia Bch., Deanco 804-499-3322
WA Bothel, Cypress Elctrns. 206-483-1144
WA Seattle, Radar Elec. 206-282-2611
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SUMTAK ELECTRONICS, Daido Corporation, 615 Pierce St., Somerset, NJ 08875, Tel: 908-805-0008, FAX: 908-805-0122; *Sls. Mgr.:* Phillip Giannini, Nat. Sls. Mgr. ..... **B•1950-1951**

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SUNDSTRAND DATA CONTROL INC., Sundstrand Corporation, P. O. Box 97001, Redmond, WA 98073-9701, Tel: 206-885-3711, TELEX: RCA 286144; Empl.: 1800; *Dist. Mgr.:* R. Heilman

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SUN ELECTRONIC SYSTEMS, INC., 1601 NW 38th Ave., Ft. Lauderdale, FL 33311, Tel: 305-587-5577; Empl.: 10; *Sls. Mgr.:* Veronica L. Pasqua ..... **D•1202-1203**

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FL Winter Springs, Micro-Elctrn. Comps. .. 407-366-1379
GA Atlanta, Electronic Mktg. Assoc. 404-448-1215
IL Park Ridge, Metcom Assoc., Corp. 708-696-1490
IN Huntington, Elctrn. Rep. 219-356-3513
IN Indianapolis, Elctrn. Rep. 317-894-1414
IA Davenport, Rush & West Assocs, Inc. 319-388-9494
KS Olathe, Rush & West Assocs., Inc. 913-764-2700
MA Westborough, Anchor Engrg. Corp. ... 508-898-2724
KY Lexington, Elctrn. Rep. 606-273-8425
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MD Livonia, Lowell-Wendt Mktg. Co. 313-464-2722
MI Wyoming, Lowell-Wendt Mktg. Co. 616-791-7370
MN Edina, Grayden & Flemmer, Inc. 612-941-1120
SC Greenville, Electronic Mktg. Assoc. 803-233-4637
MO St. Louis, Rush & West Assocs., Inc. .. 314-965-3322
FL Deerfield Bch., Micro-Elect. Comps. Corp. 305-426-8944
NJ Lodi, TRC Elctrns., Inc. 201-779-8282
NM Albuquerque, F P Sls. 505-345-5553
NY Mendon, Tech-Mark 716-624-3840
NY Utica, Tech-Mark 315-733-0575
NC Raleigh, Elctrn. Mktg. Assoc. 919-847-8800
NC Raleigh, Robert Elctrn. Sls. 919-878-4465
NC Sapphire, Robert Elctrn. Sls. 704-877-3280
OH Centerville, Dolfuss-Root & Co. 513-433-6776
OH Dayton, Dolfuss-Root & Co. 513-433-6776
OH Westlake, Dolfuss-Root & Co. 216-899-9370
OH Worthington, Dolfuss-Root & Co. 614-855-4844
PA Allentown, TRC Elctrns., Inc. 215-391-8977
TX Austin, B-P Sls. 512-346-9186
TX Houston, B-P Sls. 713-782-4144
TX Richardson, B-P Sls. 214-234-8438
VA Lynchburg, Parogem 804-528-0681
WA Redmond, S.E.A. (Sls. & Engrg. Assoc.) 206-883-4999
WA Vancouver, S.E.A. (Sls. & Engrg. Assoc.) 206-573-5161
FL Largo, Micro-Elect. Comps. Corp. 813-393-5011
WI West Allis, Metcom Assoc., Corp. 414-476-1300
Can Pointe Claire, Que., A.R. Gray & Assoc. 514-694-6378

Local Distributors

AL Birmingham, American Elctrn. Supply 205-942-4656
AL Huntsville, Comp. Distrs. Inc. 205-851-7800
AZ Tempe, On-Shore Technlg. 602-921-3000
CA Manhattan Beach, Prime Electro Prods. Co. 213-379-3642
CA Sacramento, Power & Data Technlg. .. 415-792-5087
CA San Jose, Foresight Elctrns. 408-453-0490
CA San Jose, Power & Data Technlg. 408-629-3550
CA Van Nuys, Nesco/Natl. Electro-Sls. 818-781-0505
CO Englewood, Comp. Distrs., Inc. 303-799-4916
CO Littleton, Deltex 303-779-1611
CO Littleton, Displays Plus, Inc. 303-730-7333
CT Marlborough, Pik Power 203-295-0580
CT Wallingford, Sager Elec. Supply 203-265-4600
FL Altamonte Springs, Vantage Comps. .. 407-882-1199
FL Deerfield Bch., Vantage Comps. 305-429-1001
FL Oldsmar, Applied Power Inc. 813-854-4004
FL Orlando, Sager Elec. Supp. 407-240-3114
FL Palm Bay, Comp. Distrs., Inc. 407-724-9910
GA Gastonia, JMT Automation & Controls 704-867-4401
GA Norcross, American Elctrn. Supp. 404-449-5339
GA Norcross, Applied Power Inc. 404-263-0421
GA Norcross, Comp. Distrs., Inc. 404-441-3320
IL Mt. Carmel, Thordarson Meissner 618-262-5121
IN Carmel, Altex Elctrns. 317-848-1323
MD Columbia, Sager Elec. Supp. 301-995-6580
MD Columbia, Vantage Comps. 301-720-5100
MA Andover, Vantage Comps. 508-887-3900
MA Hingham, Sager Elec. Supp. 617-749-6700
MA Sharon, Adcour, Inc. 617-784-8123
MI Brighton, Applied Power Inc. 313-227-3604
MI Livonia, LWC Distrs. 313-464-7700
MN Minneapolis, Bergquist Co. 612-835-2322
MN Minneapolis, Tortec Corp. 612-866-3662
NH Salem, Sager Elec. Supp. 603-898-1348
NJ Lodi, TRC Elec. Inc. 201-779-8282
NM Albuquerque, H.E.R. Elctrns. 505-265-8609
NY Hauppauge, Sager Elec. Supp. 516-348-1300
NY Syracuse, ADR Technlgs. Inc. 315-437-7087
NC Raleigh, Sager Elec. Supp. 919-850-9550
OH Aurora, Indl. Prods. Distbg., Inc. 216-562-8113
OH Centerville, Indl. Prods. Distbg., Inc. ... 513-435-2086
OH Cincinnati, Schuster Elctrns., Inc. 513-489-1400
OH Twinsburg, Schuster Elctrns., Inc. 216-425-8134
OK Tulsa, The Altair Co. 918-252-5781
OR Beaverton, Micro Power Elctrns. 503-626-7086
OR West Linn, Power Factor & Assocs. ... 503-657-6969
PA Allentown, TRC Elec. Inc. 215-391-8977
PA Mars, Sager Elec. Supp. 412-772-2233
PA Philadelphia, Sager Elec. Supp. 215-464-4336
TX Austin, The Altair Co. 512-837-4970
TX Carrollton, LCD Elctrns. 214-245-0600
TX Dallas, Comp. Distrs., Inc. 214-644-0373
TX El Paso, Power & Data Technlg. 505-589-0052
TX Houston, The Altair Co. 713-462-3029
TX Richardson, The Altair Co. 214-231-5166
TX Round Rock, LCD Elctrns. 512-388-1339
TX Stafford, Southwest Elctrns. 713-240-4000
WA Edmonds, Prime Source 206-743-6641
WA Redmond, Priebe Elctrns. 206-881-2363
WI Mequon, Taylor Elec. Co. 414-241-4321
WI Milwaukee, Progressive Image, Inc. 414-321-4722
WI Sullivan, Bergquist Co. 414-593-2020

T&W SYSTEMS, INC., See Versacad Corp.

TANE ALARM PRODUCTS, 247-40 Jericho Tpke., Floral Park, NY 11001, Tel: 516-328-3351, FAX: 516-326-9125; Empl.: 10; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Sam Lurie

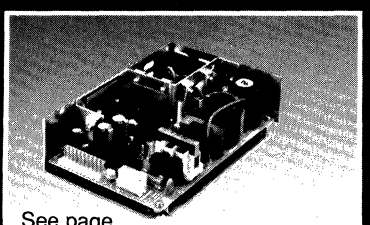
TANSITOR ELECTRONICS, West Rd., P.O. Box 230, Bennington, VT 05201, Tel: 802-442-5473, TELEX: 954007, FAX: 802-447-1297; FSC No.: 030266626; Empl.: 183; *Sls. Mgr.:* David Latchum; *Dist. Mgr.:* 225 ..... **A•1143**

Local Sales Offices & Reps

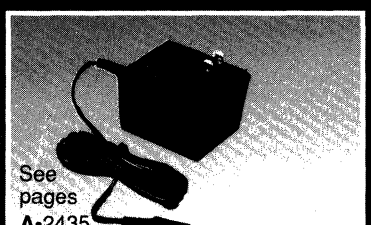
AL Huntsville, Elctrn. Mktg. Assocs. Inc. 205-880-8050, FAX:205-880-8054
AZ Tempe, Piper Sls. 602-949-0048, FAX:602-894-1032
CA Chatsworth, Wes-K Assocs. 818-770-0933, FAX:818-709-9832
CA San Diego, Wes-K Assocs. 619-695-2040, FAX:619-695-8602
CO Grand Junction, Krebill Comp. Sls. 303-243-8220, FAX:303-243-7939
CT Farmington, Ray Perron & Co., Inc. 203-673-4825, FAX:203-675-7345
FL Boca Raton, So. Atlantic Comp. Sls. ... 407-391-1034
FL Orlando, So. Atlantic Comp. Sls. 407-857-3650, FAX:407-857-3298
FL St. Petersburg, So. Atlantic Comp. Sls. 813-324-0953
GA Atlanta, Elctrns. Mktg. Assocs. Inc. 404-448-1215, FAX:404-446-9363
IL Itasca, Circuit Sls. 708-773-0200, FAX:708-773-2721
IN Ft. Wayne, Electro Reps, Inc. 219-489-8205, FAX:219-489-8408
IN Indianapolis, Electro Reps. 317-842-7202, FAX:317-841-0230
IA Cedar Rapids, R. F. Welch Co. 319-362-6824, FAX:319-362-7734
KS Olathe, Rush & West Assocs. Inc. 913-764-2700, FAX:913-764-0096
ME Yarmouth, Memar, Inc. 207-846-3791, FAX:207-846-6488
MD Annapolis, Elctrn. Engrg. 301-269-6573, FAX:301-269-6476
MA Needham, Ray Perron & Co., Inc. 617-449-6162, FAX:617-444-1074
MI Livonia, Amtech Reps. 313-474-8300, FAX:313-474-8301
MN Minneapolis, Tecteam Sls. Inc. 612-854-6616, FAX:612-854-8031
MO St. Louis, Rush & West Assocs. Inc ... 314-965-3322
NH Merrimack, Ray Perron & Co., Inc. 603-424-4423
NJ Haddonfield, Sunday O'Brien 609-429-4013, FAX:609-429-9249
NM Albuquerque, Piper Sls. 505-828-1300, FAX:505-828-1380
NY Cazenovia, S/T Woolard Co. 315-655-8145
NY Great Neck, M.O.S. Assocs. 516-487-3966, FAX:516-487-3989

TAMURA

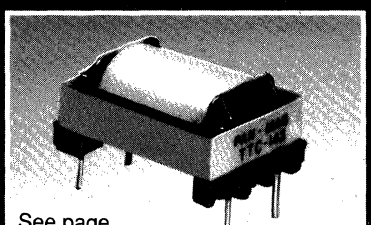
DELIVERS FROM STOCK



See page D•2062 **SINGLE AND MULTI–OUTPUT SWITCHERS**



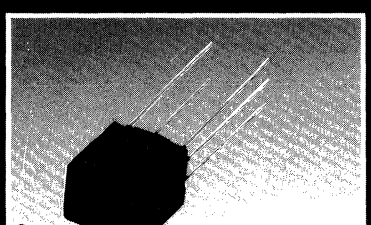
See pages A•2435, D•1495, D•2066 **WALL PLUG–IN, AC & DC POWER**



See page A•2428 **FCC PART 68 TELCOM LINE COUPLING**



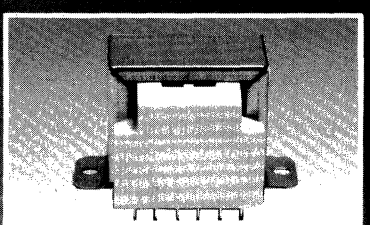
See page D•2059 **DC/DC CONVERTERS SIP & DIP PKG**



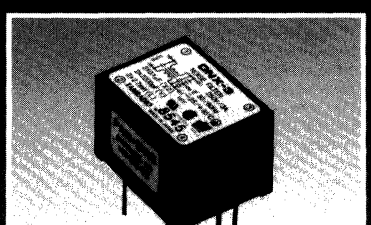
See page A•2430 **MINIATURE AUDIO & PART 68 COUPLING**



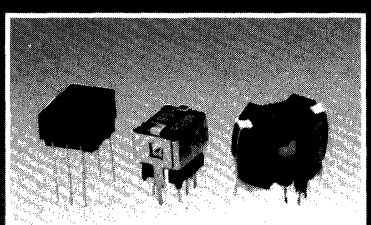
CONTACT FACTORY **COMPUTER NETWORKING BALUNS**



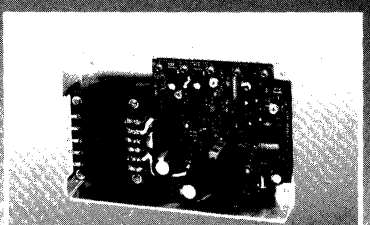
A•2432 **INT'L PCB POWER– UL 1411, IEC, VDE, & CSA**



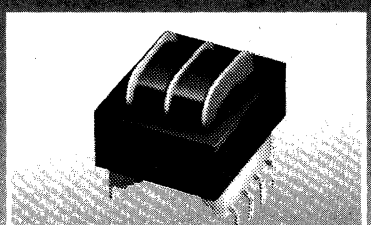
A•1643 **EMI LINE FILTERS**



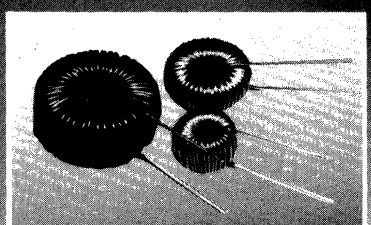
A•2431 **WIDE BAND PULSE– T1 & DIGITAL**



D•2064 **LINEAR POWER SUPPLIES**



A•2433 **UL/CSA PCB POWER**



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OH Burton, Elctrn. Comps., Inc. 216-834-0011
OH Cleveland, Elctrn. Comps., Inc. 216-331-5330, FAX:513-866-3371
OH Columbus, Elctrns. Comps., Inc. 614-231-2318, FAX:513-866-3371
OH Miamisburg (Dayton), Elctrn. Comps., Inc. 513-866-3340,FAX:513-866-3371
OH Miamisburg (Dayton), Foxtronix, Inc. ... 513-866-2112, FAX:513-866-3371
OR Portland, ES/Chase Co., Inc 503-292-8840, FAX:503-292-8827
SC Greenville, Elctrn. Mktg. Assocs., Inc. 803-233-4637,FAX:803-242-3089
TX Dallas, Stevens Sls. 214-702-0132, FAX:214-960-7369
VA Richmond, Elctrn. Engrg. & Sls, Inc. 804-794-8939, FAX:804-794-6090
WA Kirkland, ES/Chase Co., Inc. 206-823-9535, FAX:206-821-7257
WI Brookfield, Circuit Sls., Inc. 414-784-7773, FAX:414-784-4528
Can Mississauga, Ont., Gidden Morton Assoc., Inc. 416-671-8111,FAX:416-671-2422
Can Richmond, Gidden Morton Assoc., Inc. 613-838-4480,FAX:613-838-4479
Can St. Laurent, Que., Gidden Morton Assoc., Inc. 514-335-9572,FAX:514-335-9573

Local Distributors

AZ Tempe, Shelly-Ragon Elec. 602-894-2058
CA Chatsworth, Passive Comps., Inc. 818-700-8838
CA Garden Grove, Natl. Capacitor Corp. 213-598-9611,FAX:714-898-6769
CA Irvine, I.E.C. Elctrns., Inc. 714-837-9960, FAX:714-837-8308
CA San Jose, Natl. Elctrns. 408-922-0500, FAX:408-922-0448
CA Yorba Linda, Zeus Comps. 714-921-9000, FAX:714-921-2715
CO Denver, IEC Elec. 303-292-5537, FAX:303-292-0114
FL Melbourne, New Yorker Elctrns. Co., Inc. 407-727-0955,FAX:407-727-1844
FL Oviedo, Zeus Comps. 407-365-3000, FAX:407-365-2365
FL Tampa, Jaco Elctrns. Inc. 813-628-4665, FAX:813-626-8185
MD Columbia, Jaco Elctrns. Inc. 301-995-6620, FAX:301-995-6032
MA Woburn, ACI Elec. 617-935-7230
MI Livonia, R.S./Chelsea Elctrns. 313-525-1155, FAX:313-525-1184
MN St. Paul, Shelley-Ragon Elctrns. 800-328-9427, FAX:612-642-1990
MO Maryland Hts., R.S./Chelsea Elctrns. .. 314-997-7709
NJ Voorhees, Partec Comps. 609-795-4884
NY Hauppauge, Jaco Elec. 516-273-5500, FAX:516-273-5528
NY Mamaroneck, New Yorker Elctrns. Co., Inc. 914-698-7600,FAX:914-698-7026
OH Cincinnati, R.S./Chelsea Elctrns. 513-793-2450, FAX:800-582-1607
OH Dayton, Yankee Distrs., Inc. 513-890-1700, FAX:513-890-2082
OH Solon, Targetronix Corp. 216-248-7930
OR Beaverton, Shelley-Ragon Elctrns. 503-641-1691, FAX:503-646-4927
TX Addison, Jaco Elec. 214-733-4300, FAX:214-733-4604
UT Valley City, Aved 801-975-9500, FAX:801-977-0245
WA Redmond, Jaco Elctrns., Inc. 206-881-9700, FAX:206-881-9777

TAPECON, INC., 10 Latta Rd., Rochester, NY 14612, Tel: 716-621-8400; Empl.: 120; *Sls. Mgr.:* Joseph C. Pallone

TAPESWITCH CORP. OF AMERICA, 100 Schmitt Blvd., Farmingdale, NY 11735, Tel: 516-694-6312, FAX: 516-694-6304; Empl.: 100; *Sls. Mgr.:* Ed Duhon

TAPPAN WIRE & CABLE, 256 Oak Tree Rd., Tappan, NY 10983, Tel: 914-359-9300, FAX: 914-359-9369; FSC No.: 2G330; Empl.: 27; *Sls. Mgr.:* Mike Ressa

TAUBER

FAX: 619-274-2220

TAUBER ELCTRNS. INC., 4901 Morena Blvd., Bldg. 314, San Diego, CA 92117, Tel: 619-274-7242; Empl.: 38; *Sls. Mgr.:* Bob Tauber; *Dist. Mgr.:* Ed Hoscoe ..... **D•1496**

Local Sales Offices & Reps

AL Huntsville, Macro-Marketing 205-883-9630
AL Huntsville, Macro-Mktg. 205-883-9630
AZ Scottsville, Mactronix 602-998-1848
CA Fullerton, Tauber Elctrns. 1-800-829-4747
CA Los Angeles, Berman Sls. 213-556-3358
CA Santa Ana, Berman Sls. 1-800-829-4747
FL Land O'Lakes, AJ'S Power Source 813-996-2583
FL Land-O-Lakes, AJ'S Power Source ... 813-996-2583
GA Norcross, Marco Mktg. 404-662-5580
IL Wheeling, Ed Joyner 312-520-1200
IL Wheeling, Ed Joyner & Co. 312-520-1200
IA Des Moines, Beams Co. 515-255-1148
KS Shawnee Mission, Beams Co. 913-631-0300

TAURUS COMPUTER PRODUCTS, DY-4 Systems Inc., 21 Fitzgerald Rd., Nepean, Ont., Canada K2H 9J4, Tel: 613-596-9911, FAX: 613-596-0574; Empl.: 13; *Sls. Mgr.:* David Murray; *Dist. Mgr.:* David Murray

TAURUS CORPORATION, See Signal Research Inc.

TAYLOR ELECTRONICS, INC., 401 West Orion, Tempe, AZ 85283, Tel: 602-838-4523, FAX: 602-838-7456; Empl.: 25; *Sls. Mgr.:* Sharon F. Hansen

TAYLOR INDUSTRIAL SOFTWARE, , Edmonton, Alberta, Canada T5K 2M5, Tel: 403-482-7547, FAX: 403-488-8032; Empl.: 65; *Sls. Mgr.:* Glenn Saunders

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FAX: 203-929-6408

T-BAR DATA SWITCH CORP., 1 Enterprise Dr., Shelton, CT 06484, Tel: 203-926-1801, TWX: 710-463-3210; Empl.: 140; *Sls. Mgr.:* Gerard F. Ryan .... **B•1788**

Local Sales Offices & Reps

CA Arcadia, Van Gott & Assocs. 818-445-9728
FL Clearwater, Tech-Rep Assocs. 813-577-9370
IL Barrington, Perhats Assocs. 312-381-6360
KS Lenexa, MIDTEC Assocs. 913-541-0505
MD Gaithersburg, Carwithen Assocs. 301-921-9545
MO St. Louis, MIDTEC Assocs. 314-275-8666
TX Richardson, McCoy Assocs. Co. 214-864-1838

Local Distributors

IL Chicago, Newark Elctrns. 312-784-5100
CT Wallingford, Sager Elctrl. Supp. Co. 203-265-4600

TCA, 7733 Telegraph Rd., Montebello, CA 90640, Tel: 213-726-0303, FAX: 213-727-7621; Empl.: 200; *Sls. Mgr.:* Jay Giles

T.D.I. BATTERIES, 2852 Hitchcock Ave., Downers Grove, IL 60515, Tel: 708-971-3460, FAX: 708-971-3903; Empl.: 160; *Sls. Mgr.:* Kurt Padera; *Dist. Mgr.:* Theresa Kanaga

TDJ CO., INC., 1154 Morena Blvd., San Diego, CA 92110, Tel: 619-276-5920, FAX: 619-276-5960; FSC No.: 60382; Empl.: 7; *Sls. Mgr.:* R. Scherr ..... **C•1110-1111**

TDK

FAX: 708-803-6296

TDK CORPORATION OF AMERICA, Electronic Components & Material, 1600 Feehanville Drive, Mount Prospect, IL 60056, Tel: 708-803-6100; Empl.: 7,800; *Sls. Mgr.:* Tadashi Enami; *Dist. Mgr.:* Tadashi Enami (TDK Corp. of America) .... **A•1144-1147, 1273, 1294-1299, 1597, 1644-1645; D•1066, 2069**

Local Sales Offices & Reps

AL Huntsville, TDK Corp. of America 205-464-0222
CA San Jose, TDK Corp. of America 408-437-9585
CA Torrance, TDK Corp. of America 213-539-6631
IL Mt. Prospect, TDK Corp. of America ... 708-803-6100
IN Indianapolis, TDK Corp. of America ... 317-872-0370
MA Southborough, TDK Corp. of America 508-624-4262
MI Livonia, TDK Corp. of America 313-462-1210
NJ New Jersey, MH & W Intl. Corp. 201-891-8800
NJ West Orange, TDK Corp. of America .. 201-736-0023
NY Port Washington, TDK Corp. of America 516-625-0151
NC Greensboro, TDK Corp. of America ... 919-292-0012
TX Irving, TDK Corp. of America 214-506-9800
Can Ontario, MH & W Intl. Corp. 416-676-9401

TDS, Tang Ind., 1965 Pratt Blvd., Elk Grove Village, IL 60007, Tel: 1-800-323-6648, 312-806-7240, FAX: 312-806-7222

TEAL ELECTRONICS CORPORATION, 9190 Camino Santa Fe, San Diego, CA 92121, Tel: 619-693-6000, 800-888-8325, FAX: 619-693-8325; Empl.: 50; *Sls. Mgr.:* Stephanie Kaupp

TEAM SYSTEMS, Div. of Toyo Spectrum, 2934 Corvin Dr., Santa Clara, CA 95051, Tel: 408-720-8877, TELEX: 297584 TEAM UR, FAX: 408-720-9643; Empl.: 6; *Sls. Mgr.:* Bill Nicklin

TEAPO ELECTRONIC CORP. OF AMERICA, 5550 Peachtree Inds. Blvd., Norcross, GA 30071, Tel: 404-449-6220, FAX: 404-447-1109,404-448-8584; Empl.: 1000; *Sls. Mgr.:* Michael Lin

TECA, THERMOELECTRIC COOLING AMERICA CORP., 448 N. Halsted St., Chicago, IL 60622, Tel: 312-666-1600, FAX: 312-666-3964; Empl.: 50 ..... **C•1664-1665**

Local Distributors

EXP Hamburg, Germany, BWD Automotive, GMBH 040-24-67-54
Can Sudbury, Ont., Avad Indl. Sls. 705-897-2584

TECCOR ELECTRONICS INC
A SIEBE COMPANY

FAX: 214-550-1309

TECCOR ELECTRONICS, INC., 1801 Hurd Dr., Irving, TX 75038, Tel: 214-580-1515, TELEX: 79-1600; Empl.: 1250; *Sls. Mgr.:* Gerry Wiley ..... **A•2122-2125**

Local Sales Offices & Reps

AL Daphne, Interep Assocs. 205-478-1036
AL Huntsville, Interep Assocs. 205-881-1096
AZ Mesa, System Sls. of Az.(SSA) 602-464-9989
CA San Diego, O'Donnell Assocs. 619-578-1645
CA San Jose, O'Donnell North 408-456-2950
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Littleton, Harthun Assocs. 303-795-5545
CT Bridgeport, Advanced Comp. Sls. (ACS) 203-332-1124
FL Boca Raton, Perrott Assocs. 407-362-0191
FL Casselberry, Perrott Assocs. 407-830-0094
FL Clearwater, Perrott Assocs. 813-530-5779
FL Melbourne, Perrott Assocs. Inc. 407-676-0305
GA Norcross, Interep Assocs. 404-449-8680
IL Itasca, Micro Sls.(MSI) 708-285-1000
IN Huntington, Elctrn. Rep, Inc. 219-356-3513
IN Indianapolis, Elctrn. Rep, Inc. 317-894-1414
IA West Des Moines, SPS Assocs. Ltd. .. 515-225-0607
KS Olathe, SPS Assocs. Ltd. 913-764-4460
KS Wichita, SPS Assocs. Ltd. 316-733-4415
KY Lexington, Elctrn. REP, Inc. 606-273-8425
MA Still Water, JEF Comps. 508-456-3369
MA Walpole, JEF Components 508-668-6695
MI Farmington Hills, Rathsburg Assocs. .. 313-489-1500
MN Minneapolis, Electric Comp. Sls. 612-933-2594
MO Earth City, SPS Assocs. Ltd. 314-291-0520
NJ Mt. Laurel, S-J South Assocs. 609-866-1234
NM Albuquerque, Sys. Sls. of NM (SSA) .. 505-889-2901
NY Canandaigua, Bensman/Upstate Assocs. 716-396-2498
NY Lewiston, Bensman/Upstate Assocs. 716-754-9155
NY Rockville Centre, S-J Assocs. Inc. 516-536-4242
NC Raleigh, Godwin Assocs. 919-878-8000
OH Cleveland, Del Steffen & Assocs. 216-461-8333
OH Dayton, Del Steffen & Assocs. 513-293-3145
OH Lexington, Del Steffen & Assocs. 419-884-2313
PA Carnegie, Del Steffen & Assocs. 412-276-7366
TN Greenville, Interep Assocs. Inc. 615-639-3491
TX Irving, Mike Farrar 214-580-1515
NE Panama, SPS Assocs. Ltd. 402-477-7227
VA Falls Church, S-J Chesapeake 703-533-2233
NC Charlotte, Godwin Assocs. 704-549-8500
WA Lynnwood, Quadra Sls. 206-743-2633
WI Wauwatosa, Larsen Assocs. 414-258-0529
Can Concord, Ont., Astec Comps. 416-669-4022
Can Pierrefonds, Que., Astec Comps. 514-683-5473

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Arizona Comp. Co.	602-269-5655
CA	Hayward, Electro Comp. Distrs.	415-783-5800
CA	Santee, Mouser Elctrns.	619-449-2220
CA	Tustin, Added Value Elect.	714-259-8258
CT	East Haven, JV Elctrns.	203-469-2321
CT	Killingsworth, ACI Elctrns.	203-663-3311
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, Hammond Elctrns.	404-449-1996
CO	Wheat Ridge, Added Value Rcky. Mtns.	303-422-1701
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
LA	Baton Rouge, Indl. Elctrns. Supp.	504-357-4249
LA	Shreveport, Indl. Elctrns. Supp.	318-222-9459
MD	Savage, Pyttronic Inds.	301-953-9650
MA	Woburn, ACI Elctrns.	617-935-7230
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	St. Paul, Gopher Elctrns.	612-483-3322
MN	Thief River Falls, Digi-Key	800-344-4539
NE	Lincoln, Scott Elctrns.	402-466-8221
NJ	Bloomfield, Solid State Inc.	201-429-8700
NJ	Randolph, Mouser Elctrns	201-328-3322
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Penn Yan, Advacom	315-536-7221
NY	Plainview, ACI Elctrns.	516-293-6630
NC	Greensboro, Hammond Elctrns.	919-275-6391
OR	Portland, Radar Elec.	503-232-3404
PA	Export, Advacom Inc.	412-325-7551
PA	McKean, Advacom Inc.	814-476-7774
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
SC	Greenville, Hammond Elctrns.	803-233-4121
TX	Dallas, Omni Pro Intl. Inc.	214-233-9368
TX	Mansfield, Mouser Elctrns.	817-483-4422
UT	West Valley City, Added Value (AVED)	801-975-9500
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Burnaby, BC, RAE Indl. Elctrns. Ltd.	604-291-8866
Can	Calgary, Alberta, Cardinal Ind Elctrns.	403-259-6817
Can	Edmonton, Alberta, Cardinal IND Elctrns.	403-483-6266
Can	London, Ont., Peterson Co., CM	519-434-3204
Can	Montreal, Que, Electronic Wholesalers	514-769-8861
Can	Saskatoon, Sask., Cardinal Ind. Elctrns.	306-934-3443
Can	Willowdale, Ont., Electro Sonic Inc.	416-494-1666

TECHDYNE, INC., Lance Wire & Cable Div., 380 Treadwell St., Hamden, CT 06514, Tel: 203-288-5571, TWX: 510-601-0470, FAX: 203-248-0256; Empl.: 50; *Sls. Mgr.:* Bill Kahler

TECH-ETCH, INC., 45 Aldrin Rd., Plymouth, MA 02360, Tel: 508-747-0300, TELEX: 989997, FAX: 508-746-9639; Empl.: 280; *Sls. Mgr.:* P. A. Thomas

TECH LABORATORIES INC., 500 10th St., Palisades Pk., NJ 07650, Tel: 201-944-2221, FAX: 201-944-1653; FSC No.: 83332; Empl.: 25; *Sls. Mgr.:* Nino M. Vlacich ..... **B•1789**

Local Sales Offices & Reps

CA	Canoga Park, C & W Compents Sls.	818-700-2684
CA	Mtn. View, Bridge Mktg.	415-965-8045
IL	Glenview, Crimson Engrg. Co.	312-470-0024
KS	Lenexa, Midtec Assocs.	913-541-0505
MA	Norwood, Components Mktg. Svc.	617-762-4339
MI	Jackson, N. Scroggs Co.	517-750-1170
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Whippany, Ken L. Love Assocs.	201-540-0204
NY	Fairport, Net Sls.	716-223-1030
NY	Hempstead, Ken L. Love Assocs.	516-681-3155
OH	Cincinnati, Patco	513-931-3311
SC	Myrtle Beach, Candor Co. Inc.	803-448-8361
TX	Dallas, Southwest Elctrns.	214-690-9881
TX	Houston, Southwest Elctrns.	713-729-1670

TECHLAND BLUELYNX, P.O. Box 877, Cumberland, MD 21502, Tel: 800-832-4526, TELEX: 961-134, FAX: 301-777-3307; *Sls. Mgr.:* Janine Filion

FAX: 213-827-2572

TECHMAR CORP., 5420 McConnell Ave., Los Angeles, CA 90066, Tel: 213-827-8897, 1-800-TECHMAR; FSC No.: 32597; Empl.: 12; *Sls. Mgr.:* Jeff Wilson ... **C•1113-1115**

TECHMATION, INC., 2730 South Hardy, Ste. 5, Tempe, AZ 85282, Tel: 602-968-9946, FAX: 602-968-1849

TECHNAR, INC., See TRW Technar, Inc.

TECHNIC, INC., Box 9650, Providence, RI 02940-9650, Tel: 401-781-6100, TELEX: 927514, FAX: 401-781-2890; Empl.: 125; *Sls. Mgr.:* Andrew T. Ferris

TECHNICAL DEVICES, 560 Alaska Ave., Torrance, CA 90503, Tel: 213-618-8437, FAX: 213-618-1543; FSC No.: 04772; Empl.: 45; *Sls. Mgr.:* D. Murrin; *Dist. Mgr.:* D. Murrin

TECHNICAL MARKING SYS., See Autoroll Machine Corp.

TECHNICAL PANELS, INC., 9162 La Rosa Dr., Temple City, CA 91780, Tel: 800-343-1170, 818-285-3105, FAX: 818-287-0420; Empl.: 14

Local Sales Offices & Reps

CA	San Jose, McFarland Assocs. Corp.	408-993-0200
CA	Carlsbad, Zerimar Sls.	619-436-3379
IL	Mundelein, Northpoint Technlgs.	708-566-7999
NJ	Pt. Pleasant, Jade Mktg.	201-899-7265
MN	Wayzata, Cardinal Sls.	612-475-0042
RI	Warwick, Schumacher & Yarrington	401-884-5671
OH	Chagrin, Crest Comp. Sls.	216-543-9808

TECHNICAL RESEARCH & MFG., INC., See TRM, Inc.

TECHNICAL SERVICES LABORATORY INC., 95 Ready Ave., Ft. Walton Beach, FL 32548, Tel: 904-243-3722, FAX: 904-244-6653; FSC No.: 51283; Empl.: 24; *Sls. Mgr.:* Andrew J. Corbin

TECHNIPOWER, A PENRIL CO., P.O. Box 222, Commerce Pk., Danbury, CT 06813, Tel: 203-748-7001, TELEX: 710-456-9280, FAX: 203-797-9285; FSC No.: 13850; Empl.: 135; *Sls. Mgr.:* L. Carbone; *Dist. Mgr.:* Larry Carbone

TECHNIQUES, INC., 235 Jackson St., Englewood, NJ 07631, Tel: 201-569-5900, FAX: 201-569-5615; Empl.: 60

TECHNI-TOOL, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462, Tel: 215-825-4990, TELEX: 834-763, FAX: 215-828-5623; FSC No.: 30239; Empl.: 80; *Sls. Mgr.:* W. Bezar

TECHNITROL, 1952 E. Allegheny Ave., Philadelphia, PA 19134, Tel: 215-426-9105, FAX: 215-426-2836; FSC No.: 90095; Empl.: 900; *Sls. Mgr.:* G. Shilling ..... **A•1598-1605; B•1028-1029**

Local Sales Offices & Reps

CA	Livermore, United Techn. Mktg.	415-449-7644
AZ	Phoenix, Detomasi & Grupp	602-947-3724
CA	Mission Hills, Detomasi & Grupp	818-365-8285
CA	San Diego, Detomasi & Grupp	619-277-0178
CA	Torrance, Detomasi & Grupp, Inc.	213-618-8898
AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
GA	Norcross, Advanced Comps.Mktg.	404-448-7025
IL	Wauconda, Cudahy Sls.	708-526-2484
MD	Baltimore, Callas Elctrns.	301-744-7711
NY	Fairport, TAC Sls.	716-377-2250
NY	Jericho, J. Square Mktg.	516-935-3200
OH	Akron, Augnat Assocs.	216-239-2499
FL	Seminole, Q-Rep	813-397-8431
PA	Easton, The Kendon Co.	215-253-3100
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-Rep	713-988-7613
Can	Quebec, Elcom GbM, Inc.	514-668-3361

TECHNO DIVISION, DALE ELECTRONICS, INC., 7803 Lemona Avenue, Van Nuys, CA 91405-1139, Tel: 818-781-1642, FAX: 818-781-8647; FSC No.: 69274; Empl.: 140; *Sls. Mgr.:* Danny Jagirdar; *Dist. Mgr.:* Jon Trabert ..... **A•2037**

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TECHNO-ISEL USA DIVISION, Designatronics, 2101 Jericho Tunpike, New Hyde Park, NY 11040, Tel: 516-328-3970, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 85; *Sls. Mgr.:* Sam Singer

TECHNOLOGY DESIGN INC., 10838 Main St., Bellevue, WA 98006, Tel: 206-455-9822, FAX: 206-455-3449; Empl.: 16; *Sls. Mgr.:* Robert Hamilton

TECHNOLOGY DYNAMICS inc.

FAX: 201-385-0702

TECHNOLOGY DYNAMICS INC., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 70; *Sls. Mgr.:* Mark S.Jacobus

TECHNOLOGY 80, INC., 658 Mendelssohn Ave. N., Minneapolis, MN 55427, Tel: 612-542-9545, FAX: 612-542-9785; Empl.: 25; *Sls. Mgr.:* James Burkett

TECHRAND CORP. OF AMERICA, 6520 Schamber Dr., Muskegon, MI 49444, Tel: 616-798-2930, FAX: 616-798-2934; Empl.: 40; *Sls. Mgr.:* James Arter

TECHRON.

FAX: 1-219-294-8329

TECHRON DIV., Crown Intl., Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517, Tel: 219-294-8300, TWX: 810-294-2160; FSC No.: 06306; Empl.: 490 ..... **D•1017-1019**

Local Sales Offices & Reps

IL	Arlington Hgts., Berndt Assocs., Inc.	312-632-0900
CA	Milpitas, IFM Inc.	408-945-5920
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Woodbridge, Electronic Marketing Assoc.	203-397-1461
FL	Melbourne, Reynolds & Assocs., Inc.	305-259-7000
IL	Chicago, Berndt Assocs.	312-283-0713
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
NY	Syracuse, Labtronics Inc.	315-455-7314
OH	Brecksville, Audio Mktg. Assoc.	216-526-2426
PA	Montgomeryville, Eastern Sci-Mktg.	215-368-4570

TECH SPRAY, INC., Box 949, Amarillo, TX 79105, Tel: 806-372-8523, TELEX: 738450, FAX: 806-372-8750; Empl.: 58; *Sls. Mgr.:* Richard C. Johnson; *Dist. Mgr.:* Rich Johnson

TECHTROL CYCLONETICS, INC., 815 Market St., New Cumberland, PA 17070, Tel: 717-774-2746, FAX: 717-774-6799; FSC No.: 58792; Empl.: 15; *Sls. Mgr.:* James M. Griffith

TECKNIT (EASTERN FACILITY), 129 Dermody St., Cranford, NJ 07016, Tel: 908-272-5500, TELEX: 6853079 TCKNT, FAX: 908-272-2741; FSC No.: 07700; Empl.: 300; *Sls. Mgr.:* Thomas McCreery

TECLAB, Kalamazoo Technical Furniture, P.O. Box 1165, Kalamazoo, MI 49005, Tel: 616-372-6000, 800-832-5227, FAX: 616-372-6116; Empl.: 42; *Sls. Mgr.:* B. Smith ..... **C•1117-1119**

TECNETICS, See Computer Products, Inc.

TECNETICS INC., Computer Products, 6287 Arapahoe Ave., Boulder, CO 80303, Tel: 303-442-3837, FAX: 303-444-9437; Empl.: 135; *Sls. Mgr.:* Cliff Payne

Refer to Tecnetics Inc. 6287 Arapaho Ave. Boulder, CO 80303

TECO CORP., Bay Rd., P. O. Box A, Winnisquam, NH 03289, Tel: 603-524-1998, FAX: 603-524-1899; Empl.: 30; *Sls. Mgr.:* Sandra Murphy

TECOM INDUSTRIES, INC., 9324 Topanga Canyon Blvd., Chatsworth, CA 91311, Tel: 818-341-4010, TELEX: 69 8476, FAX: 818-718-1402; FSC No.: 59850001; Empl.: 134

TECTROL INC
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TECTROL, INC., 39 Kodiak Cres., Downsview, Ontario, Canada M3J 3E5, Tel: 416-630-8108; Empl.: 450; *Sls. Mgr.:* Paul Carroll ..... **D•2071-2074**

Local Sales Offices & Reps

CA	San Diego, Mesa Comps.	619-278-8021
CA	Cupertino, PEI Sls. Assoc.	408-253-1960
IL	Chicago, Century Elctrns. Corp.	312-777-9700
CT	Bloomfield, Zaslow Sls.	203-242-7781
MA	Natick, Zaslow Sls.	508-393-8150
MN	S.St. Paul, Northport Engrg., Inc.	612-457-8000
NJ	Ho-Ho-Kus, Alto Assocs.	201-447-1770
NY	Buffalo, Lynn Assocs.	716-631-0054
OH	Dayton	513-890-6811
OR	Tigard, Rep-West	503-639-0325
PA	Pittsburgh, Lynn Assocs.	412-443-3670
TX	Richardson, Interactive Comp. Sls.	214-669-2277
WA	Seattle, Rep-West	206-283-8351
WI	Wauwatosa, Larsen Assocs., Inc.	414-258-0529
Can	Downsview, Ont., Tectrol Inc.	416-630-8108

Local Distributors

CA	San Jose, Delta Lu Research	408-453-0490

TEGAL SCIENTIFIC, INC., Box 5905, Concord, CA 94524, Tel: 415-827-1054, TELEX: 380053, FAX: 415-827-1189; *Sls. Mgr.:* L. Rigali

TEGAM, INC., 7230 North Ridge Rd., Madison, OH 44057, Tel: 800-666-1010, TELEX: 205188, FAX: 216-428-7505; Empl.: 30; *Sls. Mgr.:* Gerry Hubbard

TEKA INTERCONNECTION SYSTEMS, INC.

FAX: 401-461-2310

TEKA INTERCONNECTION SYSTEMS, 45 Salem Dr., Providence, RI 02907, Tel: 401-785-4110; Empl.: 89; *Sls. Mgr.:* Barry Manchester; *Dist. Mgr.:* Barry Manchester ..... **C•1544-1549**

Local Sales Offices & Reps

OH	Dayton, Shamrock Elctrns.	513-258-1227
AL	Huntsville, Total Circuits	205-881-4000
MO	Blue Springs, Atronics	816-224-2131
AZ	Tempe, Spectrum Assocs. S.W. Inc.	602-966-1788
CA	Downey, Management Mktg. & Sls.	213-560-5584
CA	San Diego, Qualtronics	619-695-0118
CA	Sunnyvale, W. W. Posey Co.	408-746-0771
CO	Boulder, R.G. Entprs., Inc.	303-447-9211
IL	Arlington Hgts., Russell Elctrns.	708-394-5560
MA	Danvers, C.H. Burnham Assoc.	508-774-0111
MN	Wayzata, Cardinal Sls.	612-475-0041
NY	Hauppauge, Sticom Sls. & Mktg.	516-366-4221
NC	Matthews, R.G. Sls.	704-847-0049
OR	Aloha, Norwest Interconnect Sys.	503-649-7714
PA	Mt. Laurel, Wyck Mkt. Inc.	215-677-7790
TX	Houston, Mil-Rep Assocs.	713-444-2557
EXP	Huntington Beach, Intercation Inc.	714-636-3722
Can	St. Laurent, Que., HHR	514-739-7054

Local Distributors

CA	Hayward, KEA Elctrns.	415-887-2900
CA	Irvine, Mann Southwest	714-380-4170
CA	San Jose, Compass Comp.	408-432-7575
CA	San Jose, Spectra Elec.	1-800-252-1590
CA	Santa Ana, Norstan Elctrns.	800-854-8344
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Kent Elec.	408-727-9810
MA	Andover, Aved Elctrns.	617-688-3800
MA	Canton, E.P.C., Inc.	617-821-2111
MI	Roseville, Madsion Elctrns.	313-778-7640
MN	St. Paul, Shelley-Ragon, Inc.	612-642-2844
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Ronkonkoma, Conco Elctrns.	516-467-8200
NC	Raleigh, Resco Raleigh	919-781-5700
OH	Centerville, I.P.D., Inc.	513-435-2086
RI	Warwick, AL Greg Comp. Inc.	401-738-6170
TX	Allen, Prime Distbn.	214-231-0170
TX	Dallas, Cypress Elctrns.	214-869-1435
WA	Seattle, Shelley Ragon, Inc.	206-241-1980
Can	Burlington, Ont., Alternate Source Comp.	416-335-6385

TEK-COM /PRENTICE CORP., 2343 Bering Dr., San Jose, CA 95131, Tel: 408-435-9515, TELEX: 277216, FAX: 408-435-9514; FSC No.: 72242; Empl.: 23; *Sls. Mgr.:* Garry Stoddard

TEKNATIONAL INDS., INC., 430 S. Clinton Ave., Rochester, NY 14620-1103, Tel: 716-232-1291, FAX: 716-232-1295; FSC No.: 24227; Empl.: 15; *Sls. Mgr.:* J. D. Hochheimer

TEKTONE SOUND & SIGNAL, 1331 S. Killian Dr., Lake Park, FL 33403, Tel: 407-844-2383, FAX: 407-845-1587; FSC No.: 59-1500771; Empl.: 70; *Sls. Mgr.:* Carlos Mira; *Dist. Mgr.:* Carlos Mira

TEKTRONIX, INC., P.O. Box 500, Beaverton, OR 97077, Tel: 800-835-9433, TWX: 910-467-8708; FSC No.: 80009; Empl.: 12,500

TEKTRONIX, INC., Display Products, P.O. Box 500 M/S 46-943, Beaverton, OR 97077, Tel: 503-627-5000, FAX: 503-627-1070

TEKTRONIX-SIGNAL ANALYSIS UNIT, 1350 Dell Ave., No. 104, Campbell, CA 95008, Tel: 408-374-6464, FAX: 408-374-6467; *Sls. Mgr.:* Jim Searles

TEKWORKS, INC., 72 Redner Rd., Morristown, NJ 07960, Tel: 201-540-1096, FAX: 201-540-9412; Empl.: 2; *Sls. Mgr.:* David A.H. Robinson

TELCO INTERCONTINENTAL, 9812 Whithorn Dr., Houston, TX 77095, Tel: 713-855-2218, FAX: 713-859-8825; Empl.: 12; *Sls. Mgr.:* Ruth Haber

TELCOM INTERNATIONAL, INC., See Hadron, Inc.

TELEBYTE TECHNOLOGY, INC., 270 East Pulaski Road, Greenlawn, NY 11740, Tel: 516-423-3232, 800-835-3298, FAX: 516-385-8184; Empl.: 48; *Sls. Mgr.:* J. Kramer; *Dist. Mgr.:* R. Nazario

TELECOMMUNICATIONS TECHNIQUES CORP., 20410 Observation Drive, Germantown, MD 20876, Tel: 301-353-1550, FAX: 301-353-0734

TELECTRO SYSTEMS CORP., 96-18 43rd Ave., Corona, NY 11368, Tel: 718-651-8900, TWX: 510-601-8607 TELECTRO, FAX: 718-651-4103; FSC No.: 30040; Empl.: 50; *Sls. Mgr.:* Harry Sussman

TELE-DENKEN RESOURCES, INC., 7702 FM 1960 East, Ste. 300, Humble, TX 77346, Tel: 713-852-5366, TELEX: 4949653, FAX: 713-852-3869; *Sls. Mgr.:* Gary Killian; *Dist. Mgr.:* Gary Killian

TELEDYNE AEROSPACE SYS., 1007 E. 10th St., Fairmont, MN 56031, Tel: 507-235-3355, FAX: 507-235-6088; FSC No.: 24600; Empl.: 230; *Sls. Mgr.:* Robert L. Johnson

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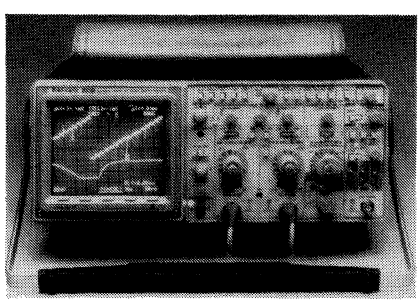

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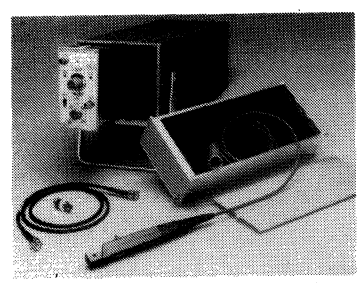

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TELEDYNE CRYSTALONICS, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140, Tel: 617-491-1670, TWX: 710-320-1196, FAX: 617-547-6119; FSC No.: 12498;Multiple; *Dist. Mgr.:* W. J. Kilgarriff

TELEDYNE GURLEY, 514 Fulton St., P.O. Box 88, Troy, NY 12181, Tel: 518-272-6300, 800-759-1844, TWX: 710-443-8156, FAX: 518-274-3660; *Sls. Mgr.:* G. S. Gordon

TELEDYNE INET, Teledyne, Inc., 2750 W. Lomita Blvd., Torrance, CA 90506, Tel: 213-325-5040, TELEX: 67-7228, FAX: 213-534-2274; FSC No.: 90911; *Sls. Mgr.:* Fred Tamjidi

TELEDYNE KINETICS, Div. of Teledyne, Inc., 410 S. Cedros Ave., Solana Beach, CA 92075, Tel: 619-755-1181, TELEX: 62877770; FSC No.: 06928; Empl.: 100; *Sls. Mgr.:* John Schuler

TELEDYNE MICROELECTRONICS, 12964 Panama St., Los Angeles, CA 90066, Tel: 213-822-8229, 213-870-9831, TWX: 910-343-7436, FAX: 213-305-0248; FSC No.: 16170; Empl.: 950; *Sls. Mgr.:* W. Kennedy

TELEDYNE MICROWAVE, 1290 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-968-2211, FAX: 415-966-1521; FSC No.: 24022; Empl.: 350; *Sls. Mgr.:* M. Lee

TELEDYNE RELAYS

FAX: 213-779-9161

TELEDYNE RELAYS, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077, TWX: 910-321-4610; FSC No.: 11532; *Sls. Mgr.:* Tom Garland ..... **B•1604-1612**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	San Jose, Teledyne Relays	408-978-8899
CT	Stratford, VISTAssociates, Inc.	203-375-5456
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
FL	Longwood, Teledyne Relays	407-682-9044
FL	Winter Pk., HHP Assocs., Inc.	407-740-0320
GA	Norcross, Advanced Comps. Mktg.	404-448-7025
IL	Bloomingdale, Teledyne Relays	708-529-1060
IA	Cedar Rapids, Stan Clothier Co.	319-365-1717
KS	Olathe, Stan Clothier Co.	913-829-0073
MD	Towson, Arbotek Assocs.	301-825-0775
MA	Marlborough, VISTAssociates	508-481-9277
MN	Eden Prairie, Stan Clothier Co.	612-944-3456
MO	St. Louis, Rothkoph & Assocs.	314-961-4485
NJ	Cranford, Teledyne Relays	201-272-0020
NM	Albuquerque, Reptronix	505-292-1718
NY	Mount Vernon, Friedman-Smith Elctrns.	914-664-4866
NY	Syracuse, Hotze & Murcan Assoc.	315-455-8807
Can	Truro, Nova Scotia, Deskin Sls.	902-893-9228
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J.C. Hofstetter Co.	216-241-4880
NJ	Cherry Hill, Vantage Sls.	609-424-6777
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
TX	Austin, Kruvand Assocs.	512-346-8579
TX	Dallas, Kruvand Asso.	214-437-3355
WA	Houston, Kruvand Assocs.	713-956-6741
UT	Salt Lake City, Thorson Rocky Mtn.	801-973-7969
WA	Seattle, TEKREP	206-286-2047
Can	Calgary, Alb., Deskin Sls.	403-270-4440
Can	Edmonton, Alb., Deskin Sls.	403-466-2106
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Nepean, Deskin Sls.	613-228-1201
Can	St. Laurent, Que., Deskin Sls.	514-331-2860
Can	Transcona, Man., Deskin Sls.	403-466-2106
Can	Vancouver, Deskin Sls.	604-324-8343

Local Distributors

AL	Huntsville, Time Elctrns.	205-721-1133
CT	Norwalk, Pioneer/CT	203-853-1515
AL	Huntsville, Pioneer/Alabama	205-837-9300
AZ	Tempe, Time-Arizona	602-967-2000
CA	Camarillo, Milgray/Los Angeles	805-484-4055
CA	Chatsworth, Time Elctrns.	818-998-7200
FL	Clearwater, Pioneer/Clearwater	813-536-0445
FL	Deerfield Bch., Pioneer/Deerfield Bch.	305-428-8877
CA	Irvine, Milgray/Orange County	714-753-1282
CA	San Diego, Time Elctrns.	619-586-0129
CA	San Jose, Pioneer/San Jose	408-495-9100
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Tustin, Time Elctrns.	714-669-0100
CO	Englewood, Time Elctrns.	303-799-8851
CT	Norwalk, Pioneer/Connecticut	203-853-1515
CT	Milford, Milgray/Conn.	203-878-5538
FL	Altamonte Springs, Pioneer/Altamonte Spgs.	407-834-9090
WI	Brookfield, Pioneer Wisconsin	414-784-3480
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Orlando, Time Elctrns.	407-841-6565
FL	Winter Pk., Milgray/Fla.	407-647-5747
NY	Woodbury, Pioneer Woodbury	516-921-8700
GA	Atlanta, Electro-Air-Georgia	404-351-3545
GA	Atlanta, Milgray/Atlanta	404-446-9777
NY	Binghamton, Pioneer Binghamton	607-772-9300
GA	Norcross, Pioneer/Norcross	404-448-1711
GA	Norcross, Time Elctrns.	404-368-0969
IL	Addison, Pioneer/Chicago	708-495-9680
IL	Palatine, Milgray/Chicago	708-202-1900
IL	Schaumburg, Time Elctrns.	708-303-3000
IN	Indianapolis, Pioneer/Indianapolis	317-573-0880
KS	Overland Pk., Milgray/Kansas City	913-236-8800
MD	Columbia, Milgray/Wash.	301-621-8169
MD	Columbia, Time Elctrns.	301-964-3090
MA	Lexington, Pioneer/Mass.	617-861-9200
MA	Peabody, Time Elctrns.	508-532-9900
MA	Wilmington, Milgray/New England	508-657-5900
MI	Grand Rapids, Pioneer Western Mich.	616-698-1800
MI	Livonia, Pioneer/Mich.	313-525-1800
MN	Eden Prairie, Pioneer Twin Cities	612-944-3355
MN	Edina, Time Elctrns.	612-835-1250
MO	Manchester, Time Elctrns.	314-391-6444
MO	St. Louis, Pioneer St. Louis	314-432-4350
NJ	Fairfield, Pioneer NJ	201-575-3510
NJ	Marlton, Milgray/Delaware Valley	609-983-5010
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Parsippany, Milgray/New Jersey	201-335-1766
NY	Buffalo, Summit Dist.	716-887-2800
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Farmingdale, Milgray Elctrns.	516-391-3000
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Pittsford, Milgray/Rochester	716-381-9700
NY	Rochester, Summit Dist.	716-334-8110
NY	Fairport, Pioneer Rochester	716-381-7070
OH	Cleveland, Milgray/Cleveland	216-447-1520
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Columbus, Time Elctrns.	614-794-3301
OH	Dayton, Pioneer/Dayton	513-236-9900
OR	Portland, Time Elctrns.	503-684-3780
PA	Horsham, Pioneer/Delaware Valley	215-674-4000
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300
TX	Austin, Pioneer	512-835-4000
TX	Austin, Time Elctrns.	512-346-7346
TX	Austin, Wyle	512-834-9957
TX	Dallas, Milgray/Dallas	214-248-1603
TX	Dallas, Pioneer/Dallas	214-386-7300
TX	Houston, Pioneer/Houston	713-495-4700
TX	Richardson, Time Elctrns.	214-644-4644
TX	Stafford, Milgray/Houston	713-240-5360
UT	Salt Lake City, Milgray/Utah	801-272-4999
UT	W. Valley City, Time Elctrns.	801-973-8494
Can	Pointe Claire, Que., Milgray/Montreal	514-426-5900
WA	Redmond, Time Elctrns.	206-882-1600
Can	Calgary, Alb., Deskin Sls.	403-270-4440
Can	Edmonton, Alb., Deskin Sls.	403-466-2106
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Mississauga, Ont., Time Elctrns. of Can., Inc.	416-572-5300
Can	Nepean, Deskin Sls.	613-228-1201
Can	St. Laurent, Que., Deskin Sls.	514-331-2860
Can	Transcona, Man., Deskin Sls.	204-224-1321
Can	Truro, Nova Scotia, Deskin Sls.	902-893-9228
Can	Vancouver, BC, Deskin Sls.	604-324-8343
Can	Willowdale, Ont., Milgray Elctrns.	416-756-4481

TELEDYNE ROTOLITE, P.O. Box 398, Owen, WI 54460, Tel: 800-524-0105, TWX: 710-986-3017; *Sls. Mgr.:* J. F. Stickel

TELEDYNE RYAN ELECTRONICS, 8650 Balboa Ave., San Diego, CA 92123, Tel: 619-560-6400, TELEX: 695-028, TWX: 910-335-1174, FAX: 619-560-1147; Empl.: 400; *Sls. Mgr.:* J.E. Wallin

FAX: 213-779-9161

TELEDYNE SOLID STATE, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250; Tel: 213-777-0077, TWX: 910-321-4610; FSC No.: 63745; *Sls. Mgr.:* Tom Garland ..... **B•1604-1612**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	San Jose, Teledyne Solid State	408-978-8899
CO	Englewood, Thorson Rocky Mtn.	303-799-3435
CT	Stratford, VISTAssociates	203-375-5456
FL	Longwood, Teledyne Relays/Teledyne Solid State	407-682-9044
FL	Winter Pk., HHP Assocs., Inc.	407-740-0320
GA	Norcross, Advanced Comps. Mktg.	404-448-7025
IL	Bloomingdale, Teledyne Solid State	708-529-1060
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
IA	Cedar Rapids, Stan Clothier Co.	319-365-1717
KS	Olathe, Stan Clothier Co.	913-829-0073
MD	Towson, Arbotek Assocs.	301-825-0775
MA	Marlborough, VISTAssociates	508-481-9277
MN	Eden Prairie, Stan Clothier Co.	612-944-3456
MO	St. Louis, RothKopf & Assocs.	314-961-4485
NJ	Cranford, Teledyne Solid State	201-272-0020
NM	Albuquerque, Reptronix	505-292-1718
NY	Mount Vernon, Friedman-Smith Elctrns.	914-664-4866
NY	Syracuse, Hotze & Murcan Associates	315-455-8807
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
NJ	Cherry Hill, Vantage Sls.	609-424-6777
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
TX	Austin, Kruvand Assocs.	512-346-8579
TX	Dallas, Kruvand Assocs.	214-437-3355
TX	Houston, Kruvand Assocs.	713-956-6741
UT	Salt Lake City, Thorson Rocky Mtn.	801-942-1683
WA	Seattle, Tekrep Elec.	206-286-2047
Can	Calgary, Alb., Deskin Sls.	403-290-4440
Can	Edmonton, Alb., Deskin Sls.	403-466-2106
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Nepean, Deskin Sls.	613-228-1201
Can	St. Laurent, Que., Deskin Sls.	514-331-2860
Can	Transcona, Man., Deskin Sls.	204-224-1321
Can	Truro, Nova Scotia, Deskin Sls.	902-893-9228
Can	Vancouver, Deskin Sls.	604-324-8343

Local Distributors

AL	Huntsville, Pioneer/Alabama	205-837-9300
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Camarillo, Milgray/Los Angeles	805-484-4055
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Irvine, Milgray/Orange Ctny	714-753-1282
CA	San Diego, Time Elctrns.	619-586-0129
CA	San Jose, Pioneer/San Jose	408-954-9100
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Time Elctrns.	714-669-0100
CO	Englewood, Time Elctrns.	303-799-8851
CT	Milford, Milgray/Conn.	203-878-5538
CT	Norwalk, Pioneer/CT	203-853-1515
FL	Altamonte Spgs., Pioneer/Altamonte Spgs.	407-834-9090
FL	Clearwater, Pioneer/Clearwater	813-536-0445
FL	Deerfield Bch., Pioneer/Deerfield Bch.	305-428-8877
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Orlando, Time Elctrns.	407-841-6565
FL	Winter Pk., Milgray/Fla.	407-647-5747
GA	Atlanta, Electro-Air/Georgia	404-351-3545
GA	Duluth, Pioneer/Norcross	404-623-1003
GA	Norcross, Milgray/Atlanta	404-446-9777
GA	Norcross, Time Elctrns.	404-448-4448
GA	Norcross, Time Elctrns.	404-368-0969
IL	Addison, Pioneer/Chicago	708-495-9680
IL	Palatine, Milgray/Chicago	708-202-1900
IL	Schaumburg, Time Elctrns.	708-303-3000
IN	Indianapolis, Pioneer/Indiana	317-573-0880
KS	Overland Pk., Milgray/Kansas City	913-236-8800
MD	Columbia, Milgray/Wash.	301-621-8169
MD	Columbia, Time Elctrns.	301-964-3090
MD	Gaithersburg, Pioneer/Gaithersburg	301-921-0660
MA	Lexington, Pioneer/Mass.	617-861-9200
MA	Peabody, Time Elctrns.	508-532-9900
MA	Wilmington, Milgray/New England	508-657-5900
MI	Grand Rapids, Pioneer Western Michigan	616-698-1800
MI	Livonia, Pioneer/Mich.	313-525-1800
MN	Eden Prairie, Pioneer/Twin Cities	612-944-3355
MN	Edina, Time Elctrns.	612-835-1250
MO	Manchester, Time Elctrns.	314-391-6444
MO	St.Louis, Pioneer St. Louis	314-432-4350
NJ	Fairfield, Pioneer New Jersey	201-575-3510
NJ	Marlton, Milgray/Delaware Valley	609-983-5010
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Parsippany, Milgray/New Jersey	201-335-1766
NY	Birmingham, Pioneer/Binghamton	607-722-9300

NY Buffalo, Summit Dist. 716-887-2800
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Fairport, Pioneer/Rochester 716-381-7070
NY Farmingdale, Milgray/New York 516-391-3000
NY Haupauge, Time Elctrns. 516-273-0100
NY Pittsford, Milgray/Upstate New York .. 716-381-9700
NY Rochester, Summit Dist. 716-334-8110
NC Charlotte, Pioneer/Charlotte 704-527-8188
NC Durham, Pioneer/Durham 919-544-5400
NC Raleigh, Milgray/Raleigh 919-790-8094
NC Raleigh, Time Elctrns. 919-847-9650
NY Woodbury, Pioneer/Woodbury 516-921-8700
OH Cleveland, Milgray/Cleveland 216-447-1520
OH Cleveland, Pioneer/Cleveland 216-587-3600
OH Columbus, Time Elctrns. 614-794-3301
OH Dayton, Pioneer/Dayton 513-236-9900
OR Portland, Time Elctrns. 503-684-3780
PA Horsham, Pioneer/Delaware Valley Horsham 215-674-4000
PA Pittsburgh, Pioneer/Pittsburgh 412-782-2300
TX Austin, Pioneer/Austin 512-835-4000
TX Austin, Time Elctrns. 512-346-7346
TX Dallas, Milgray/Dallas 214-248-1603
TX Dallas, Pioneer/Dallas 214-386-7300
TX Houston, Pioneer/Houston 713-495-4700
TX Richardson, Time Elctrns. 214-644-4644
TX Stafford, Milgray/Houston 713-240-5360
UT Salt Lake City, Milgray/Utah 801-272-4999
WA Redmond, Time Elctrns. 206-882-1600
WI Brookfield, Pioneer/Wisconsin 414-784-3480
Can Calgary, Alb., Deskin Sls. 403-270-4440
Can Edmonton, Alb., Deskin Sls. 403-466-2106
Can Markham, Ont., Deskin Sls. 416-475-1412
Can Mississauga, Ont., Time Elctrns. of Canada, Inc. 416-572-5300
Can Nepean, Deskin Sls. 613-228-1201
Can Pointe Claire, Que., Milgray/Montreal 514-426-5900
Can St.Laurent,Que., Deskin Sls. 514-331-2860
Can Transcona, Man., Deskin Sls. 204-224-1321
Can Truro,Nova Scotia, Deskin Sls. 902-893-9228
Can Vancouver,B.C., Deskin Sls. 604-324-8343
Can Willowdale,Ont., Milgray Elctrns. 416-756-4481

TELEDYNE TABER, Teledyne Inc., 456 Bryant St. P.O. Box 164, N. Ton., NY 14120, Tel: 716-694-4000, 800-333-5300, TELEX: 710-262-1264, FAX: 716-694-1450; Empl.: 100; *Sls. Mgr.:* Bernie W. Daube

TELEDYNE THERMATICS, Teledyne Inds., Inc., P O Box 909, Elm City, NC 27822, Tel: 919-236-4311, ESYLNK: 62877220, FAX: 919-236-3613; FSC No.: 12515; *Sls. Mgr.:* J. H. Morris; *Dist. Mgr.:* J.H. Morris

TELEFUNKEN, See AEG Corp.

TELEGENIX, INC., Div. of Inductotherm Industries, P.O. Box 5550, Cherry Hill, NJ 08034, Tel: 609-424-5220, FAX: 609-424-0889; Empl.: 85

TELEMET, Geotel, Inc., 25 Davids Dr., Hauppauge, NY 11788, Tel: 516-436-7260, TWX: 510-227-9850, FAX: 516-436-7257; Empl.: 35; *Sls. Mgr.:* Paul H. Paulson III

TELENEX CORPORATION, A Unit of General Signal Corp., 13000 Midlantic Dr., Mt. Laurel, NJ 08054, Tel: 609-234-7900, FAX: 609-778-8700; Empl.: 400; *Sls. Mgr.:* Kirby Holmes, EVP-Mktg. & Sls.

TELEPACIFIC ELECTRONICS CO., INC., Pacific Vista Sys., 1261 Liberty Way, Vista, CA 92083, Tel: 619-598-6729, FAX: 619-598-9316; Empl.: 40; *Sls. Mgr.:* Rick Mulanix

TELEPHONICS CORPORATION/PRD INSTRUMENTS, 770 Park Avenue, Huntington, NY 11743, Tel: 516-549-6415/6428, TELEX: 510-222-4494, FAX: 516-549-6114; FSC No.: 78711, 9N770; Empl.: 22; *Sls. Mgr.:* Ronald Freedman

TELEPLEX, INC., Alford Division, 32 Sixth Rd., Woburn, MA 01801, Tel: 617-935-8610, FAX: 617-933-4512; FSC No.: 07177; Empl.: 20; *Sls. Mgr.:* Lois Clark, V.P.

TELEQUARZ-GMBH, See Raltron Electronics Corp.

TELESIS CONTROLS CORP., Box 5000, Chillocothe, OH 45601, Tel: 614-642-3200, FAX: 614-642-2037; Empl.: 61; *Sls. Mgr.:* Robert Perelman

TELE-TECH CORPORATION, P.O. Box 790, Bozeman, MT 59715, Tel: 406-586-0291, FAX: 406-587-0653; FSC No.: 62759; Empl.: 75; *Sls. Mgr.:* Robert E. Diggs

TELETERMINAL CORP., Greenland, NH 03840, Tel: 603-431-1200; Empl.: 13

TELEVISION EQUIPMENT ASSOCS., Box 393, So. Salem, NY 10590-0393, Tel: 914-763-8893, FAX: 914-763-9158; Empl.: 10

TELLUREX CORP., 1248 Hastings, Traverse City, MI 49684, Tel: 616-947-0110, FAX: 616-947-5821; Empl.: 16; *Sls. Mgr.:* Gregg Smith

TELONIC/BERKELEY, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652, Tel: 714-494-9401, FAX: 714-497-7331; FSC No.: 04423; Empl.: 50; *Sls. Mgr.:* Christopher Chrissie

TELPAR, INC., 4137 Billy Mitchell Rd., Box 796, Addison, TX 75001, Tel: 214-233-6631, TELEX: 73-2561, FAX: 214-233-8947; Empl.: 28; *Sls. Mgr.:* Bob Reynolds ..... **D•1117**

TELTEC, INC., 7890 12th Ave. S., Minneapolis, MN 55425, Tel: 612-854-9632, FAX: 612-854-8601; FSC No.: 57856; Empl.: 5; *Sls. Mgr.:* Victor Vachhani; *Dist. Mgr.:* Victor Vachhani

TELTRON, INC., 2 Riga Lane, Birdsboro, PA 19508, Tel: 215-582-2711, TELEX: 4990805, FAX: 215-582-0851; FSC No.: 28287; Empl.: 35; *Sls. Mgr.:* Clyde Mock

TEMESCAL/AIRCO COATING TECHNOLOGY, The BOC Group, Inc., 2700 Maxwell Way, Fairfield, CA 94533, Tel: 707-425-1010, FAX: 707-425-2986; Empl.: 200; *Sls. Mgr.:* Brian Kaemmer

TEMP-FLEX CABLE, INC., 11 Depot Street, S. Grafton, MA 01560, Tel: 508-839-5987, FAX: 508-839-4128; FSC No.: 0CGL7; Empl.: 48; *Sls. Mgr.:* Warren Persak

TEMPIL DIV., Big Three Inds., Hamilton Blvd., S. Plainfield, NJ 07080, Tel: 908-757-8300, TELEX: 138-662, FAX: 908-757-9273; Empl.: 38; *Sls. Mgr.:* A. P. Jeanguenin

TEMPO INSTRUMENT, INC., 87 Modular Ave., Commack, NY 11725, Tel: 516-864-3700, TWX: 510-226-3787, FAX: 516-864-2196; FSC No.: 07031; Empl.: 205; *Sls. Mgr.:* Len Lattanzi

TEMPOSONICS SENSORS DIVISION, MTS Sys. Corp., PO Box 13218, Research Triangle Park, NC 27709, Tel: 919-677-0100, FAX: 919-677-0200; *Sls. Mgr.:* Corey Minnich

TEMPTRONIC CORPORATION, 55 Chapel St., Newton, MA 02158, Tel: 617-969-2501, FAX: 617-969-2475; Empl.: 75ò; *Sls. Mgr.:* Edward Lowerre, Paul Beland

TEMPUSTECH, INC., 295 Airport Rd., Naples, FL 33942, Tel: 813-643-2424, FAX: 813-643-4981; Empl.: 14

TENNELEC/NUCLEUS INC., 601 Oak Ridge Tpke., Oak Ridge, TN 37830, Tel: 615-483-8405, TELEX: 557482, TWX: 810-572-1018, FAX: 615-483-5891; Empl.: 135

Tenney
ENGINEERING, INC.

FAX: 908-686-7971

TENNEY ENGINEERING, 109 Springfield Rd., Union, NJ 07083, Tel: 908-686-7870, TWX: 710-985-4725; Empl.: 204; *Sls. Mgr.:* Jerome A. Perlstein, Mgr. Application Engr. ..... **D•1205**

Local Sales Offices & Reps

AZ Phoenix, Jayson Co. Inc. 602-867-1964
CA San Carlos, Tenney Engrg., Inc. 415-595-8101
CA Santa Ana, Tech Science 714-558-6964
CO Littleton, Tenney Engrg., Inc. 303-798-0945
IL Roselle, Rock Sls., Inc. 708-351-9903
MD Wheaton, Brimberg Sls. 301-946-2670
MI Southfield, Comtel Instrs. Co. 313-358-2505
MO Blue Springs, ThomCo Sls. 816-229-7667
NJ Union, Tenney Engrg., Inc. 201-686-7870
NY Buffalo, Electrolab, Inc. 716-875-9969
OH Cleveland, Comtel Instrs. Co. 216-442-8080
OH Dayton, Comtel Instrs. Co. 513-426-5310
OH Columbus, Comtel Instrs. Co. 614-876-1446
Can Dorval, Que., John G. Weiss, Ltd. 514-685-6644

TENOR COMPANY, 17020 W. Rogers Dr., New Berlin, WI 53151, Tel: 414-782-3800, FAX: 414-782-0005; Empl.: 30; *Sls. Mgr.:* P. Yoblin; *Dist. Mgr.:* P. Yoblin

TENSOLITE COMPANY, Subsidiary of Carlisle Corp., 100 Tensolite Drive, St. Augustine, FL 32092, Tel: 904-829-5600, FAX: 904-829-3447; Empl.: 210; *Sls. Mgr.:* William Dungan; *Dist. Mgr.:* Jack Swindle

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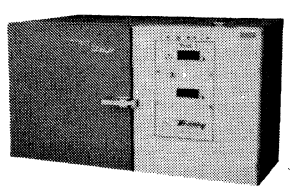

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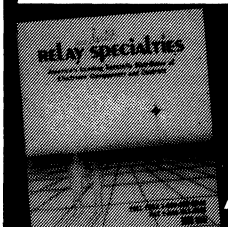

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MO	St. Louis, G.M. Brown & Assocs.	314-839-3600
NM	Albuquerque, Compass Mktg. & Sls.	505-344-9990
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Charlotte, Quantum Mktg., Inc.	704-523-8822
NC	Raleigh, Quantum Mktg., Inc.	919-846-5728
OH	Kettering, Spectro-Com	513-299-0864
OH	Novelty, Spectro-Com	216-338-5226
PA	Philadelphia, Check Assocs., Inc.	215-487-3007
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls., Inc.	214-234-0255
WA	Seattle, Northmar, Inc.	206-524-5170
WI	Milwaukee, M. Gottlieb Assocs. Inc.	414-546-4466
WI	Oregon, M. Gottlieb Assocs. Inc.	608-835-5540
Can	Gloucester, True North Technlg.	613-837-2553
Can	Montreal, Que., True North Technlg.	514-848-7058
Can	Rexdale, True North Technlg.	416-744-2233

Local Distributors

AL	Huntsville, Reptron Elctrns.	205-722-9500
CA	Fremont, KEA Elctrns.	415-651-2600
CA	Industry, ITAL Elctrns. Sls., Inc.	818-968-8515
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	San Diego, Southland Comps. Inc.	619-673-3800
CA	Santa Maria, Garrett Inst. & Comps.	805-922-0594
CA	Tustin, H.T.S.	714-259-7733
CA	Van Nuys, EW Elctrns.	818-782-9020
CA	Yorba Linda, Corona Elctrns.	714-283-8185
FL	Clearwater, Atlantic Elctrns.	813-531-5900
FL	Deerfield Bch., Atlantic Elctrns.	305-698-6400
FL	Ft Lauderdale, Stock Elctrns.	305-978-9875
FL	Ft. Lauderdale, Reptron Elctrns., Inc.	305-735-1112
FL	Lakeland, Atlantic Elctrns.	813-687-0200
FL	Tampa, Reptron Elctrns., Inc.	813-854-2351
FL	W. Palm Bch., Atlantic Elctrns.	407-686-8553
GA	Norcross, Reptron Elctrns., Inc.	404-446-1300
IL	Bensenville, Voyager Elctrns.	708-860-1300
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620
IL	Schaumburg, Reptron Elctrns., Inc.	708-882-1700
IN	Indianapolis, Meunier Elctrns. Supp.	317-635-3511
IN	Indianapolis, MAR Elctrns.	317-633-6699
IN	Indianapolis, R.M. Elctrns. Co. Inc.	317-291-7110
MD	Beltsville, Petricko Sls., Inc.	301-937-4960
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Andover, Aved Elctrns., Inc.	800-441-AVED
MA	Billerica, Baldwin Comps. Ctr. Inc.	508-667-6710
MI	Livonia, Reptron Elctrns., Inc.	313-525-2700
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Minneapolis, K & H Elctrns. Distbg. Corp.	800-328-8515
MN	Minnetonka, Reptron Elctrns., Inc.	612-938-0000
NH	Salem, Diamond Elctrns.	603-894-4420
NJ	Whippany, A.D.I.	201-428-0510
NM	Albuquerque, Betatron	505-821-1122
NY	Buffalo, Summit Dists.	716-887-2800
NY	Ronkonkoma, Baldwin Comps. Ctr. Inc.	800-645-5608
NY	Syracuse, A.D.R. Technlgs.	315-437-7087
NC	Raleigh, Reptron Elctrns.	919-870-5189
OH	Cincinnati, Schuster Elctrns., Inc.	513-489-1400
OH	Solon, Reptron. Elctrns.	216-349-1415
OH	Twinsburg, Schuster Elctrns.	216-425-8134
OH	Worthington, Reptron Elctrns., Inc.	614-436-6675
PA	Wayne, Peak Elctrns.	215-293-9000
TX	Austin, Tinkertronics, Inc.	512-926-4420
TX	Carrollton, Reptron Elctrns.	214-702-9373
TX	Dallas, Off the Shelf Comps.	214-247-0052
TX	Richardson, Comp. Technlg. Corp.	214-437-2211
TX	Richardson, Off the Shelf Comps.	214-238-0808
WA	Seattle, KAM	206-382-1300
WI	Mequon, Lake-View Elctrns. Corp.	414-377-8250
Can	Burlington, Alternate Source Comp.	416-335-6385
Can	Calgary, Memco	403-258-3399
Can	Surrey, Memco	604-590-1553

BRILL ELECTRONICS
(415) 834-5888
610 E 10th St . Oakland. CA 94606
TOPAZ®
(213) 452-8002
1220 Olympic Bl Santa Monica. CA 90404

TODD
PRODUCTS CORP.

FAX: 516-231-3473

TODD PRODUCTS CORP., 50 Emjay Blvd., Brentwood, NY 11717, Tel: 516-231-3366; Empl.: 250 ..... **D•1505, 2077-2106**

Local Sales Offices & Reps

AL	Huntsville, Glen White Assocs.	205-882-6751
CA	Huntington Bch., Todd Prods. Corp.	714-969-8633
CA	San Jose, Quantum Coefficient Sys.	408-432-1070
CO	Englewood, Thorson Rocky Mtn. Inc.	303-799-3435
FL	Deerfield Beach, Glen White Assocs.	305-570-8545
FL	Satellite Beach, Glen White Assocs.	407-773-3514
FL	Tarpon Springs, Glen White Assocs.	813-938-7557
GA	Norcross, Glen White Assocs.	404-441-1447
IL	Elk Grove Vlg., Control Sls. Inc.	708-595-2110
MD	Towson, Glen White Assocs.	301-321-7235
MA	Hingham, Northeast Reps.	617-749-8700
MI	Livonia, Electro Mktg.	313-421-7590
MI	Muskegon, ELectro MKtg.	616-798-1912
MN	Minneapolis, R. K. Sales Assocs.	612-571-1001
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NJ	Fairfield, T.A.M.	201-575-4130
NJ	Princeton, Murtronic Assocs.	609-394-3737
NY	Syracuse, Labtronics	315-455-7314
NC	Raleigh, Glen White Assocs.	919-848-1931
OH	Dayton, Electro Mktg.	513-890-8322
OH	No. Royalton, Electro Mktg.	215-582-0075
OR	Portland, Venture Mktg.	503-624-0617
PA	Pittsburgh, Electro Mktg.	412-823-5400
TN	Gray, Glen White Assocs.	615-477-8850
TX	Houston, AID Elctrns. Inc.	713-575-7959
TX	Irving, AID Elctrs. Inc.	214-790-4761
UT	Salt Lake City, Thorson Rocky Mtn. Inc.	801-942-1683
VA	Lynchburg, Glen White Assocs.	804-385-6110
WA	Bellevue, Venture Elctrns. Inc.	206-454-4594
WI	Brookfield, Control Sls. Inc.	404-797-9500

TODD SYSTEMS, INC., 50 Ash St, Yonkers, NY 10701, Tel: 914-963-3400, FAX: 914-963-3506; Empl.: 45; *Sls. Mgr.:* S. Edwards ..... **A•2438-2441**

Local Distributors

AL	Mobile, Kretzer's Inc.	205-438-5611
CA	San Francisco, Aris Corp.	415-550-8605
CA	San Francisco, Delray Distr.	415-777-4405
CT	Norwalk, Park Distr.	203-853-2010
FL	Miami, Gay Mar, Inc.	305-371-0765
FL	Miami Bch., B. Frank Inc.	305-861-8227
GA	Macon, Giga Corp.	912-745-2897
IL	Skokie, Sargent Welch Inc.	312-677-0600
LA	New Orleans, Gulf Marine Supp.	504-525-6252
MD	Bethesda, Albee Sls.	301-897-8088
MA	Revere, Sozio's	617-547-6900
NJ	Newark, Cotrapex, Inc.	201-589-1416
NJ	Newark, Pinto Trading	201-344-7748
NY	New York, ABC Trading Co.	212-228-5080
NY	New York, Rosetta Elec.	212-233-9088
NY	New York, Taft Elctrns.	212-575-5194
OH	Dayton, K. Elctrns.	513-426-1877
TX	Houston, Cross & Co.	713-673-3100
TX	Houston, Western Sls.	713-869-6671
VA	Fairfax, Atlantic Export	703-573-8383
WA	Seattle, ForeigN Elctrns.	206-682-2761
WA	Seattle, Pearl Elctrns.	206-622-6200
EXP	NY, New York, Able Intl., Ltd.	212-696-5300

TOKIN AMERICA, INC., 155 Nicholson Ln., San Jose, CA 95134, Tel: 408-432-8020, FAX: 408-434-0375; Empl.: 20; *Sls. Mgr.:* William English; *Dist. Mgr.:* William English

TOKIN MAGNETICS, INC., 1100 Fulton Place, Fremont, CA 94539, Tel: 415-490-7500, FAX: 415-490-7502; Empl.: 70

TOKO AMERICA, INC., 1250 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 708-297-0070, FAX: 708-699-7864; Empl.: 75; *Sls. Mgr.:* Frank Migliarese; *Dist. Mgr.:* Tom Quinlan

TOPAZ, INC., See Square D Co. Power Protection Sys.

TOPFLIGHT, 160 East 9th Ave., York, PA 17404, Tel: 717-843-9901, 800-233-9386, FAX: 717-845-6087; Empl.: 250; *Sls. Mgr.:* Bill Ciabattoni

TOPLINE COMPONENTS, P.O. Box 5100, Garden Grove, CA 92645, Tel: 714-898-3830, FAX: 714-891-0321; Empl.: 50

TOPWARD INSTRUMENTS, Div. of Hauman, Inc., 2031 Ringwood Avenue, San Jose, CA 95131, Tel: 408-434-0888, TWX: 510-101-2820, FAX: 408-434-9832; Empl.: 100; *Dist. Mgr.:* Thomas C. Trieu

TORAD COIL CO., INC., 283 Linden Rd., Wayne, NJ 07470, Tel: 201-835-6195; *Sls. Mgr.:* Dan Gupta

TORELCO, INC., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111, Tel: 201-374-8641, FAX: 201-374-7611; Empl.: 20; *Sls. Mgr.:* David R. Franklin ..... **A•1278**

TOREMA U.S.A., INC., 10401 West Office Drive, Houston, TX 77042, Tel: 713-977-2500, FAX: 713-977-5031; FSC No.: QB2R8; Empl.: 10; *Sls. Mgr.:* David P. Snelling

Toroid
SUPERIOR TRANSFORMERS

FAX: 301-860-0302

TOROID CORP. OF MARYLAND, 608 Naylor Mill Rd., Salisbury, MD 21801, Tel: 301-860-0300; Empl.: 50; *Sls. Mgr.:* Lennart Elmlund ..... **A•2442-2446**

Local Sales Offices & Reps

AZ	Phoenix, Saguaro Sls.	602-861-1856
CA	Anaheim, Texel	714-998-2941
CA	San Diego, Texel	619-560-1050
CA	San Jose, Marketing Co.	408-272-6836
CA	Seal Beach, Texel	213-596-9411
CA	Simi Valley, Texel	805-582-1223
IL	Wheeling, Ed Joyner & Co.	708-520-1200
MA	Southboro, Sullivan Tech. Sls.	508-485-2215
NJ	Newton, T & K Sls.	201-579-7654
NY	Clark Mills, KLM Garner	315-853-6126
NY	Pittsfrod, KLM Garner	716-381-8350
NY	Smithtown, T & K Sales.	516-724-3456
PA	Huntingdon Valley, Ed Leiby & Assoc.	215-659-8938
PA	Huntingdon Valley, Ed Leiby & Assocs.	215-659-8938
VT	Ludlow, Verro & Assoc.	802-228-5240
VA	Alexandria, Ed Leiby & Assocs.	703-360-9039
Can	Nepean, Ont., Ellam & Assoc. Ltd.	613-727-3892

TOROTEL PRODUCTS INC.

FAX: 816-763-2278

TOROTEL PRODS. INC., 13402 S. 71 Hwy., Grandview, MO 64030-3199, Tel: 816-761-6314; Empl.: 250; *Sls. Mgr.:* H. Foland ..... **A•1274-1277, 2448-2451**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	Redwood City, Hickey Ind. Sls.	415-594-9978
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
CO	Monument, Sunbird Ind.	719-481-2900
FL	Orlando, Perrott Assocs.	407-830-0094
IN	Greenwood, Valentine & Assocs.	317-888-2260
KS	Overland Pk., QDC Inds.	913-642-2214
MD	Baltimore, Dickison Sls. Co.	301-823-0923
MA	Lowell, Underwood Sls.	508-256-8191
GA	Atlanta, L&D, Inc.	404-395-7079
NY	Northport, R. P. Luce & Co., Inc.	516-754-5064
NY	Syracuse, Rep Tech. Inc.	315-437-2845
NC	Raleigh, L & D, Inc.	919-292-3201
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
PA	Langhorne, R.P. Luce & Co.	215-757-3518

TOROTRON CORP., 519 South Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-2050; Empl.: 14; *Sls. Mgr.:* Miriam Zanger ..... **D•1330**

TORQ CORP., 32 W. Monroe St., Bedford, OH 44146, Tel: 216-232-4100, FAX: 216-232-4104; Empl.: 50; *Sls. Mgr.:* Lee Seabeck

TORTRAN INC., 915 Pembroke St., Bridgeport, CT 06608, Tel: 203-367-5188, FAX: 203-384-8120 ..... **A•2447**

TORWICO ELCTRNS. INC., 410 Oberlin Ave. South, Lakewood, NJ 08701, Tel: 908-364-1800, FAX: 908-363-6234; Empl.: 200

TOSHIBA INSTRUMENTATION DIV., Toshiba Intl. Corp., 5354 S. 129th E. Ave., Tulsa, OK 74134, Tel: 918-252-3548, FAX: 918-250-9023; Empl.: 20; *Sls. Mgr.:* Lewis E. Smith

TOTAL POWER INTERNATIONAL, INC., 418 Bridge St., Lowell, MA 01850, Tel: 508-453-7272, FAX: 508-453-7395; Empl.: 15; *Sls. Mgr.:* Patrick Letendre .... **D•2107**

All states not listed call T.P.I. direct 508-453-7272

Local Sales Offices & Reps

AZ	Tempe, Thor Engrg.	602-438-8494
CA	La Jolla, K & S Assocs.	619-453-5720
CA	San Jose, Bytec Sls., Inc.	408-435-8004
CA	Torrance, Amasco	213-781-9494
CT	Weston, Paquette Elctrns.	203-544-8424
CO	Denver, WEST Inc.	303-477-8180
FL	Ft. Myers, Rainbow Sls.	813-482-0019
GA	Lilburn, The Phillip-Matthew Corp.	404-381-1662
IL	Brookfield, Synmark	414-781-4775
IL	Palatine, Vine Sls., Inc.	708-934-5476
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
IA	Cedar Rapids, Complete Sls.	315-393-7610
MD	Ellicott City, Technology Sls.	301-461-7802
MA	Marlboro, JDS Reps.	508-460-0187
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Oakdale, Complete Sls.	612-731-2923
NJ	Kenvil, Compoments for Elctrns.	201-927-6662
NY	Albany, Lynn Assocs.	518-459-1239
NY	Buffalo, Lynn Assocs.	716-631-0054
NC	King, The Phillip- Matthew Corp.	919-983-9790
OR	Portland, Index, Inc.	503-297-3364
PA	Gibsonia, Lynn Assocs.	412-443-3670
TX	Dallas, Rem Components	214-234-1069
UT	Salt Lake City, WEST Inc.	801-292-8787
WA	Bellevue, Inex, Inc.	206-451-9635
WA	Lynnwood, Blair Hirsh Co.	206-774-8151
WI	Appleton, Vine Sls.	414-731-9873
Can	Mississauga, RFM Electro Sls. Inc.	416-677-0027

Local Distributors

FL	Orlando, Rainbow Sls.	305-658-1082
GA	Norcross, GMT Dist.	404-263-0421
MA	Framingham, JDS Reps.	508-872-5876
MA	Marlboro, Now/JDS Reps.	508-460-0187
MI	Brighton, Applied Power Inc.	312-227-3604
PA	Reading, Barbey Elctrns.	215-376-7451
TX	Houston, Wofford	713-847-3583
TX	Richardson, Off the Shelf	214-238-0808

TOTAL TEMPERATURE INSTRUMENTATION, INC., PO Box 1073, 30 Krupp Dr., Williston, VT 05495, Tel: 802-863-0085, FAX: 802-863-1193; Empl.: 5; *Sls. Mgr.:* Bob Berman; *Dist. Mgr.:* Bob Berman

TOWER ELECTRONICS, INC., 281 S. Commerce Circle, Fridley, MN 55432, Tel: 612-571-3737, FAX: 612-571-5605

TOYOCOM USA INC., 617 E. Golf Rd., Ste. 112, Arlington Heights, IL 60005, Tel: 708-593-8780/1-800-TOYOCOM, FAX: 708-593-5678; Empl.: 10; *Sls. Mgr.:* Seiichi Omoto ..... **A•1472-1482**

Local Sales Offices & Reps

AZ	Tempe, Cantec Sls.	602-345-1276
CA	Irvine, English/Damco	714-753-1950
MI	Livonia, Giesting & Assoc.	313-478-8106
CA	Santa Clara, Pinnacle Sls.	408-249-7400
CO	Denver, West	303-477-8180
FL	Maitland, EIR	407-660-9600
GA	Norcross, Electramark	404-446-7915
IL	Arlington Hgts., MB Sls.	312-392-9499
IN	Carmel, Giesting & Assoc.	317-844-5222
IA	Cedar Rapids, ATS	319-393-8280
MD	Rockville, CEtech	301-590-0111
MD	Timonium, CEtech	301-666-0315
MA	Randolph, Hatch	617-963-3306
MI	Coloma, Giesting & Assoc.	616-468-4200
MI	Livonia, Giesting & Assoc.	313-478-8106
MN	Minneapolis, Scott Elctrn.	612-929-2985
NJ	Mountainside, Henry G. Richter	201-233-4615
NM	Alburquerque, Cantec Sls.	505-889-9165
NY	Fayetteville, Henry G. Richter	315-637-6713
NC	Raleigh, L & D Inc.	919-876-5301
OH	Cincinnati, Giesting & Assoc.	513-385-1105
OH	Cleveland, Giesting & Assoc.	216-261-9705
OK	Tulsa, Hugh J. Daley	918-494-7711
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Phoenixville, Henry G. Richter	215-495-6176
PA	Pittsburg, Giesting & Assoc.	412-828-3553
TX	Austin (xtal), Rice Entpr.	512-355-2296
TX	Austin (SIMM), Gardin-Moore	512-244-2859
TX	Ft. Worth (xtal), Rice Entpr.	817-497-5284
TX	Plano (SIMM), Gardin-Moore	214-985-1193
UT	Salt Lake City, West	801-292-8787
WA	Bellevue, Quest Mktg.	206-747-9424
Intl	San German, Digit-Tech Sls.	809-892-4317
Can	Mississauga,Ont., Canadian Mktg. Technlgs., Inc.	416-612-0900

TOYO SPECTRUM CORP., 2934 Corvin Drive, Santa Clara, CA 95051, Tel: 408-720-8877, 800-338-1981, TELEX: 297584 TEAM UR, FAX: 408-720-9643; *Sls. Mgr.:* Bill Nicklin

TRACEWELL ENCLOSURES, INC., 567 Enterprise Dr., Westerville, OH 43081, Tel: 614-846-6175, 800-848-4525, FAX: 614-846-4450; Empl.: 50; *Sls. Mgr.:* Walter G. Waldron ..... **C•1120-1125**

TRA-CON, INC., 55 North St., Medford, MA 02155, Tel: 617-391-5550; Empl.: 55; *Sls. Mgr.:* Dan Romanow

TRACOR FLIGHT SYSTEMS, INC., Tracor, Inc., A Westmark Co., 1241 E. Dyer Rd., Santa Ana, CA 92705, Tel: 714-662-0333, TWX: 510-601-1467 FSI HDQT; FSC No.: 6B468; Empl.: 550; *Sls. Mgr.:* A. Mallamo



FAX: 813-886-2794

TRAK MICROWAVE CORP., 4726 Eisenhower Blvd., Dept. E-1, Tampa, FL 33634, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 12855; *Sls. Mgr.:* Thomas L. Roberts; *Dist. Mgr.:* Sharon Altimari ..... **A•1829-1833; D•1078, 1194**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444
CA	Granada Hills, S & S Technlg., Inc.	818-366-2866
CA	Mountain View, Disman Bakner	415-969-3010
CA	Redondo Bch., S & S Techlg, Inc.	213-379-9335
CA	San Diego, S & S Technlg. Inc.	619-484-2996
CO	Parker, Howard Assocs.	303-841-5755
FL	Melbourne, Jerry Williams, Inc.	407-259-7700
FL	Tampa, M. Lader Co.	813-264-1444
WA	Bellevue, Arva Hudson	206-455-0773
GA	Lawrenceville, M. Lader Co.	404-985-8057
IL	Mt. Prospect, Cain-Forlaw	708-253-3578
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MD	Columbia, M. Lader Co.	301-381-1550
MD	Conowingo, M. Lader Co.	301-378-3449
MA	Andover, Bee Assoc.	508-475-2124
MO	Florissant, Blair Engrg.	314-831-4069
NM	Albuquerque, Thorson Desert States, Inc.	505-293-8555
NY	Liverpool, R&D Assocs.	315-457-0100
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NC	Greensboro, M. Lader Co.	919-674-8970
PA	Conshohocken, M. Lader Co.	215-825-3177
TX	Austin, Thorson Co.	512-345-1985
TX	Dallas, Thorson Co.	214-233-5744
TX	Houston, Thorson Co.	713-558-8205
Can	Ottawa, Giga Tron Assocs. Ltd.	613-225-4090

Local Distributors

AZ	Scottsdale, Spirit Elctrns.	602-998-1533
CA	Mtn. View, Comstock Distrs., Inc.	415-969-3010
NY	Ronkonkoma, Compucon Distr., Inc.	516-981-8810
PA	Conshohocken, MLC Distrs., Ltd.	215-825-3177
TX	Dallas, Thorson Co.	214-233-5744

TRAK MICROWAVE LTD., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, Scotland DD2 1TY, Tel: 44-382-561509, FAX: 44-382-562643; Empl.: 30



FAX: 813-886-2794

TRAK SYSTEMS, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E-1, Tampa, FL 33634-6391, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 11165; *Sls. Mgr.:* Thomas L. Roberts ..... **D•1078, 1194-1195**

Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
AZ	Phoenix, J. Smith Assocs.	602-267-0981
CA	Huntington Beach, Scientific Dvcs. West	714-840-3501
CA	San Diego, Scientific Dvcs. West	619-268-9635
CA	San Jose, Scientific Dvcs. West	408-554-0455
CO	Parker, Howard Assocs.	303-841-5755
FL	Sarasota, Bass Assocs.	813-378-1405
GA	Atlanta, Magaro & Assocs.	404-451-8862
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
MD	Andover, Saret Assocs.	508-475-9332
MD	Annapolis, Blackwood Assocs.	301-268-3669
NM	Albuquerque, J. Smith Assocs.	505-345-6501
NC	Greensboro, Magaro & Assocs.	919-282-4424
OR	Portland, Scientific Dvcs. West	503-248-6340
PA	Philadelphia, Rabal Assocs.	215-922-6914
TX	Arlington, J. T. Houston Assocs.	817-265-2931
WA	Bellevue, Scientific Dvcs. West	206-637-0945
Can	Ottawa, Giga Tron Assocs., Ltd.	613-225-4090

TRANSAMERICA DELAVAL, INC., See IMO Delaval, Inc., CEC Instruments Div.

TRANSAMERICA DELAVAL, See IMO Delaval, Inc., Gems Sensors Div.

Trans American Transformer, Inc.

FAX: 516-928-0852

TRANS AMERICAN TRANSFORMER, 26 Hulse Rd., E. Setauket, NY 11733, Tel: 516-928-0762; FSC No.: 61619; Empl.: 30 ..... **A•2452**

TRANSCO PRODUCTS, INC., Subsidiary of Datron Systems Inc., Vard Newport, Camarillo, CA 93012, Tel: 805-987-8007, TELEX: 857579, FAX: 805-484-0830; FSC No.: 82152; Empl.: 300; *Sls. Mgr.:* A. Kwon, V.P. of Mktg.

TRANSDUCERS & SYSTEMS, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; Empl.: 60; *Sls. Mgr.:* J. L. Jamieson ..... **B•1947**

All states not listed consult factory, N. Branford, CT

Local Sales Offices & Reps

CT	Suffield, Digital & Analog Sls.	203-668-1664
IN	Indianapolis, Rixan Assoc.	513-278-4216
OH	Dayton, RIXAN Assocs.	513-278-4216
PA	Bensalem, Rixan Assoc.	513-278-4216
SC	Greer, Trask Instrumentation	803-292-8900
TX	Humble, Talon Tech. Sls.	713-852-3962

TRANSDUKTOR, INC., See Ulveco, Inc.

TRANSENE, Rte. 1, Rowley, MA 01969, Tel: 508-948-2501, FAX: 508-948-2206; Empl.: 21; *Sls. Mgr.:* H. Femino

TRANSFORMER DESIGN , MTE Corporation, W147 N9525 Held Drive, Menomonee Falls, WI 53051, Tel: 414-253-8200, FAX: 414-253-8222; Empl.: 120; *Sls. Mgr.:* John A. Houdek

TRANSFORMER TECHNOLOGIES, INC., 52 Putnam St., Mt. Vernon, NY 10550, Tel: 914-668-1600, FAX: 914-668-4794; Empl.: 15; *Sls. Mgr.:* Thomas Quaglieri ..... **A•2453**

Local Sales Offices & Reps

IL Highland Pk., Mid-Tek Mktg. 708-831-1130
NJ Brunswick, Synergy Sls. 201-828-5090
VA Ashland, Glasscock Assocs. 804-798-2125

TRANSICOIL, INC., Eagle-Picher, P.O. Box 9011, Valley Forge, PA 19485, Tel: 215-539-4400, FAX: 215-539-3400; FSC No.: 82686; Empl.: 290

TRANSICOIL INC., Penn Airborne Products, 950 Industrial Hwy., Southampton, PA 18966, Tel: 215-355-3400, TELEX: 834-759, FAX: 215-322-2194; FSC No.: 25805; Empl.: 41; *Sls. Mgr.:* Claude Mercier

TRANSICOIL INC., Robinson-Halpern Products, 2560 General Armistead Blvd., Trooper, PA 19403, Tel: 215-539-4400, FAX: 215-539-3400; Empl.: 300; *Sls. Mgr.:* Francis Mashintonio

TRANSISTOR DEVICES, INC., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-361-6622, FAX: 201-361-7665; FSC No.: 09004; Empl.: 650; *Sls. Mgr.:* Don Fedderly ..... **D•1331, 2108-2109**

Local Sales Offices & Reps

AL Huntsville, Reynolds & Assocs., Inc. 205-539-1485
AZ Scottsdale, Dave Menegay & Assocs. 602-994-9519
AR El Dorado, Kemp Instrs. 501-862-5869
CA Bakersfield, FLW, Inc. 805-398-0720
CA Campbell, SMA 408-370-6900
CA Canoga Pk., FLW, Inc. 818-719-0037
CA Carlsbad, FLW, Inc. 619-434-5251
CA Costa Mesa, FLW Inc. 714-751-7512
CO Denver, Elcom, Inc. 303-337-2300
CT Watertown, May Technlg., Inc. 203-274-3777
FL Coral Spring, Reynolds Assocs., Inc. .. 305-344-4536
FL Melbourne, Reynolds Assocs., Inc. 407-259-7000
FL Newport Richey, Reynolds Assocs., Inc. 813-372-8369
GA Duluth, Reynolds Assocs., Inc. 404-476-4992
IL Wheeling, Ed Joyner & Co. 312-520-1200
KS Overland Pk., WEB Assocs./Elctrns. .. 913-381-7986
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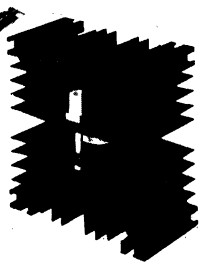

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NJ Hasbrouck Hgts., Comp-Tech Sls. 201-288-7400
NY E. Syracuse, Advance Components ... 315-437-6700
NY Endicott, Advanced Comps. Corp. 607-785-3191
NY Hicksville, Comp-Tech Sls. 516-593-2628
NY Kingston, Advanced Comp. Corp. 914-339-1730
NY New York, Roburn Agencies, Inc. 914-968-1016
NY Rochester, Advanced Comps. Corp. ... 716-544-7017
NY Scottsville, Advanced Comps. Corp. ... 716-889-1429
NC Raleigh, Reynolds & Assocs., Inc. 919-876-0282
OH Arcanum, Ashby Assocs., Inc. 513-692-8713
OH Cleveland, Ashby Assocs., Inc. 216-461-0826
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Pittsburgh, Ashby Assocs. 412-343-5105
PA Southampton, Campbell Assoc. 215-322-6630
TX Lewisville, Jim Hughes Co. 214-221-1536, 214-221-1538
UT Murray, Elcom 801-262-2400, 801-262-2472
VA Alexandria, Dyna-Rep Co. 703-354-1222
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
Can Weston Ont., Duncan Instrs. Canada Ltd. 416-742-4448

TRANSKINETIC SYS., 110 Shawmut Rd., Canton, MA 02021, Tel: 617-828-3000; Empl.: 17; *Sls. Mgr.:* D. Pettijohn

TRANSMAGNETICS, 210 Adams Blvd., Farmingdale, NY 11735, Tel: 516-293-3100, TWX: 510-224-6420, FAX: 516-293-3793; FSC No.: 17755; Empl.: 44; *Sls. Mgr.:* Fred Haber ..... **D•1196-1199**

TRANS METRICS, INC., 5325 Naiman Pkwy Ste.E , Solon, OH 44139, Tel: 216-248-2229, FAX: 216-248-7780; FSC No.: 6685; Empl.: 20; *Sls. Mgr.:* James N. Dietrich

TRANSONIC SYSTEMS INC., 34 Dutch Mill Road, Ithaca, NY 14850, Tel: 607-257-5300, TELEX: 413523, ESYLNK: 62050974; Empl.: 40

TRANSTECHNOLOGY ELECTRONICS, Transtechnology Corporation, 8800 Allen Rd., Peoria, IL 61615-1584, Tel: 309-693-3300, TWX: 510-390-3691, FAX: 309-693-3308; FSC No.: 30463; Empl.: 280; *Sls. Mgr.:* Arthur J. Mallamo, Jr.; *Dist. Mgr.:* Arthur J. Mallamo, Jr.

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CA San Jose, B.J. White 415-837-7201
CA Woodland Hills, Cal Ward Sls. 818-883-2202
FL Altamonte Springs, Krebs Myton Assoc. 407-788-9333
GA Atlanta, Krebs Myton Assoc. 404-399-7895
IL Hillside, Cadre Tech. Rep., Inc. 708-449-3900
IA Blue Grass, Rothkopf & Assocs. 319-381-4396
KS Olathe, Rothkopf & Assocs. 913-829-8898
MD Baltimore, Hagy Assocs. 301-931-2022
MA St. Louis, Rothkopf & Assocs., Inc. 508-851-4010
NM Albuqerque, H & H Elctrns. 505-889-3300
NY Setauket, Smith Engrg. Sls. 516-689-6514
OH TippCity, Cleary Sls. Co. 513-667-7703
PA Newtown Square, Hagy Assocs. 215-459-0504
TX Centerville, MC2 801-298-3388
TX Colleyville, DeArmond Entprs. 817-267-2048
TX Dallas, M-Rep 214-484-5711
VA Charlottesville, Pdg Sls. 804-979-7085
WA Bellevue, Lehr Assocs. 206-453-9993

Local Distributors

CA Brea, Aeroflite 714-773-4251
CA Van Nuys, Air Electro 818-988-4400
WA Auburn, West Air Intl. 206-631-1000

TRANSTECTOR SYSTEMS, INC., P.O. Box 300, Hayden Lake, ID 83835, Tel: 800-829-2901, TELEX: 150-077TRANSTECPFLS, FAX: 208-772-9016; FSC No.: 30992; Empl.: 150; *Sls. Mgr.:* Mary Munger; *Dist. Mgr.:* Mike Sweeney

TRANS-TEK, P.O. Box 338, Rte. 83, Ellington, CT 06029, Tel: 203-872-8351, TELEX: 99207, FAX: 203-872-4211; FSC No.: 27109; Empl.: 40; *Sls. Mgr.:* William R. Padin

TRAN-TEC CORP., Box 1044, Columbus, NE 68601, Tel: 402-564-2748, FAX: 402-564-4946; Empl.: 46; *Sls. Mgr.:* Cliff Schroeder

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CA Redwood City, Woodworth Co. 415-365-0252
CA Tustin, Sierra-Pacific Engrg. Co. 714-731-3411
CO Lafayette, Pierce-Robbins Assocs. 303-665-3296
FL Palm Bch. Gardens, Russell Assocs. .. 305-627-1503
GA Atlanta, Russell Assocs. 404-255-8422
IN Ft. Wayne, Scott Elctrns, Inc. 219-489-5690
IA Hiawatha, Ard Sls. Co. 319-393-6392
MD Bel Air, Russell Assocs. 301-879-9180
MA Wakefield, H.C. Jappe Co. 617-245-9359
PA Westchester, Russell Assocs. 215-696-0700
NY Bay Shore, Russell Assocs. 516-666-6500
NY Morrisville, Naylor Elec. Co. 315-684-9620
OH Cleveland, D. Steffen & Assocs. 216-461-8333
TX Dallas, Russell Assocs. 214-699-0383
WA Bellevue, Russell Assocs. 206-455-3694

TRATEC OF CALIFORNIA, INC., 3802 Main St. Ste. 3, Chula Vista, CA 91911, Tel: 619-476-1155, ESYLNK: 619-476-1176; Empl.: 250; *Sls. Mgr.:* Dale Fox

TREE TECHNOLOGIES CORPORATION, Baird Research Pk., 1576 Sweet Home Rd., Buffalo, NY 14228, Tel: 716-688-4640, FAX: 716-636-3630; Empl.: 8; *Sls. Mgr.:* Victor Demjanenko, PH.D.

TREK, INCORPORATED, 3932 Salt Works Road, Medina, NY 14103-0231, Tel: 716-798-3140, FAX: 716-798-3106; Empl.: 141; *Sls. Mgr.:* Peter R. Bossard, Ph.D.; *Dist. Mgr.:* Mark J. Delucia

TREMETRICS INC., Baker Hughes Incorporated, 6500 Tracor La., Bldg. 27, Austin, TX 78725-2100, Tel: 512-929-2051, TWX: 910-874-1366, FAX: 512-929-2747; FSC No.: 63409; Empl.: 160; *Sls. Mgr.:* William R. Murphy; *Dist. Mgr.:* Will Hoover

TREND CIRCUITS, 44358 Old Warm Springs Blvd., Fremont, CA 94538-6148, Tel: 415-651-1150, FAX: 415-651-5763; Empl.: 142; *Sls. Mgr.:* Colleen Frisz

TREND DLC, Card Technology, 70 Eisenhower Dr., Paramus, NJ 07652, Tel: 201-845-7373, FAX: 201-845-3337; Empl.: 60; *Sls. Mgr.:* Joseph R. La Manna

TRENT, INC., 201 Leverington Ave., Philadelphia, PA 19127, Tel: 215-482-5000, FAX: 215-482-9389; Empl.: 55

TRIAC ELECTRONIC SYSTEMS, INC., 87-27 Myrtle Ave., Glendale, NY 11385, Tel: 718-441-4759, TWX: 221500 ASAS ATT TRIAC; Empl.: 35; *Sls. Mgr.:* Victor Botnick

TRIAD POWER SYSTEMS, See Behlman Engineering

THE TRIANGLE TOOL GROUP, INC., Cameron Rd., P.O. Box 1807, Orangeburg, SC 29115, Tel: 803-534-7010, FAX: 803-536-6632; FSC No.: 30106; *Sls. Mgr.:* Herbert L. Tait

TRICONEX CORP., 15091 Bake Parkway, Irvine, CA 92718, Tel: 714-768-3709, 800-325-2128 (outside Ca), FAX: 714-768-6601; Empl.: 60; *Sls. Mgr.:* Peter B. Robinson; *Dist. Mgr.:* Paul Hamilton

TRICON INDUSTRIES, INC., Brazing Alloys & Chemical Products Div., 5000 Chase St., Downers Grove, IL 60515-4012, Tel: 708-963-0220, FAX: 708-963-0269; Empl.: 19; *Sls. Mgr.:* T. R. Boedeker

TRICON INDUSTRIES, INC., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076, Tel: 708-964-2330, FAX: 708-964-5179; Empl.: 289; *Sls. Mgr.:* Robert Stevens

TRIDAK, 1120 Federal Rd., Brookfield, CT 06804, Tel: 203-775-1287, TELEX: 62009593, FAX: 203-775-4376; Empl.: 20; *Sls. Mgr.:* Frank Barbera

TRIDYNE PROCESS SYSTEMS, DBI Industries, 80 Allen Rd., So. Burlington, VT 05403, Tel: 802-863-6873, FAX: 802-860-1591; Empl.: 35; *Sls. Mgr.:* Bonnie Rousseau

TRIGON/ADCOTECH, Dynatech, 100 S. Milpitas Blvd., Milpitas, CA 95035, Tel: 408-946-4300, FAX: 408-263-9217; Empl.: 50; *Sls. Mgr.:* Gary Dotzler

TRILITHIC, INC., 9202 E. 33rd St., Indianapolis, IN 46236, Tel: 800-344-2412, FAX: 317-895-3613; FSC No.: 23042; Empl.: 120; *Sls. Mgr.:* D. Distler

TRILOBYTE COMPUTER CORPORATION, 14477 Catalina St., San Leandro, CA 94577, Tel: 415-895-1100, TWX: 910-350-0171, FAX: 415-895-2244; Empl.: 15

TRI-MAG, Inc.

FAX: 209-651-0188

TRI-MAG, INC., 1601 N. Clancy Ct., Visalia, CA 93291, Tel: 209-651-2222, TELEX: (ITT) 4994462; FSC No.: 64771; Empl.: 80 ..... **A•1646-1648; D•2110-2113**

Local Sales Offices & Reps

AL Huntsville, EPI, Inc. 205-534-3747
CA Burlingame, William J. Purdy Co. 415-347-7701
CA Laguna Hills, Electro-Venture 714-581-9244
FL Land O'Lakes, AJ's Power Source, Inc. 813-996-2583
IL Arlington Hgts., Coombs Assocs., Inc. 312-439-9810
KS Overland Pk., EPI, Inc. 913-642-9118
MD Ambler, W.R. Hartmaier Assoc., Inc. ... 301-788-7128
MS Jackson, EPI, Inc. 601-856-6251
MO St. Louis, EPI, Inc. 314-962-1411
MA Southboro, Sullivan Tech. Sls. 508-485-2215
NJ Ridgewood, Ballou, Inc. 201-444-6990
NY Rochester, R.M. Scanlon & Assoc., Inc. 716-924-7450
NY Syracuse, R.M. Scanlon & Assoc., Inc. 315-463-7682
OH Mentor, Sales Plus, Inc. 216-942-7811
OK Tulsa, Cunningham Comps. 918-665-3562
OR Beaverton, Pacific Mktg. Spec. 503-641-9373
PA Ambler, W.R. Hartmaier Assoc. Inc. 215-643-6691
PA Ambler, W.R. Hartmaier Assocs., Inc. .. 215-643-6691
TX Austin, Cunningham Comps. 512-255-1510
TX Dallas, Cunningham Comps. 214-699-3485
TX Houston, Cunningham Comps. 713-461-4197
WA Redmond, Pacific Mktg. Spec. 206-882-3144
WI Milwaukee, Coombs Assocs., Inc. 414-351-6123

Local Distributors

MA Needman, Power Electro Supp. Co. ... 718-767-1447

TRIMM INC., Newton Instr. Co., 400 W. Lake St., Box 489, Libertyville, IL 60048, Tel: 708-362-3700, FAX: 708-680-3888; FSC No.: 81812; Empl.: 50; *Sls. Mgr.:* Howard Zarch

TRIM-TRONICS, INC., 2763 Route 20 East, Cazenovia, NY 13035, Tel: 315-655-9528, FAX: 315-655-2149; Empl.: 20; *Sls. Mgr.:* James E. Dowd

TRINETICS INC., 55807 Currant Rd., Mishawaka, IN 46545-4899, Tel: 219-259-8535, FAX: 219-259-8552; FSC No.: 3677; Empl.: 100; *Sls. Mgr.:* P. L. Kamerer

TRIO LABORATORIES, INC., 80 Dupont St., Plainview, NY 11803, Tel: 516-349-0400, FAX: 516-349-0442; FSC No.: 00638; Empl.: 60; *Sls. Mgr.:* Richard Frerking, Dir. of Sls. & Mktg.

TRIONICS, INC., P.O. Box 225, St. Charles, IL 60174, Tel: 312-232-9117, FAX: 312-232-0820; Empl.: 50

TRIO-TECH INTERNATIONAL, 355 Parkside Dr., San Fernando, CA 91340, Tel: 818-365-9200, TELEX: 194811(TTI INTL SFDO), FAX: 818-365-8210; Empl.: 266; *Sls. Mgr.:* Jon Easterson

TRIPLE I, See PHI Technologies, Inc.

TRIPLETT CORPORATION, One Triplett Dr., Bluffton, OH 45817-9987, Tel: 419-358-5015, TWX: 810-490-2400, FAX: 419-358-7956; *Sls. Mgr.:* Joel Weldy; *Dist. Mgr.:* Tony Augsburger

TRIPP-LITE, 500 No. Orleans, Chicago, IL 60610-4188, Tel: 312-329-1777, FAX: 312-644-6505; Empl.: 150; *Sls. Mgr.:* Ray Foster

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TRIRIDGE CORPORATION, P.O. Box 2130, Leesburg, FL 34749-2130, Tel: 904-728-0799/1-800-537-3529; Empl.: 45

TRIRIDGE CORP., P.O. Box 12420, Pittsburgh, PA 15231, Tel: 412-899-2288, 800-537-3529, FAX: 412-899-2284; FSC No.: 31951; Empl.: 48; *Sls. Mgr.:* Michael Minich ..... **B•1613**

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AL Huntsville, Hughes & Assoc. 205-533-4664
CA Seal Beach, Texel 213-596-9411
FL Maitland, EIR Inc. 407-660-9600
GA Norcross, Hughes Assocs. 404-662-1587
IL Downers Grove, Golten Assocs. 708-512-0093
MA Chelmsford, Interstate Sls. Assocs. 508-256-2287
MN Stillwater, Kits Co. 612-439-8088
MS Corinth, Hughes Assocs. 601-287-2915
NY Manhasset, Win-Cor Elctrn.Sls. 516-627-9474
NC Cary, Hughes Assocs. 919-467-7029
TN Knoxville, Hughes Assocs. 615-558-0283

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CA Los Angeles, Masters Distrs. 213-452-1229
OH Warren, Rem Elctrn. Supp. Co. 216-373-1300
PA McKean, Advacom Inc. 814-476-7774

TRM, INC., 401 Kelly Ave., Grenier Field, Manchester, NH 03103, Tel: 603-627-6000, FAX: 603-627-6025; Empl.: 40; *Sls. Mgr.:* A. Butts

FAX: 818-706-1040

TROMPETER ELECTRONICS, INC., 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91362-4047, Tel: 818-707-2020; FSC No.: 14949; Empl.: 180; *Sls. Mgr.:* Dick Coleman; *Dist. Mgr.:* Raymond Calvin .... **C•1556-1561**

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AL Huntsville, Currie, Peak and Frazier ... 205-536-1506
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CA Santa Clara, ISG 408-980-1166
CA Temecula, Knight Co. 619-452-7196
CO Denver, Aztec Entprs. 303-779-5285
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FL Pace, Currie, Peak & Frazier 904-994-0599
FL Tampa, Currie,Peak, & Frazier 813-963-1076
FL W.Melbourne, Currie, Peak & Frazier .. 407-724-6795
GA Duluth, Currie, Peak & Frazier 404-497-9404
IL Arlington Heights, Berndt Assocs. 312-632-0900
IN Carmel, Berndt Assocs. 317-844-0114
KS Overland Pk., Baka 913-432-5252
KS Wichita, Baka 316-682-8411
MD Landover, Sel-Tronics 301-341-2700
MA Lowell, Underwood Sls. 508-256-8191
MI Sterling Hgts., Geotronix 313-254-0520
MN EPA (Bortech Sls.), EPA (Bortech Sls.) 612-835-9002
MO St. Johns, Baka 314-429-2252
NJ Elmwood Park, L & M Assoc. Eng. Rep. 201-797-0441
NM Albuquerque, Aztec Entprs. 505-262-1688
NY Buffalo, T.A.E. Reps. 716-688-5008
NY Clifton Park, T.A.E. Reps. 518-371-3117
NY New York, L & M Assocs. Eng. Rep. .. 212-243-6155
NY Rochester, T A E Reps. 716-586-8710
NY Whitney Point, T.A.E. Reps. 607-692-3705
NC Charlotte, Currie, Peak & Frazier 704-846-1702
NC Greensboro, Currie, Peak & Frazier ... 919-373-0380
OH Richfield, Geotronix 216-659-6100
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PA Allison Park, Geotronix 412-487-1770
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TX Grand Prairie, ION Assocs. 214-647-8225
UT Salt Lake City, Aztec Entprs. 801-467-4675
WA Bothell, Evergreen Mktg. 206-485-8063
WI Milwaukee, Berndt Assocs. 414-545-8400
Can Markham, Ont., Componets, Ltd. 416-479-7200
Can St. Laurent, Que., Componetics, Ltd. ... 514-331-9930

TRONTECH, INC., 38 Industrial Way E., Eatontown, NJ 07724, Tel: 908-542-1133; Empl.: 70; *Sls. Mgr.:* Albert E. Arbuckle

TRUEVISION, 7340 Shadeland Station, Indpls., IN 46256, Tel: 317-841-0332, FAX: 317-576-7700; Empl.: 64; *Sls. Mgr.:* Greg Vandendries

TRULINE CORPORATION, 909 W. Visalia Rd., Farmersville, CA 93223, Tel: 209-747-1261, FAX: 209-747-0280; Empl.: 85; *Sls. Mgr.:* R. W. Aubery

TRUMETER COMPANY, INC., 38 West 32nd St., New York, NY 10001, Tel: 212-564-0666, 800-537-2261, FAX: 212-268-0432; Empl.: 9; *Sls. Mgr.:* Rene Jacobus

TRW LSI PRODUCTS INC., PO Box 2472, La Jolla, CA 92038, Tel: 619-457-1000, FAX: 619-455-6314; FSC No.: 59621; Empl.: 290; *Sls. Mgr.:* Al Jonas, Dir. Sls.

TRW MICROWAVE, See FEI Microwave

TRW RESISTIVE PRODUCTS DIV., See International Resistive Co.

TRW TECHNAR, INC., TRW, Inc., 5462 Irwindale Ave., Irwindale, CA 91706, Tel: 818-334-0250, FAX: 818-969-4781; Empl.: 750; *Sls. Mgr.:* George R. Downs

TS PRODUCTS, INC., 12455 Branford St., Bldg. 22, Arleta, CA 91331-3429, Tel: 818-896-6676, FAX: 818-896-2816; Empl.: 6; *Sls. Mgr.:* James T. Thomasson; *Dist. Mgr.:* James T. Thomasson ..... **D•2245**

Local Sales Offices & Reps

CA Corona Del Mar, Motion Control, Inc. .. 714-675-0211
CA Los Angeles, TS Products, Inc. 818-896-6676
CA Montebello, TUCUL Engrg. 818-791-1364

TSSI, 8205 S.W. Creekside Place, Beaverton, OR 97005, Tel: 503-643-9281, FAX: 503-646-4954; Empl.: 50; *Sls. Mgr.:* Dean Turnbaugh, V.P., N.A. Sls.; *Dist. Mgr.:* David Flaningam, V.P., Intl. Sls.

TTE

FAX: 213-445-2791

TTE, INCORPORATED, 2251 Barry Ave., W. Los Angeles, CA 90064, Tel: 213-478-8224; FSC No.: 07766; Empl.: 30; *Sls. Mgr.:* S. J. Sodaro ..... **A•1708-1717**

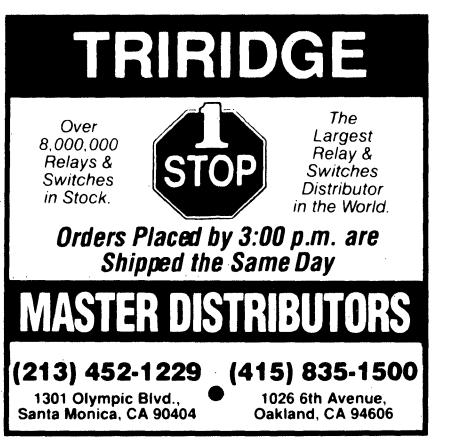
T T I TESTRON INC., 41 Century Drive, Woonsocket, RI 02895, Tel: 401-766-9100, FAX: 401-766-9017; Empl.: 250; *Sls. Mgr.:* Carl Reed

TUCKER ELECTRONICS, Box 551419, Dallas, TX 75355-1419, Tel: 214-348-8800, 800-527-4642, TELEX: 79-1726, TWX: 62812862, FAX: 214-348-0367; Empl.: 43; *Sls. Mgr.:* Don Stabeno

TUMBLER CORP. CABLE DIV., 175 Kootenai Drive, Fremont, CA 94539, Tel: 415-657-3002, FAX: 415-770-1933; Empl.: 86; *Sls. Mgr.:* Vincent P. Lin

TUNGSTONE BATTERIES, INC., 18 Billings St., Sharon, MA 02067, Tel: 617-784-2000, FAX: 617-784-5563; Empl.: 23; *Sls. Mgr.:* William O'Connell





TURCK INC., 3000 Campus Drive, Minneapolis, MN 55441-2656, Tel: 612-553-9224, 1-800-328-0580, 1-800-544-PROX, FAX: 612-553-0708; Empl.: 75; *Sls. Mgr.:* Jerald L. Moser, Dir.of Sls.; *Dist. Mgr.:* Daniel P. Cina, Eastern Reg'l Sls. Mgr., Brad Nielson, Western Reg'l Sls. Mgr.

TUSONIX, INC., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, Tel: 602-744-0400, TELEX: 102-299640, TWX: 310-299640, FAX: 602-744-6155; FSC No.: 59660; Empl.: 800; *Sls. Mgr.:* Robert H. Jones; *Dist. Mgr.:* John H. Ohlrich

TUSTIN ELECTRONICS CO., 1580 N. Kellogg Drive, Anaheim, CA 92807, Tel: 714-777-5800, FAX: 714-777-5814; FSC No.: 7025-0010; *Sls. Mgr.:* Saul Tunkelrott

TWO TECHNOLOGIES,INC., 419 Sargon Way, Horsham, PA 19044, Tel: 215-441-5305, FAX: 215-441-0423; Empl.: 10; *Sls. Mgr.:* Joan Rickards

TWP, INC., 2133 4th St, Berkeley, CA 94710, Tel: 415-548-4434, TELEX: 171-267, FAX: 415-548-3073; Empl.: 10; *Sls. Mgr.:* C. Donahue

TYCO INSTR. DIV., See Data Instrs.

TYCOR INTERNATIONAL INC., 6107-6 Street S.E., Calgary, Alberta, Canada T2H 1L9, Tel: 403-259-3200, FAX: 403-253-0663; *Sls. Mgr.:* Scott Lee, Canadian

TYTON CORP., Box 23055, 7930 N. Faulkner Rd., Milwaukee, WI 53223, Tel: 414-355-1130, 800-535-5552, TWX: 910-262-3094, FAX: 414-355-7341; *Sls. Mgr.:* Jim Campion, VP Sls.; *Dist. Mgr.:* Terry Tuttle

UCE, INC., 35 Rockland Rd., Norwalk, CT 06854, Tel: 203-838-7509, FAX: 203-838-2566; Empl.: 20; *Sls. Mgr.:* Greg Borstelmann

U. E. SYSTEMS, INC., 12 West Main St., Elmsford, NY 10523, Tel: 914-592-1220, 800-223-1325, TELEX: 229676, FAX: 914-347-2181; Empl.: 20

ULTRAN LABORATORIES, 139R North Gill St., State College, PA 16801, Tel: 814-238-9083, TELEX: 82-0978, FAX: 814-234-3367; FSC No.: 6625, 6635; Empl.: 20

ULTRA VOLT, CS9002, Ronkonkoma, NY 11779, Tel: 800-876-POWER, FAX: 516-363-2423; Empl.: 11; *Sls. Mgr.:* Jim Morrison ..... **D•2115**

ULTRONIX, INC., A Company of Vishay, P.O. Box 1090, Grand Junction, CO 81502, Tel: 303-242-0810, FAX: 303-242-5917; FSC No.: 05347; Empl.: 250; *Sls. Mgr.:* Rai Warzecha; *Dist. Mgr.:* Linda Million, Sls. Coord. ..... **A•1992-1995**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
AZ	Tempe, Dale Elctrns.	602-966-0291
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, V.E.C. San Diego	619-690-5112
CA	Tustin, V.E.C. Los Angeles	714-544-7024
CO	Loveland, V.E.C. Rockey Mtns.	303-667-7500
FL	Altamonte Springs, Semtronic Assocs.	407-831-8233
GA	Roswell, JWL Assocs.	404-993-0100
IL	Skokie, I.R.I. of IL	312-967-8430
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
KS	Olathe, Tech Sls.	913-829-2800
MD	Glen Burnie, Tri-Mark, Inc.	301-761-6000
MD	Lutherville, J.A. Dougherty Sls., Inc.	301-321-7890
MA	Wakefield, Howard C. Jappe Co.	617-245-9359
MA	Westwood, Comp Rep Assocs.	617-329-3454
MI	Plymouth, Jay Mktg.	313-459-1200
MN	Bloomington, I.R.I. of MN	612-854-8027
MO	St. Louis, Tech Sls.	314-521-2044
NJ	Flanders, K & R. Eng.	201-584-5235
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	E. Rochester, L-Mar Assocs.	716-381-9100
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Centerville, EMA, Inc.	513-433-2800
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5000
OH	Dayton, Scott Elctrns.	513-294-0539
OH	Reynoldsburg, Scott Elctrns.	614-863-1281
OR	Beaverton, L D Elctrns.	503-684-8221
PA	Horsham, T M I	215-441-4300
TX	Dallas, Edward F. Aymond Co.	214-826-7620
TX	Houston, Edward F. Aymond	713-943-3149
WA	Bellevue, UniComp, Inc.	206-869-5124
WA	Snohomish, L D Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Brooksfield, I.R.I. of Wisconsin	414-789-9393
Can	British Columbia, Kaytronics, Inc.	604-294-2000
Can	Concord, Ont., Kaytronics	416-669-2262
Can	Kanata, Ont., Kaytronics	613-564-0080
Can	Ville St. Laurent, Ont., Kaytronics	514-745-5800
CA	San Clemente, Diversitech Reps.	714-366-1496
CO	Boulder, Intersys	303-443-5897
FL	Coral Springs, PSR Technlgs. Inc.	305-753-5732
GA	Lithia Springs, Effective Mktg. Force	404-948-6023
IL	Itsaca, LTD Technlgs.	708-773-2900
IN	Fishers, Rathsburg Assoc.	317-577-4500
MA	N. Reading, Yankee Tech	508-664-0865
MI	Farmington Hills, Rathsburg Assoc.	313-489-1500
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	St. Louis, Thomas L. Dowell & Assocs.	314-849-4234
NY	Orchard Park, Davis-Callahan Co.	716-662-5988
OH	Franklin, Wiethe & Young Assoc.	513-422-5959
OR	Tualitin, Weaver & Assocs. Inc.	503-691-0665
PA	Spring City, Classen & Doolittle Assocs.	215-948-5958
TX	Dallas, Rich Sls.	214-257-0761
TX	Round Rock, Rich Sls.	512-244-0205
EXP	Inglewood, Eldon Industries, Inc.	213-642-7716

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Ulveco

FAX: 713-977-5031

ULVECO, INC., 10401 West Office Dr., Houston, TX 77042, Tel: 1-800-527-7042; Empl.: 50; *Sls. Mgr.:* Ron Schneider ..... **A•2454-2457**

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Escondido, Van Gott & Assocs.	619-489-0893
CA	Santa Clara, Gagner-Toomey Assocs., Inc.	408-244-2200
CO	Franktown, MRC	303-660-8750
CT	Avon, Tom Maguire Assocs.	203-673-3019
FL	Maitland, E I R, Inc.	407-660-9600
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MN	Minneapolis, Electro-Serv Co.	612-338-3475
NH	Windham, Tom Maguire Assocs.	603-432-0363
NY	Plainview, Robert Smith Assocs.	516-681-3155
PA	Exton, Linear Sls.	215-524-8080
WA	Seattle, Northmar, Inc.	206-524-5170
WI	Thiensville, TFL Assocs. Inc	414-242-6800
Can	Toronto, Cana Reps.	416-250-6683

UNADILLA ANTENNA MFG. CO., Ballardvale Station, P.O. Box 4215, Andover, MA 01810, Tel: 508-475-7831, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* P. Jannini

FAX: 619-744-7320

UNDERWATER KINETICS, 1020 Linda Vista Dr., San Marcos, CA 92069, Tel: 619-744-7560; Empl.: 85; *Sls. Mgr.:* Greg Sippel ..... **C•1127-1129**

UNDERWOOD INDUSTRIES OF N.Y., INC., d/b/a Viking Products, 456 Broad St., P.O. Box 269, Waverly, NY 14892, Tel: 607-565-4551, FAX: 607-565-9650; Empl.: 7; *Sls. Mgr.:* Robert Pichette

UNGAR, Div. Eldon Inds., Inc., 5620 Knott Ave., Buena Park, CA 90621, Tel: 714-994-2510, TELEX: 4720750 Eldon, FAX: 714-523-7790; FSC No.: 78976; Empl.: 140; *Sls. Mgr.:* Richard Shivers; *Dist. Mgr.:* Dianna Maes

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AZ	Tempe, Rich Sls. Co.	602-968-7787
CA	Gardena, Ungar Sls. Assocs.	213-532-6837
CA	Mountain View, Production Innovation	415-968-0380

UNICO, 3725 Nicholson Rd., Franksville, WI 53126-0505, Tel: 414-886-5678, TWX: 910-271-2385, FAX: 414-886-8396; Empl.: 250; *Sls. Mgr.:* Joseph Glover

UNICORP

FAX: 201-674-3803

UNICORP, 291 Cleveland St., Orange, NJ 07050, Tel: 201-674-1700, 800-526-1389; FSC No.: 04729; Empl.: 82; *Sls. Mgr.:* B. Levine ..... **C•1598-1599**

Local Sales Offices & Reps

CA	Irvine, The Hapco Group	714-474-8474
CO	Wheatridge, Skip Jutze Assoc.	303-231-0900
CT	Lyme, Gerard M. Blaney Assoc.	203-434-9497
IL	Addison, Houlihan Sls. Co.	708-543-7200
NJ	Ramsey, R.W. Rundle Assocs.	201-327-4151
PA	Doylestown, George Recentio Assocs.	215-348-7577

UNIMAX SWITCH CORP., See C & K/Unimax, Inc.

UNIMEASURE, INC., 7055 N.W. Grandview Dr., Corvallis, OR 97330, Tel: 503-757-3158, FAX: 503-757-0858

UNION CARBIDE CHEMICALS & PLASTICS COMPANY INC., Industrial Chemicals Div., Crystal, 9320 Chesapeake Dr., Ste. 216, San Diego, CA 92123, Tel: 619-279-4500, FAX: 619-565-8926; Empl.: 125; *Sls. Mgr.:* L. R Rothrock

UNIPLEX CORP., 221 E. Little Canada Rd., St. Paul, MN 55117, Tel: 612-490-1936, FAX: 612-490-0495; Empl.: 8; *Sls. Mgr.:* M. Bryan

UNIPOWER CORPORATION

FAX: 305-971-1837

UNIPOWER CORPORATION, 2981 Gateway Dr., Pompano Bch., FL 33069-4803, Tel: 305-974-2442; FSC No.: 62125; Empl.: 65; *Sls. Mgr.:* Warren Peters, Mgr. Tech. Sls. ..... **D•2116-2130**

Local Sales Offices & Reps

AL	Huntsville, Marco Mktg.	205-883-9630
AZ	Phoenix, Shefler-Kahn	602-257-0884
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-453-9018
CA	Santa Clara, Gagner-Toomey	408-244-2200
CO	Denver, AKI Enterprises	303-388-4488
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	407-425-6149
IL	Itasca, Beta Technlg. Sls.	708-250-9586
IA	Cedar Rapids, Stan Clothier	319-393-1576
KS	Olathe, Stan Clothier	913-829-0073
MD	Gaithersburg, Deltatronics	301-253-0615
MA	Arlington, Interstate Sls.	617-646-3914

MA Chelmsford, Interstate Sls. 508-256-2287
MI Livonia, Lowell-Wendt Mktg. 313-464-2722
MI Wyoming, Lowell-Wendt Mktg. 616-457-0900
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO St. Charles, Stan Clothier 314-928-8078
NY Great Neck, F & F Metro 516-482-4080
NY Rochester, Elcom Sls. Inc. 716-385-1400
NY Syracuse, Elcom Sls. Inc. 315-685-8967
NC Charlotte, RG Sls. 704-531-0096
OH Columbus, McFadden Sls. 614-761-3177
PA Blue Bell, Deltatronics 215-641-9930
TX Houston, Jim D. Gray Assocs. 713-342-1710
TX Richardson, Jim D. Gray Assocs. 214-699-9976
VA Pohaton, Deltatronics 804-492-9027
Can Mississauga, Andy Bauman Assocs. .. 416-828-2600
Can W. Vancouver, Leister Blake Entprs.... 604-926-6127

Local Distributors

CA N. Hollywood, B.J. Wolfe 213-877-5518
CA San Jose, ForeSight Elctrns. 408-453-0219

UNI-POWER HYBRIDS INTERNATIONAL, See Hybrids Intl. Ltd., Thick Film Div., and Hi-Q Crystals, Hybrids Intl. Ltd.

UNIT DESIGN, 1811 N. Case St., Orange, CA 92665, Tel: 714-282-8100, TWX: 910-250-0136, FAX: 714-526-0119; Empl.: 15; *Sls. Mgr.:* Bill Potter

UNITED CHEMI-CON

FAX: 708-640-6341

UNITED CHEMI-CON INC., 9801 W. Higgins Rd., Rosemont, IL 60018, Tel: 708-696-2000; Empl.: 65; *Sls. Mgr.:* R. Donham ..... **A•1148-1149**

Local Sales Offices & Reps

PA Spring House, Hartmaier, Assoc. 215-643-6691
AL Huntsville, R. O. Whitesell 205-883-5110
CA Irvine, English/Damco Sls. 714-753-1950
CT Plainville, Northeast Reps 203-866-6030
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IN Indianapolis, R. O. Whitesell 317-876-9000
KS Overland Pk., Spectrum Sls. 913-648-6811
KY Versailles, R. O. Whitesell 606-873-1182
MA Hingham, Northeast Reps. 617-749-8700
MI Grand Rapids, R. O. Whitesell 616-942-5420
MI Southfield, R. O. Whitesell 313-559-5454
MI St. Joseph, R. O. Whitesell 616-983-7337
MN Plymouth, Twist Co. 612-550-0922
NH Mt. Vernon, Northeast Reps 603-880-8199
NJ Englewood Cliffs, Caravan Sls., Corp. 201-567-7600
NY Hauppauge, Aurora Mktg. 516-434-1313
NY Pittsford, Franklin Sls. Corp. 716-248-8251
NC Greensboro, Caravan Sls. 919-271-2668
NC Raleigh, Tingen Tech Sls., Inc. 919-870-7123
OH Cincinnati, R. O. Whitesell 513-521-2290
OH Cleveland, R. O. Whitesell 216-447-9020
OH Columbus, R. O. Whitesell 614-888-9396
OH Dayton, R. O. Whitesell 513-298-9546
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TN Knoxville, R. O. Whitesell 615-694-9476
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TX Houston, Mil-Rep 713-444-2557
TX Richardson, Mil-Rep 214-644-6731
WA Redmond, Earl & Brown 206-885-5064
Can Richmond Hill, Renmark Elctrns. 416-881-8844

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AZ Phoenix, Arizona Comps. 602-269-5655
AZ Tempe, Bell Inds. 602-269-5655
AZ Tempe, Future Elctrn. 602-968-7140
AZ Tempe, Time Elctrns. 602-967-2000
CA Agoura Hills, Bell Inds. 818-706-2608
CA Agoura Hills, Time Elctrns. 818-707-2890
CA Anaheim, Time Elctrns. 714-937-0911
CA Camarillo, Milgray Elctrns. 800-635-7812, 805-484-4055
CA Chatsworth, Future Elctrns. 818-700-0914
CA Chatsworth, Passive Comps. 818-700-8838
CA Fountain Valley, Components Ctr. 714-979-0433
CA Irvine, Kelex Elctrns. 714-863-1230
CA Irvine, Milgray Elctrns. 714-753-1282
CA Irvine, S.A.I. 213-376-0861
CA Riverside, Elctrn. Supp. 714-683-7300
CA San Diego, Elctrn. Supp. 619-693-8222
CA Santa Clara, Components Ctr. 408-988-6931
CA Sunnyvale, Capsco Sls., Inc. 408-734-3020
CA Tustin, Capstone Elctrns. 713-730-0349
CA Tustin, Projections Unltd. 714-544-2700
CO Denver, Capstone Elctrns. 303-375-1300
CO Englewood, Nep Elctrns. 303-799-9898
CO Englewood, Time Elctrns. 303-799-8851
CO Westminster, Future Elctrns. 303-650-0123
CO Wheatridge, Bell Inds. 303-424-1985
CT Bethel, Future Elctrns. 203-743-9594
CT Cheshire, Time Elctrns. 203-271-3200
CT East Haven, JV Elctrns. 203-469-2321
CT Milford, Milgray 800-922-6911
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Altamonte Springs, Bell Inds. 407-339-0078
FL Altamonte Springs, Future Elctrns. 407-767-8414
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FL Clearwater, Future Elctrns. 813-578-2770
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
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FL Ft. Lauderdale, Time Elctrns. 305-974-4800
FL Longwood, RM Elctrns. 407-862-9191
FL Tampa, Reptron Elctrns. 813-855-4656
FL Winter Pk., Milgray Elctrns. 800-241-5523
GA Atlanta, Time Elctrns. 404-984-0923
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Future Elctrns. 404-441-7676
GA Norcross, Hammond Elctrns. 404-449-1996
GA Norcross, Milgray Elctrns. 800-241-5523
GA Norcross, Reptron Elctrns. 404-446-1300
IL Arlington Hgts., Milgray Elctrns. 800-322-6271
IL Elk Grove Vlg., Bell Inds. 708-640-1910
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IL Northbrook, Classic Comps. 708-272-9650
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IL Schaumburg, Future Elctrns. 708-882-1255
IL Schaumburg, Reptron Elctrns. 708-882-1700
IL Schaumburg, Time Elctrns. 708-303-3000
IL Wood Dale, Nep Elctrns. 708-595-8500
IN Ft. Wayne, Bell Inds. 219-423-3422
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IN Indianapolis, RM Elctrns. 317-291-7110
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MD Columbia, Milgray Elctrns. 800-638-6656
MD Columbia, Time Elctrns. 301-964-3090
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MA Sandwich, JV Elctrns. 508-833-0700
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MA Westborough, Future Elctrns. 508-366-2400
MA Wilmington, Capstone Elctrns. 508-657-5874
MA Wilmington, Milgray Elctrns. 800-334-6941
MA Wilmington, North Star Elctrns. 508-657-5155
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MI Ann Arbor, Bell Inds. 313-971-9093
MI Grand Rapids, RM Elctrns. 616-531-9300
MI Livonia, Reptron Elctrns. 313-525-2700
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MN Eden Prairie, Future Elctrns. 612-944-2200
MN Eitzen, Capacitor Assocs. 507-495-3306
MN Minnetonka, Reptron Elctrns. 612-938-0000
MN New Brighton, Parts One 612-633-8079
MO St. Louis, Time Elctrns. 314-391-6444
NH Nashua, Brevan Elctrns. 603-889-7230
NJ Marlton, Milgray Elctrns. 800-257-7111
NJ Mt. Laurel, Capstone Elctrns. 609-727-7800
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NJ Parsippany, Milgray Elctrns. 800-622-0291
NJ Rockaway, Tonar Inds. 201-586-9000
NJ Teterboro, EAC 201-288-4477
NM Albuquerque, Bell Inds. 505-292-2700
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NY Canandiaga, Advacom, Inc. 716-396-9050
NY E. Syracuse, ADR Technlgs. 315-437-7087
NY Farmingdale, Milgray Elctrns. 800-645-4729
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NY Liverpool, Future Elctrns. 315-451-2371
NY Melville, S.A.I. 516-293-2710
NY Penn Yan, Advacom 315-536-2221
NY Rochester, Masline Elctrns. 716-546-5373
NC Charlotte, Time Elctrns. 704-522-7600
NC Charolette, Elctrn. Mktg. Corp. 704-394-6195
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Capstone Elctrns. 919-954-0600
NC Raleigh, Century Elctrn. Comps. 919-782-2116
NC Raleigh, EAC 919-970-9700
NC Raleigh, Milgray Elctrns. 800-562-3118
NC Raleigh, Sager Elctrns. 919-850-9550
OH Cleveland, Milgray Elctrns. 800-321-0006
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OH Highlands Hills, Elctrn. Mktg. Corp. 216-442-3441
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PA King of Prussia, Time Elctrns. 215-337-0900
PA Malvern, Interface Elctrns. 215-889-2060
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PA Norristown, Century Elctrn. Comps. ... 215-631-5400
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PA York, E.C.I. 717-846-5334
SC Greensville, Hammond Elctrns. 803-233-4121
TX Austin, Kent Elctrns. 512-834-1900
TX Carrollton, Capstone Elctrns. 214-380-9049
TX Dallas, Milgray Elctrns. 800-637-7227
TX Houston, Time Elctrns. 713-530-0800
TX Irving, HArper, S.I.D. 214-621-0500
TX Richardson, Bell Inds. 214-690-0466
TX Richardson, S.A.I. 214-231-6330
UT Midvale, Bell Inds. 801-255-9611
UT Salt Lake City, Future Elctrns. 801-972-8489
UT Salt Lake City, Milgray Elctrns. 800-537-9739
UT Salt Lake City, Standard Supp. Co. 801-486-3371
UT W. Valley, Time Elctrns. 801-973-8181
VT Rutland, S.A.I. 802-775-7126
WA Bothell, Projections Unltd. 206 485-2147
WA Redmond, Capsco Sls., Inc. 206-869-7400
WA Redmond, Future Elctrns. 206-881-8199
WA Redmond, Time Elctrns. 206-882-1600
WI New Berlin, Classic Comps. 414-786-5300
WI New Berlin, Nep Elctrns. 414-785-9100
WI Waukesha, Bell Inds. 414-547-8879
Can Calgary, Zentronics 403-295-8838
Can Mississauga, Time Elctrns. 416-672-5300
Can Mississauga, Zentronics 416-564-9600
Can Nepean, Carsten Elctrns. 613-726-9250
Can Ottawa, Future Elctrns. 613-820-8313
Can Richmond, Electrosonics, Inc. 604-273-2911
Can Richmond, Zentronics 604-273-5575
Can Scarborough, Carsten Elctrns. 416-495-7705
Can Willowdale, Milgray Elctrns. 800-268-3315, 416-756-4481

UNITED ELECTRIC CONTROLS, P. O. Box 9143, Watertown, MA 02272-9143, Tel: 617-926-1000, TELEX: 92 2445, FAX: 617-926-2568; Empl.: 420; *Sls. Mgr.:* Dave Williams; *Dist. Mgr.:* George Miller

UNITED FOAM PLASTICS, 172-Q E. Main St, Georgetown, MA 01833, Tel: 508-352-2200, TWX: 710-347-0315, FAX: 508-352-7169; FSC No.: 55900; Empl.: 200; *Sls. Mgr.:* R.L. Bailly

Local Sales Offices & Reps

AL Decatur, United Foam Plastics Corp. .. 205-351-0800
CT Pawcatuck, United Foam Plastics 203-599-1242
FL Kissimee, United Foam Plastics Corp. 407-933-4880
GA Fairburn, United Foam Plastics 404-964-5888
NJ Somerset, United Foam Plastics 201-560-9550
PA Bridgeport, United Foam Plastics 215-272-5430

UNITED PRICING REPORTS, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

UNITED SOLDER WRAP INC., See Vector Elctrn. Co., Solderwrap of CA, Inc.

UNITED STATES CRYSTAL CORP., 3605 McCart St, Fort Worth, TX 76110, Tel: 817-921-3014, TWX: 910-893-4084, FAX: 817-923-0424; FSC No.: 52847; Empl.: 75; *Sls. Mgr.:* Jan Henderson

UNITED STATES ELECTRONICS, 60 Brown Ave., Springfield, NJ 07081, Tel: 201-912-0111, FAX: 201-912-0015; Empl.: 20

UNITED SUPERTEK, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0730, FAX: 408-922-0534; Empl.: 55; *Sls. Mgr.:* Roger Meade

UNITED TECHNOLOGIES CONTROL SYSTEMS, 131 Godfrey St, Logansport, IN 47401, Tel: 219-747-6142, TWX: 810-295-0699; Empl.: 3,700; *Sls. Mgr.:* Terry Smith

UNITED TECHNOLOGIES MICROELECTRONICS CENTER, United Technologies Corp., 1575 Garden of The Gods Rd., Colorado Springs, CO 80907, Tel: 719-594-8000, 1-800-MIL-UTMC, FAX: 719-594-8032; Empl.: 485; *Sls. Mgr.:* Dwight Deem

UNITED WIRE & CABLE CORP., 425 Shrewsbury St, Worcester, MA 01604, Tel: 508-757-3872, FAX: 508-753-2173; FSC No.: 51348; Empl.: 10; *Sls. Mgr.:* T. P. Andrews

UNIT INDUSTRIES, 1140 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-4161, FAX: 714-871-4164; FSC No.: 0AMM9; Empl.: 40; *Sls. Mgr.:* D. Molby

UNITRACK INDUSTRIES, INC., 1372 Enterprise Dr., Goshen Corp. Pk., P.O. Box 1927, West Chester, PA 19380, Tel: 215-692-0800; *Sls. Mgr.:* Anna Orcutt

UNITREK CORPORATION, 3000 Lewis & Clark Hwy., Ste.2, Vancouver, WA 98661, Tel: 206-699-7277, FAX: 206-694-6930; Empl.: 40; *Sls. Mgr.:* John Sailer

UNITRODE CORP., 580 Pleasant St., Watertown, MA 02172, Tel: 617-926-0404, FAX: 617-924-1235; Empl.: 2,000; *Sls. Mgr.:* Leslie Wallace; *Dist. Mgr.:* Ron Myers

UNITRON INC., 10925 Miller Rd., Dept. EE, Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511, FAX: 214-341-2099; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* James Baker

UNIVERSAL AD-YU/D-F INC., 2517 E. Norwich St., Milwaukee, WI 53207, Tel: 414-482-4100; FSC No.: 90101; Empl.: 10; *Sls. Mgr.:* Ronald Tessmer

UNIVERSAL DATA SYSTEMS, INC., Motorola Information Systems Group, 5000 Bradford Dr., Huntsville, AL 35805-1993, Tel: 205-430-8000, TELEX: 752602 UDS HTV, FAX: 205-830-5657; Empl.: 950; *Sls. Mgr.:* Tony Zalenski

UNIVERSAL INSTRS. CORP., MECHANIZED ELCTRN. ASSEMBLY (MEA) DIV., See Mechanized Elctrn. Assembly Div., Universa

UNIVERSAL MFG., CO. INC., 1168 Grove St., Irvington, NJ 07111, Tel: 201-374-9800, TELEX: 710-995-4647, FAX: 201-374-2265; Empl.: 60; *Sls. Mgr.:* Martin Mayer; *Dist. Mgr.:* Martin Mayer

FAX: 914-241-3129

UNIVERSAL VOLTRONICS CORP, Thermedics Inc./ThermoElctron Corp., 27 Radio Circle Dr., Mt. Kisco, NY 10549, Tel: 914-241-1300, TWX: 710-571-2142; FSC No.: 14225; Empl.: 85 ..... **D•2131-2133**

Local Sales Offices & Reps

FL	Satellite Beach, BWS Microwave Marktg.	407-773-6170
MA	Whitinsville, Power Factor & Assocs. ..	617-234-6415
NV	Las Vegas, Trembly Assoc., Inc.	702-739-9770
NM	Albuquerque, Trembly Assoc., Inc.	505-266-8616
PA	Audubon, Holmes Assocs.	215-666-0636
PA	Audubon, Holmes Assocs., Inc.	215-666-0636
TX	El Paso, Trembly Assocs., Inc.	915-533-9380
UT	No. Salt Lake City, Trembly Assocs., Inc.	801-295-4703
Can	Nepean, Ont., Datacomp Elctrns.	613-723-8825
Can	Toronto, Ont., Datacomp Elctrns.	416-533-4076

Local Distributors

AZ	Phoenix, Trembly Assoc. Inc.	602-967-2058
CO	Wheat Ridge, Trembly Assoc. Inc.	303-421-8900
NV	Las Vegas, Trembly Assoc. Inc.	702-739-9770
NM	Albuquerque, Trembly Assoc. Inc.	505-266-8616
TX	El Paso, Trembly Assoc. Inc.	915-533-9380
UT	North Salt Lake, Trembly Assoc. Inc. ..	801-295-4703
EXP	London, England, Stansberry Assoc. Int'l, Inc.	01-467-0535
Can	Toronto, Ont., Datacomp Elctrns.	416-533-4076

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UNIVERSITY SOUND, INC., Mark IV Industries, 13278 Ralston, Sylmar, CA 91342, Tel: 818-362-9516, FAX: 818-367-5292; Empl.: 72; *Sls. Mgr.:* Jeffrey J. Pallin

UPSYSTEMS, INC., Subsidiary of Chloride Power Elec., One Technology Place, Caledonia, NY 14423, Tel: 716-538-4421, FAX: 716-538-6345; FSC No.: 3698; *Sls. Mgr.:* Steve Olson

URBAN ELECTRONICS, P. O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 508-785-2265; Empl.: 50; *Sls. Mgr.:* G. Urban

USAR SYSTEMS, INC., 568 Broadway Ste. 405, New York, NY 10012, Tel: 212-226-2042, FAX: 212-226-3215; Empl.: 3; *Sls. Mgr.:* Yannis Milios

DIGITAL

FAX: 206-576-0515

U. S. DIGITAL CORP., 8409 N.W. 15th Court, Vancouver, WA 98665, Tel: 206-576-0514, 800-736-0194 (Sales); *Sls. Mgr.:* David Madore ..... **B•1952-1955**

Local Sales Offices & Reps

VA	Roanoke, Engrg. & Mktg. Corp. of VA	703-562-0726

Local Distributors

VA	Roanoke, Engrg. & Mktg. Corp. of VA	703-562-0726

USD PRODUCTS , Div. of Bussmann, 7300 W. Wilson Ave., Chicago, IL 60656, Tel: 708-867-4600, FAX: 708-867-2211; Empl.: 200; *Sls. Mgr.:* Mr. Chris Osmun

USECO DIV., Litton Inds, 13536 Saticoy St, Van Nuys, CA 91409, Tel: 818-786-6381, FAX: 818-902-4516; FSC No.: 88245; Empl.: 100; *Sls. Mgr.:* Peggy Slattery

U.S. ELCO,INC., 2930 Scott Blvd., Santa Clara, CA 95054, Tel: 1-800-888-ELCO, FAX: 408-980-9754; *Sls. Mgr.:* Douglas Hemingway

U.S. INSTRUMENT RENTALS, INC., AT&T Capital Corp., 1830 West Airfield Drive, D/FW Airport, TX 75261, Tel: 800-874-7123; Empl.: 500; *Sls. Mgr.:* Greg Lapham

U. S. LASER CORP., 825 Windham Court North, Wyckoff, NJ 07481, Tel: 201-848-9200, FAX: 201-848-9006; Empl.: 25; *Sls. Mgr.:* James F. Golden

U.S. POWER/RELCO MIDWEST, U.S. Power Converting Co., 8830 West 61st North, Wichita, KS 67205, Tel: 316-722-6440; Empl.: 12; *Dist. Mgr.:* Jonathan P. Snow ..... **C•1092; D•2027**

U.S. POWER CONVERTING COMPANY/RELCO, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503, Tel: 213-316-9984, FAX: 213-316-9050; Empl.: 8; *Sls. Mgr.:* Van Snow; *Dist. Mgr.:* Tom Clark ..... **C•1092; D•2027**

Local Sales Offices & Reps

KS	Wichita, U.S. Power Converting/Relco	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616
Can	Torrance, U.S. Power Conv. Co.	213-316-9984

Local Distributors

CA	Torrance, U.S. Power Converting/L. Snow & Assocs.	213-316-9984
KS	Witchita, U.S. Power Converting/Relco	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

U.S. SENSOR CORP., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000, FAX: 714-639-1220; Empl.: 25 ..... **B•1871**

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls. Inc. ...	602-996-0635
AZ	Tucson, Compass Mktg. & Sls. Inc.	602-577-5146
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Englewood, Compass Mktg. & Sls., Inc.	303-721-9663
FL	Orlando, Richmar Elctrns. Corp.	407-352-3755
IL	Downers Grove, Richmar Elctrns. Corp.	708-968-0118
IN	Indianapolis, Richmar Elctrns. Corp. ...	317-577-9950
IA	Iowa City, Richmar Elctrns. Corp.	319-354-8894
MA	Canton, John Ferrari Co.	617-821-4599
MI	Farmington, J.P.Bergin Assocs.	313-471-7940
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-344-9990
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
WI	Butler, Richmar Elctrns. Corp.	414-781-1730

U.S. TERMINALS INC., 7502 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-8145, FAX: 513-561-8755; FSC No.: 12615; Empl.: 45; *Sls. Mgr.:* George L.Stepp ..... **C•1563**

Local Sales Offices & Reps

AZ	Phoenix, Gramer & Co.	602-942-1415
FL	Melbourne, Jerry Williams, Inc.	407-259-7700
IL	Chicago, LTD Technologies	708-773-2900
IL	Itasca, LTD Technologies	708-773-2900
IA	Cedar Rapids, J.R. Sls. Engrg., Inc.	319-393-2232
IA	Cedar Rapids, J.R. Sls.Engrg.,Inc.	319-393-2232

FAX: 818-287-7350

U.S. TOYO FAN CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-5297; Empl.: 20; *Sls. Mgr.:* Peter Jeanseau; *Dist. Mgr.:* Peter Jeanseau ..... **C•1668-1669**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Oceanside, Noo Rep Tech Sls.	619-941-0558
CA	San Gabriel, U.S. Toyo Fan Corp.	818-287-5297
CA	Santa Clara, U.S. Toyo Fan Corp.	408-988-1260
FL	Winter Springs, Sunland Assocs.	407-365-9533
IL	Downers Grove, Golten Assoc.	708-512-0093
IA	Cedar Rapids, Stan Clothier Co.	319-393-1576
KS	Olathe, Stan Clothier Co.	913-829-0013
MD	Cockeysville, Dalbrook Corp.	301-666-2212
MI	Farmington Hills, W. R. Hummon	313-474-0661
MN	St. Paul, Innovate Sls.	612-225-9772
MO	St. Charles, Stan Clothier Co.	314-928-8078
NJ	Fort Lee, Nepture Elec.	201-461-2789
NY	E. Syracuse, Fountain, Young & Co. ..	315-437-7733
NY	Plainview, Neptune Elec.	516-349-1600
NC	Matthews, Arthur, Harris & Assoc.	704-845-1085
OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix	513-252-6700
OR	Beaverton, Unicomp, Inc.	503-643-1645
PA	Allison Pk., Geotronix Inc.	412-487-1770
PA	Colmar, Dalbrook Corp.	215-997-2770
TX	Richardson, Zonk Assocs.	214-238-7651
TX	Stafford, Zonk & Assocs.	713-561-7777
WA	Snohomish, Unicomp, Inc.	206-568-0511
PR	Santruce, SISCO	809-726-3137
Can	Islington, Ont., Pipe-Thompson Ltd. ...	416-236-2355

Local Distributors

AZ	Phoenix, Aero-Space Southwest	602-269-5655
CA	Anaheim, Almo/Pacesetter	714-777-4711
CA	Fremont, Terminal Sls. Corp.	415-656-7722
CA	Tustin, Added Value Elctrns. Distr.	714-259-8258
MN	Fridley, Voyager Elect.	612-571-7766
UT	Salt Lake City, Added Value Elect.	801-975-9500
IL	Elk Grove, Martec Assocs.	708-956-8090
MD	Beltsville, Petricko Sls.	301-937-4960
MA	Haverhill, Cord Elctrns.	617-374-0100
MI	Farmington Hills, Versatron	313-474-0667
MN	Fridley, Voyager Elec.	612-571-7766
NV	Las Vegas, Kiesub Corp.	702-733-3888
NJ	Corbin City, Index	609-628-4040
NM	Albuquerque, Betatron	505-821-1122
NY	Elmsford, Multimeterics	914-347-3666
NY	Endwell, Pryme-Line Distr.	607-748-5200
OH	Richfield, Alpha Distr. Corp.	216-659-7100
OR	Beaverton, Hansen Elctrns.	503-642-4455
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
TX	Richardson, Zec Sls.	214-669-0895
Can	Mississauga, Ont., Rush Elex. Ltd.	416-677-7280

UTE MICROWAVE, 3500 Sunset Ave., Asbury Park, NJ 07712, Tel: 908-922-1009, TELEX: 13-2461, FAX: 908-922-0848; FSC No.: 23261; Empl.: 35

UTI INSTRUMENTS CO., 2030 Fortune Drive, San Jose, CA 95131, Tel: 408-428-9400, FAX: 408-428-0823; Empl.: 80; *Sls. Mgr.:* Clyde Madsen

UVP, INC., 5100 Walnut Grove Ave., P.O. Box 1500, San Gabriel, CA 91778, Tel: 818-285-3123, TELEX: 371 6381, FAX: 818-285-2940; Empl.: 100

VACO PRODUCTS, 7200 McCormick Blvd., Chicago, IL 44139-3395, Tel: 708-677-9500, TELEX: 72-4431; Empl.: 250; *Sls. Mgr.:* Bill Redmond

VALHALLA SCIENTIFIC

FAX: 619-457-0127

VALHALLA SCIENTIFIC, 9955 Mesa Rim Rd., San Diego, CA 92121, Tel: 619-457-5576; Empl.: 75; *Sls. Mgr.:* Kerry Clark ..... **D•1332-1333**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier	205-536-1506
CA	Costa Mesa, Cutlass Elctrns.	714-549-9358
CA	San Diego, Amasco	619-292-7666
CA	San Jose, ARC Tech. Resources	408-263-6486
CA	Sunnyvale, ARC Technical Resources	408-773-8871
CA	Torrance, Cutlass Elctrns.	213-324-7360
FL	Orlando, Currie, Peak & Frazier	407-855-0843
FL	Pace, Currie, Peak & Frazier	904-994-0599
FL	Tampa, Currie, Peak & Frazier	813-963-1076
FL	W. Melbourne, Currie, Peak & Frazier	407-724-6795
GA	Dulth, Currie, Peak & Frazier	404-497-9404
IL	Arlington Hgts., Comtel Midwest Co.	708-392-4040
IN	Indianapolis, Comtel Midwest Co.	317-253-1681
KS	Shawnee Mission, Comtel Midwest Co.	913-268-0762
LA	Lockport, AIREP Elctrns.	504-693-3666
MD	Lanham, Sel-Tronics	301-731-8080
MA	Hopkinton, Eastern Sys.	508-435-2151
MI	Farmington Hills, Carter, McCormic & Peirce (CMP)	313-477-7700
MN	Wayzata, Comtel Midwest Co.	612-476-1551
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co., Inc.	816-436-6445
NY	Rochester, Eastern Systems	716-292-1460
NC	Charlotte, Currie, Peak & Frazier	704-846-1702
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Englewood, Carter, McCormic & Peirce (CMP)	513-836-0951
OH	Parma, Carter, McCormic & Peirce (CMP)	216-398-0400
OK	Tulsa, AIREP Elctrns.	918-592-7711
OR	Portland, Westcon, Inc.	503-283-0132
PA	Philadelphia, Robert Meyers Assocs.	215-224-1663
PA	Pittsburg, Carter, McCormic & Peirce (CMP)	412-826-3800
TX	Austin, AIREP Elctrns.	512-327-0778
TX	Dallas, AIREP Elctrns.	214-349-4360
TX	Tomball, AIREP Elctrns.	713-255-2828
VA	Hampton, Sel-Tronics	804-827-6308
WI	New Berlin, Comtel Midwest Co.	414-544-6042

Local Distributors

MD	Sparks, EIL Instruments	301-771-4800
NY	Rochester, Transcat	716-458-4801
NC	Charlotte, EIS	704-392-7366

VALIDYNE ENGINEERING CORPORATION, 8626 Wilbur Ave., Northridge, CA 91324, Tel: 818-886-2057, TELEX: 65-1303, FAX: 818-886-6512; Empl.: 200

VALLEY ELECTROMAGNETICS, ECM Motor Co., 1099 Proctor Dr., Elkhorn, WI 53121, Tel: 414-723-6400, FAX: 414-723-6461; Empl.: 100; *Sls. Mgr.:* R. Forschler

VALOR

FAX: 619-458-0875

VALOR ELECTRONICS, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, Tel: 619-458-1471, TELEX: 653406 VALORSD; FSC No.: 15003; Empl.: 2000; *Sls. Mgr.:* Brad Rogers; *Dist. Mgr.:* Bill Karlicek ..... **A•1606-1607; D•2134**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech.	205-464-0033, FAX:205-464-9909
AZ	Scottsdale, American Mktg., Inc.	602-948-2778, FAX:602-860-4455
CA	Garden Grove, Elsco Elctrns.	714-891-4621, FAX:714-891-1251
CA	Santa Clara, Fahrner-Miller Assocs.	408-727-9800, FAX:408-496-6952
CO	Englewood, Comp. Sls.	303-779-8060, FAX:303-779-8357
FL	Orlando, So. Atlantic Comp.	407-857-3650, FAX:407-857-3298
FL	Seminole, So. Atlantic Comp.	813-595-6397, FAX:407-857-3298
GA	Norcross, Benchmark	404-446-1711, FAX:404-448-2854
IL	Arlington Hgts., KMA	708-398-5300, FAX:708-398-5708
MD	Annapolis, Electronic Eng.	301-249-0616, FAX:301-249-0617
MA	Topsfield, Whitehead Assocs. Inc.	617-887-8050, FAX:617-887-5434
MI	Canton, Techrep Inc.	313-981-1950, FAX:313-981-2006
MN	Minneapolis, DeBeck-Hays Assocs. Inc.	612-835-3610,FAX:612-835-0515
NJ	Kinnelon, Ashtec, Inc.	201-838-3467, FAX:201-838-5773
NJ	Marlton, BGR Assocs.	609-983-1020, FAX:609-983-1879
NY	Port Washington, Ashtec Inc.	516-767-0336, FAX:516-767-0981
OH	Dayton, KW Elctrn. Sls.	513-890-2150, FAX:513-890-5408
OH	Shaker Hgts., KW Elctrn. Sls.	216-491-9177, FAX:216-491-9102
TX	Austin, Kruvand	512-219-9441,FAX:512-219-1932
TX	Dallas, Kruvand	214-437-3355,FAX:214-680-8854
UT	Midvale, Comp. Sls.	801-561-5099, FAX:801-561-6016
VA	Midlothian, Elctrns. Engr.	804-794-8939, FAX:804-794-6090
WA	Seattle, Northmar Inc.	206-524-5170, FAX:206-524-0402
WI	Milwaukee, KMA	414-259-1771,FAX:414-259-0246
PR	Rio Piedras, D.K. Mktg.	809-765-5380, FAX:809-758-5380

Local Distributors

AL	Huntsville, Hall-Mark Elctrns. Corp.	205-837-8700
AZ	Phoenix, Hall-Mark Elctrns. Corp.	602-437-1200
CA	Chatsworth, Hall-Mark Elctrns. Corp.	818-773-4560
CA	Duluth, Hall-Mark Elctrns. Corp.	404-623-4400
CA	Irvine, Hall-Mark Elctrns. Corp.	714-727-6000
CA	Rocklin, Hall-Mark	916-624-9781
CA	San Diego, Hall-Mark Elctrns. Corp.	619-268-1201
CA	San Jose, Hall-Mark Elctrns. Corp.	408-432-4000
CO	Englewood, Hall-Mark Elctrns. Corp.	303-790-1662
CT	Cheshire, Hall-Mark Elctrns. Corp.	203-271-2844
FL	Casselberry, Hall-Mark Elctrns. Corp.	407-830-5855
FL	Largo, Hall-Mark Elctrns. Corp.	813-541-7440
FL	Pompano Bch., Hall-Mark Elctrns. Corp.	305-971-9280
IL	Wood Dale, Hall-Mark Elctrns. Corp.	708-860-3800
IN	Indianapolis, Hall-Mark Elctrns. Corp.	317-872-8875
KS	Lenexa, Hall-Mark Elctrns. Corp.	913-888-4747
MD	Columbia, Hall-Mark Elctrns. Corp.	301-988-9800
MA	Billerica, Hall-Mark Elctrns. Corp.	508-667-0902
MA	Needham, Cronin Elect.	617-449-5000
MI	Livonia, Hall-Mark Elctrns. Corp.	313-462-1205
MN	Eden Prairie, Hall-Mark Elctrns. Corp.	612-941-2600
MN	Roseville, Parts 1	612-633-8079
MO	Earth City, Hall-Mark Elctrns. Corp.	314-291-5350
NJ	Mt. Laurel, Hall-Mark Elctrns. Corp.	609-235-1900
NJ	Parsippany, Hall-Mark Elctrns. Corp.	201-515-3000
NY	Fairport, Hall-Mark Elctrns. Corp.	716-425-3300
NY	Ronkonkoma, Hall-Mark Elctrns. Corp.	516-737-0600
NC	Raleigh, Hall-Mark Elctrns. Corp.	919-872-0712
OH	Solon, Hall-Mark Elctrns. Corp.	216-349-4632
OH	Worthington, Hall-Mark Elctrns. Corp.	614-888-3313
OK	Tulsa, Hall-Mark Elctrns. Corp.	918-254-6110
TX	Dallas, Hall-Mark Elctrns. Corp.	214-343-5822
WA	Seattle, Hall-Mark Elctrns. Corp.	206-547-0415
WI	New Berlin, Hall-Mark Elctrns. Corp.	414-797-7844

VALPEY-FISHER:MATEC CORP, 75 South St, Hopkinton, MA 01748, Tel: 508-435-6831, FAX: 508-435-5289; FSC No.: 5955; Empl.: 120; *Sls. Mgr.:* Donald Elliott; *Dist. Mgr.:* John Pimentel

VALPEY-OPT COMPANY, Valpey-Fisher Corp./Opt Inds., 75 South St., Hopkinton, MA 01748, Tel: 508-435-6831, FAX: 508-435-5289; Empl.: 7; *Sls. Mgr.:* Wim Van Den Akker

VAMISTOR CORP., 115 Industrial Pk., Sevierville, TN 37862, Tel: 615-453-0001, FAX: 615-453-0003; FSC No.: 56856; Empl.: 53; *Sls. Mgr.:* John Farry, Sls. Mgr.; *Dist. Mgr.:* John Farry, Dist. Mgr.

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Can	Mississauga, Ont., Nica Power Battery Corp.	416-828-7100

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VA-TRAN SYSTEMS INC., 677 Anita St. Ste. A , Chula Vista, CA 91911, Tel: 619-423-4555, FAX: 619-423-4604; Empl.: 10; *Sls. Mgr.:* J.E. Sloan

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FAX: 813-347-7520

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MA Lexington, Zeus 617-863-8800

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FL	Oviedo, Zeus	407-365-3000
MD	Columbia, Zeus	301-997-1118
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MN	Eden Prarie, TTI	612-944-5080
MN	St. Pauls, Shelley Ragon	612-642-2823
MO	St. Louis, Chelsea	314-426-4500
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NJ	Mt. Laurel, Future	609-778-7600
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FL	Totowa, JACO	201-942-4000
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NY	Liverpool, Future	315-451-2371
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OH	Columbus, TTI	614-848-5757
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VESTA TECHNOLOGY, INC., 7100 W. 44th Ave. Ste 101, Wheat Ridge, CO 80033, Tel: 303-422-8088, FAX: 303-422-9800; Empl.: 9

VETRA SYSTEMS CORP., 27 Newtown Rd., Plainview, NY 11803, Tel: 516-454-6469, FAX: 516-454-1648; Empl.: 10; *Sls. Mgr.:* Jim Del Rossi

VG CONTROLS, INC., 34 Jenkins Road, Hewitt, NJ 07421, Tel: 201-853-4600, TELEX: 201-853-7913; Empl.: 3

VGI, INC., Vikay Industrial Pte. Ltd., 1800 Vernon St., Roseville, CA 95661, Tel: 916-783-7878, FAX: 916-783-7845; Empl.: 14; *Sls. Mgr.:* Gary Johnson

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VIBRAC, 16 Columbia Dr., Amherst, NH 03031, Tel: 603-882-6777, TELEX: 312698 VIBRAC, FAX: 603-886-3857; Empl.: 50; *Sls. Mgr.:* R. Searle

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VIBRA-METRICS, INC., 1014 Sherman Ave., Hamden, CT 06514, Tel: 203-288-6158, 1-800-8-SENS-IT; Empl.: 25; *Sls. Mgr.:* William McClain ..... **B•1957**

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RI	Narragansett, Pat Assoc.	401-783-9565
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UT	West Amercan Fork, Highland Tech. Mktg.	801-756-2634
WI	Mequon, James L. Griffin Co. Inc.	414-241-4451
EXP	Hamden, CT, Vibra-Metrics, Inc.	203-288-6158
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VIDEO DISPLAY CORP., 1868 Tucker Industrial Dr., Tucker, GA 30084, Tel: 404-938-2080,800241-5005, FAX: 404-493-3903; Empl.: 300; *Sls. Mgr.:* Robert (Bob) Liss; *Dist. Mgr.:* Randy Russell

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VIRGINIA PANEL CORPORATION, 1400 New Hope Rd., Waynesboro, VA 22980, Tel: 703-949-8376, FAX: 703-942-2856; FSC No.: 18117; Empl.: 130; *Sls. Mgr.:* Norman D. Wood

FAX: 703-375-0135

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VL

FAX: 213-738-5340

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VA	Fairfax, SCI Rep, Inc.	703-385-0600
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VTC, INCORPORATED, Control Data Corp., 2401 E. 86th St., Bloomington, MN 55425, Tel: 612-851-5200, 800-882-2667, TELEX: 857113, FAX: 612-851-5199; Empl.: 400; *Sls. Mgr.:* Dan Griffith, VP Sls.; *Dist. Mgr.:* Sue Mansk

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WALDMANN LIGHTING CO., 9 W. Century Dr., Wheeling, IL 60090, Tel: 708-520-1060, FAX: 708-520-1730; *Sls. Mgr.:* Gary Cardoza

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NY	Jericho, Metro Tech. Sls., Inc.	516-935-3330
TN	Nashville, INSUL-REPS Inc.	615-383-0524
WA	Seattle, Repwest	206-283-8351

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NY Le Roy, SSAI 716-768-7213
OH Dayton, INH Comp. Sls. 513-434-8808
TX Dallas, Allied Comps. 214-238-0408
WI Milwaukee, Bierhaus Sls. 414-963-0318

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WAVETEK, (Western Area Sales Office), 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-565-9234

WAVETEK, (Central Area Sales Office), 5808 Churchman Bypass, Indianapolis, IN 46203, Tel: 317-782-4619

WAVETEK, Southeast Area Sales Office, 2085 U.S. 19 North, Ste. 102, Clearwater, FL 34623, Tel: 813-797-1792

WAVETEK DATRON, See Datron Instruments (or call area sales offices)

WAVETEK MICROWAVE, INC., (Formerly Pacific Measurement, Inc.), 488 Tasman Dr., Sunnyvale, CA 94089, Tel: 408-734-5780, FAX: 408-747-1265

For sales offices and representatives, see Wavetek San Diego, Inc.

WAVETEK RF PRODUCTS, INC., (Formerly Wavetek Indiana, Inc.), 5808 Churchman By-Pass, Indianapolis, IN 46203-6109, Tel: 317-788-9351, FAX: 317-788-5999; FSC No.: 34280; Empl.: 303; *Sls. Mgr.:* Sara Mussmann; *Dist. Mgr.:* Ben Constantini

For Sls. Ofcs. & Reps. 9145 Balboa Ave, San Diego, CA 92123

WAVETEK SAN DIEGO, INC. , Wavetek Corp., 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-279-2200, FAX: 619-565-9558; *Sls. Mgr.:* Bob Hynes

WEBER, Inmark Corporation-Importer, 4 Byington Place, Norwalk, CT 06850, Tel: 203-866-8474, FAX: 1-203-866-0918

WEBER U.S., INC., Weber AG, 291 Great Valley Parkway, Malvern, PA 19355, Tel: 215-651-0770, FAX: 215-651-0775; Empl.: 7; *Sls. Mgr.:* Theo Notaras

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Can Kirkland, Que., WECO Elctrl. Connectors Inc. 514-694-9136
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WEED INSTRUMENT CO., INC., 707 Jeffrey Way, P.O. Box 300, Round Rock, TX 78680-0300, Tel: 512-255-7043, FAX: 512-388-4362; Empl.: 123; *Sls. Mgr.:* Jim Robertson

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TX Missouri City, Jack Guinn 713-437-2011

WEIR ELECTRONICS, INC., Weir Elctrns., Ltd., 418 3rd St., Annapolis, MD 21403, Tel: 301-268-0122, FAX: 301-268-7909; Empl.: 2; *Sls. Mgr.:* Barbara Bunting

WEIR ELCTRNS. LTD., Durban Rd., Bognor Regis, West Sussex, ENG PO 22 9RW, Tel: 0243-865991, TELEX: 86543, FAX: 0243-868613; Empl.: 500; *Sls. Mgr.:* Peter Cole (Exp.)

WEITEK CORP., 1060 E. Arques, Sunnyvale, CA 94086, Tel: 408-738-8400; Empl.: 220

WEITZ ELECTRONICS/MARVWA USA, Tel: 718-523-3688, FAX: 718-657-6938; Empl.: 49; *Sls. Mgr.:* Greg Weitz

Local Sales Offices & Reps

AZ Scottsdale, Kaye C.R. 602-948-8433
CA Santa Clara, Amelox, Inc. 408-970-9366
CO Thornton, Kaye C.R. 303-426-7951
FL Longwood, EAB Inc. 407-339-4986
GA Atlanta, EAB Inc. 404-975-3660
MN Edina, Orrin Eames Tech. Sls. 612-944-3494
RI Warwick, Ertronics 401-732-3567
TX Dallas, Passive Component Assocs. .. 214-824-6162

Local Distributors

IL Lemont, Trend Tronics 708-972-1166
NJ Roselle, Lectron Inds. 201-245-5858
NY Bohemia, Edge Elctrns. 516-567-6300

WELCH ALLYN, INC., Data Collection Div., 4619 Jordan Rd., Skaneateles Falls, NY 13153-0187, Tel: 315-685-8945, FAX: 315-685-3172; *Sls. Mgr.:* Richard Kraetz; *Dist. Mgr.:* Andy Adams

WELLEX CORPORATION, 44141 S. Grimmer Blvd., Fremont, CA 94538, Tel: 415-490-3263, TELEX: 3717647, FAX: 415-490-5531; Empl.: 356; *Sls. Mgr.:* John E. Soares

WELLS ELECTRONICS, INC., 1701 S. Main St., South Bend, IN 46613, Tel: 219-287-5941, TELEX: 4937960, FAX: 219-287-0356; FSC No.: 219-287-0356; Empl.: 200; *Sls. Mgr.:* Mike Myers

WELLS-GARDNER ELCTRNS. CORP., 2701 N. Kildare Ave., Chicago, IL 60639, Tel: 312-252-8220, FAX: 312-252-8072; Empl.: 282; *Sls. Mgr.:* Lawrence J. Brady ..... **B•1133**

Local Sales Offices & Reps

IL Inverness, James Inds. 1-708-358-8000
MA Action, Boston Elctrns. 508-264-4456
NJ Mountainside, Henry G. Richter, Inc. ... 201-233-4615
NY Fayetteville, Henry G. Richter, Inc. 315-637-6713
OH Cincinnati, JMK Elctrns. 513-271-3860
PA Phoenixville, Henry G. Richter, Inc. 215-495-6176

WENZEL ASSOCIATES, INC., 14050 Summit Dr., Austin, TX 78728, Tel: 512-244-7741, FAX: 512-244-9338; FSC No.: 62821; Empl.: 32; *Sls. Mgr.:* Liz Ronchetti

WERLATONE, INC., P. O. Box 47, Rte. 22, Brewster, NY 10509, Tel: 914-279-6187, FAX: 914-279-7404; FSC No.: 28812; Empl.: 11; *Sls. Mgr.:* G. Werlau

WESCHLER INSTRUMENTS

FAX: 216-238-0660

WESCHLER INSTRUMENTS, 16900 Foltz Parkway, Cleveland, OH 44136, Tel: 216-238-2550; Empl.: 125; *Sls. Mgr.:* Jim Tatalick ..... **D•1395-1405**

Local Sales Offices & Reps

AZ Kachina Controls 602-886-4984
CA Northern CA, Seco Controls 415-798-8300
CA Southern CA, RDX Corp. 714-599-0985
CO Anderson Controls 303-692-0290
FL Datarep Inc. 407-843-5224
GA Cascade Controls 404-998-1027
IL Ray Knitter Assoc. 708-690-6363
IN IN North, Jacks Margis 219-374-5905
IN IN South, Ray Knitter Assoc. 317-862-2788
LA Mid South Sls. 504-641-7480
MA Eastern Systems 508-435-2151
MI G&D Assoc. 313-684-5233
MN Waltam Sales 612-781-2778
MO Controls Midwest 816-842-4290
NV Vegas, Kachina Ctrls. 702-741-5666
NJ RJM Sales 908-322-7880
NM Kachina Controls 505-260-1741
NY NY (East), Expert Ind. 518-869-3355
NC Sunbelt Instruments 704-375-3132
OH OH (North), Contact Weschler 216-238-2550
OH OH (South), Annett Ind. 513-831-2800
OR McLaren Inc. 503-627-0757
PA PA (East), RJM Sales 215-643-6610
PA PA (West), Contact Weschler 216-238-2550
TX Northern TX, Seaton Corp. 214-980-9860
TX Southern TX, Lynn Elliott 713-499-1571
UT Anderson Controls 801-566-5864
VA Martin Control Equip. 804-321-7143
WA McLaren Inc. 206-827-9400
WV Contact Weschler 216-238-2550
WI WI (East), Knitter Assoc. 414-544-1976

WESCO ELECTRICAL CO., 201 Munson St., Greenfield, MA 01301, Tel: 413-774-4358, FAX: 413-774-4562; FSC No.: 12673; Empl.: 150; *Sls. Mgr.:* James R. DeSanty ..... **A•1150-1151**

Local Sales Offices & Reps

AZ Tempe, ACS of AZ 602-731-9711
CT Milford, Cuming Assoc. 203-878-3946
FL Maitland, EIR, Inc. 305-660-9600
IL Palatine, Houlihan Sls. 708-543-7200
IN Indianapolis, John H. Weaver Co. 317-257-7661
MD Severna Park, Jenco Sls. 301-544-8652
MA Framingham, Bengal Assocs. 617-877-2639
MA Randolph, Bengal Assocs. 617-961-4120
MI Madison Hgts., DEM Sls., Inc. 313-583-1500
MN Minneapolis, Furber Sls. Co. 612-881-3620

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NY Shirley, Tri-Tek Mktg. 516-395-3391
NC Raleigh, Quantum Mktg. 919-846-5728
OH Novelty, Spectro-Com 216-338-5226
PA Montgomeryville, Quick Response Tech Sls. 215-362-9225
TN McMinnville, B & D Mktg. 615-473-7155

WESCORP ANTISTATIC PRODUCTS, 144 S. Whisman Rd., Mountain View, CA 94041, Tel: 415-969-7717, TELEX: 345507, FAX: 415-969-6130; Empl.: 15; *Sls. Mgr.:* Thelma Paxton

WES-GARDE COMPONENTS GROUP, INC., 190 Elliott St., Hartford, CT 06114, Tel: 203-525-6907

WESTAMP, 1542 15th St., Santa Monica, CA 90404, Tel: 213-393-0401, TELEX: 3720078, FAX: 213-451-1058; FSC No.: 12745; Empl.: 100; *Sls. Mgr.:* Michael Mula

WESTBERG MANUFACTURING INC. (WESTACH), 3400 Westach Way, Sonoma, CA 95476, Tel: 707-938-2121; Empl.: 20; *Sls. Mgr.:* R. R. Westberg

WEST COAST ELEC. MFG., 14045 Garfield Ave, Paramount, CA 90723, Tel: 213-633-1010, FAX: 213-633-1018; FSC No.: 81823; Empl.: 25; *Sls. Mgr.:* W. E. Seal

WESTCON, 959 Cheney Ave., Marion, OH 43302, Tel: 614-382-5771, TELEX: 3775688; Empl.: 50

WESTCON, INC., 5101 N. Interstate Ave., Portland, OR 97217, Tel: 503-283-0132, FAX: 503-283-0137; Empl.: 15; *Sls. Mgr.:* Jan M. Rundquist; *Dist. Mgr.:* Jan M. Rundquist

WESTCOR CORPORATION, 485-100 Alberto Way, Los Gatos, CA 95032, Tel: 408-395-7050, FAX: 408-395-1518; *Sls. Mgr.:* Nancy Pepper

WEST ELECTRONIC SALES TEAM, 14340 Bolsa Chica Rd.G , Westminster, CA 92683, Tel: 714-898-0120, 213-495-5569, FAX: 714-894-6544; Empl.: 14; *Sls. Mgr.:* Mark Wickham; *Dist. Mgr.:* Jack Carrigan

WESTERN CASE, INC., 14351 Chambers Rd., Tustin, CA 92680, Tel: 714-838-8460, FAX: 714-838-3039; *Sls. Mgr.:* David B. Horne

WESTERN DIGITAL CORP., 8105 Irvine Center Drive, Irvine, CA 92718, Tel: 714-932-6000, FAX: 714-932-6498; Empl.: 6500; *Sls. Mgr.:* Tom DeMarchi

WESTERN ELECTRO-MECHANICAL CO., INC., 300 Broadway, Oakland, CA 94607, Tel: 415-452-1936, FAX: 415-452-1939; Empl.: 9; *Sls. Mgr.:* Hal Johnson

WESTERN ELCTRN. COMPS. CORP., 1250-A Avenida Acaso, Camarillo, CA 93010, Tel: 805-482-8002, TELEX: 401076, FAX: 805-482-8675; Empl.: 15; *Sls. Mgr.:* Russ Geary

WESTERN ELECTRONIC PRODUCTS CO., 915-G Calle Amanecer, San Clemente, CA 92672, Tel: 714-492-4677, FAX: 714-492-5952; Empl.: 6; *Sls. Mgr.:* Tony English; *Dist. Mgr.:* Shaun Ramsey

GRAPHTEC

FAX: 714-855-0895

WESTERN GRAPHTEC, 11 Vanderbilt, Irvine, CA 92718-2067, Tel: 714-770-6010, 800-854-8385; Empl.: 72 ..... **D•1425**

Local Sales Offices & Reps

AL Huntsville, W. A. Brown Instrs. 205-830-9224
AK Anchorage, Alaska Science & Tech. .. 907-562-2482
AZ Chandler, Vic Myers Assocs. 602-241-9324
CA Irvine, Western Graphtec 714-770-6010
CO Aurora, Mark Myers Assocs. 303-629-9676
CO Colorado Springs, Western Graphtec 719-576-8858
FL Boca Raton, Western Graphtec 407-392-4550
FL Ft. Lauderdale, W. A. Brown 305-776-6661
FL Melbourne, W. A. Brown Instrs. 407-723-0766
FL Orlando, W. A. Brown Instrs. 407-648-9660
GA Norcross, W. A. Brown Instrs. 404-449-7194
IL Arlington Hgts., Comtel Midwest 312-392-4040
IN Indiannapolis, Comtel Midwest 317-253-1681
KS Shawnee Mission, Comtel Midwest ... 913-268-0762
MD Landover, Sel-Tronics 301-341-2700
MA Andover, Western Graphtecs 508-470-1806
MA Hopkinton, Eastern Sys. 508-435-2151
MI Milford, T.M.S. 313-360-1514
MN Wayzata, Comtel Midwest 612-476-1551
MO St. Peters, Western Graphtec 314-279-3915
NM Albuquerque, Vic Myers Assocs. 505-294-1791
NY Cedar Grove, K.L.S. 201-785-4450
NY Kings Pk., K.L.S. 516-724-3155
NC Cary, W. A. Brown 919-460-1120
OH Beavercreek, T.M.S. 513-429-1142
OH Westlake, T.M.S. 216-327-3527
OK Tulsa, J. Wisdom & Assocs. 918-665-8899
PA Bridgeville, T.M.S. 412-221-2338
TX Richardson, J. Wisdom & Assocs. 214-470-9093
TX Round Rock, J. Wisdom & Assocs. 512-255-1167
UT Salt Lake City, Vic Myers 801-581-1760
VA Hampton, Sel-Tronics 804-827-6308
WA Bellevue, Western Instrs. 206-881-5110
WI New Berlin, Comtel Midwest 414-544-6042

WESTERN MULTIPLEX CORP., 310 Harbor Blvd., Belmont, CA 94002, Tel: 415-592-8832, TELEX: 295114 VIA RCA, FAX: 415-592-4249; FSC No.: 94-2620670; Empl.: 33; *Sls. Mgr.:* Graham Barnes

WESTERN RESERVE ELECTRONICS, 2150 Highland Rd., Twinsburg, OH 44087, Tel: 216-425-4951, FAX: 216-425-4956; Empl.: 100; *Sls. Mgr.:* Robert Rhodes

WESTINGHOUSE ELECTRIC CORP., Control Division, P.O. Box 819, Oldsmar, FL 34667, Tel: 813-855-4621, TELEX: 358713; Empl.: 200; *Sls. Mgr.:* E.A. Schiff

WEST INSTRUMENT, A Mark IV Company, 2101 Oxford Road, Des Plaines, IL 60018-1919, Tel: 708-390-7711, FAX: 708-390-7234; Empl.: 150; *Sls. Mgr.:* W. J. Bell, Jr.; *Dist. Mgr.:* W. J. Bell, Jr.

WESTLAKE COMPONENTS INTERNATIONAL, 30961 Agoura Rd., Ste. 309, Westlake Village, CA 91361, Tel: 800-228-1097, FAX: 818-717-1754; *Sls. Mgr.:* Rick Odorfer

WESTON INSTRUMENTS, Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590; Empl.: 35; *Sls. Mgr.:* Gerald D. Frank; *Dist. Mgr.:* Gerald D. Frank ..... **D•1338-1339**

Local Distributors

AL Birmingham, Brownell Instrs. & Controls Co. 205-323-4761
AL Mobile, Brownell Instrs. & Controls Co. 205-479-8581
AL Montgomery, Southern Controls, Inc. .. 205-277-5030
AZ Phoenix, Brownell Electro, Inc. 602-269-8396
AZ Tempe, Crompton Metermaster 602-431-0015
AR Little Rock, Brownell Electro, Inc. 501-562-2061
CA Los Angeles, Brownell Electro, Inc. 213-532-1150
CA Los Angeles, EIL Instrs., Inc. 213-685-7020
CA Palo Alto, Metermaster/Palo Alto 415-960-8500
CA San Diego, Crompton Metermaster ... 619-560-4841
CA Sunnyvale, EIL Instrs., Inc. 408-245-4320
CA Yorba Linda, Crompton Metermaster 714-921-2101
CO Aurora, R & R Instrmn. 303-340-8728
CO Denver, Brownell Electro, Inc. 303-333-3541
CO Denver, EIL Instrs., Inc. 303-534-4160
CT Middletown, EIL Instrs., Inc. 203-346-6646
CT Rocky Hill, Brownell Electro, Inc. 203-721-9343
FL Miami, Brownell Instrs. & Controls Co. 305-884-3197
FL Orlando, Brownell Instrs. & Controls Co. 407-843-6776
FL Palm Bay, EIL Instrs., Inc. 407-725-8300
GA Atlanta, Brownell Instrs. & Controls Co. 404-762-5181
GA Kennesaw, CMI Metermaster 404-425-8902
IL Bridgeview, EIL Instrs. 708-430-2292
IL Countryside, Inotek/Pacific Indicator .. 708-352-3500
IL Glendale Heights, Crompton Metermaster 708-351-4554
IN Indianapolis, EIL Instrs., Inc. 317-545-1373
IN Indianapolis, Rockwell Engrg. Co. 317-251-9453
KS Overland Pk., Brooks Elctrns., Inc. 913-648-3131
KY Louisville, EIL Instrs., Inc. 502-454-3420
LA Harahan, Butler Land Inc. 504-734-8888
LA New Orleans, Indl. Instr. Works 504-733-8355
MD Sparks, EIL Instrs., Inc. 301-771-4800
MA Burlington, EIL Instrs., Inc. 617-272-9450
MA Southbridge, Crompton Metermaster .. 508-765-1676
MA Woburn, Brownell Instrs. & Controls Co. 617-935-7820
MI Southfield, Comtel Instrs. 313-358-2505
MN Edina, Brownell Electro. 612-942-8171
MN Minneapolis, Instrmn. Svc., Inc. 612-544-8916
MO St. Louis, Indl. Svc. Labs. 314-535-5760
MO St. Louis, Scherrer Instrs., Inc. 314-644-5362
NJ Edison, Brownell Instrs. & Controls Co. 201-287-3355
IL Elk Grove Vlg., Brownell Electro, Inc. .. 312-364-9292
NJ Pennsauken, EIL Instrs., Inc. 609-488-0474
NY Clarence, EIL Instrs., Inc. 716-634-8500
OH Cleveland, Comtel Instrs. Co. 216-442-8080
NY Farmingdale, Brownell Instrs. & Controls Co. 516-420-5990
NY Hauppauge, EIL Instrs., Inc. 516-231-6333
NY New York, Brownell Instrs. & Controls Co. 212-691-1171
NY New York, Nilsson Labs. 212-675-7944
NY Pittsford, EIL Instrs., Inc. 716-586-8251
NC Charlotte, Brownell Instrs. & Controls Co. 704-597-1270
NC Charlotte, EIL Instrs., Inc. 704-376-2237
OH Hilliard, Comtel Instrs. Co. 614-872-8305
NC Raleigh, Brownell Instrs. & Controls Co. 919-876-6524
OH Cleveland, Crompton Metermaster 216-351-1234
OH Dayton, Comtel Instruments co. 513-426-5310
OH Dayton, EIL Instrs., Inc. 513-435-2134
OK Tulsa, Tri-State Instr. Lab 918-836-0286
OR Portland, Brownell Electro, Inc. 502-226-3286
PA Bridgeville, Brownell Electro, Inc. 412-221-0074
PA Pittsburgh, Comtel Instruments Co. ... 412-922-5720
PA Pittsburgh, EIL Instrs., Inc. 412-823-2255
PA Pittsburgh, Process Engrg. Co. 412-561-5050
PA Trevose, Brownell Electro, Inc. 215-364-1400
SC Columbia, Brownell Electro, Inc. 803-772-6111
TN Knoxville, Brownell Instrs. & Controls Co. 615-966-3441
TN Memphis, Brownell Instrs. & Controls Co. 901-795-8483
TN Nashville, Brownell Instrs. & Controls Co. 615-885-1302
TX Dallas, Butler & Land, Inc. 214-343-8800
TX Dallas, EIL Instrs., Inc. 214-357-0297
TX Garland, Crompton Metermaster 214-271-5671
TX Harlingen, Bush Supply Co. 512-428-1613
TX Houston, Brownell Instrs. & Controls Co. 713-699-1981
TX Houston, Butler & Land, Inc. 713-896-0808
TX Houston, CMI Meters & Instr. 713-644-1631
TX Houston, EIL Instrs., Inc. 713-271-3100
UT Salt Lake City, Brownell Electro, Inc. .. 801-262-8498
VA Bluefield, Brownell Electro, Inc. 703-322-3402
VA Norfolk, Brownell Electro, Inc. 804-855-2400
VA Norfolk, EIL Instrs., Inc. 804-885-9553
VA Richmond, Metermetrics 804-275-1431
TX Lubbock, Brownell Electro, Inc. 806-747-0211
WA Redmond, EIL Instrs., Inc. 206-882-3222
WI Milwaukee, E-M Instrs. 414-272-7799
Can Mississauga, Ont., EIL Instrs., Inc. 416-624-6660

WESTREX PRODUCTS, 25 Denby Rd., Boston, MA 02134, Tel: 617-254-1200, FAX: 617-254-6848; Empl.: 200; *Sls. Mgr.:* Bruce Burgess; *Dist. Mgr.:* Bruce Burgess

WESTRONICS INC. OF TEXAS, A Baker Hughes Co., 5001 Blue Mound Rd., Box 961003, Ft. Worth, TX 76161, Tel: 817-625-2311, FAX: 817-625-1068; Empl.: 180; *Sls. Mgr.:* Jim Bittikoffer

WHEELOCK, INC., 273 Branchport Ave., Long Branch, NJ 07740, Tel: 201-222-6880, FAX: 201-222-8707; Empl.: 200; *Sls. Mgr.:* William L. Goldstein, Sls./Mktg. VP

BRIAN R. WHITE CO., INC., 313 Henry Station Rd., Ukiah, CA 95482, Tel: 707-462-9795, FAX: 707-462-4800; *Sls. Mgr.:* Larry Richmond

WHITE-RODGERS LOGANSPORT DIV., See Stancor/ White Rodgers

S.S WHITE TECHNOLOGIES INC., 151 Old New Brunswick Rd, Piscataway, NJ 08854-3761, Tel: 908-752-8300; FSC No.: 0KZS2; Empl.: 100; *Sls. Mgr.:* Rich Henriksen; *Dist. Mgr.:* Pam Barnhard

WHITE TECHNOLOGY, INC., Bowmar Instrument Corp., 4246 E. Wood St., Phoenix, AZ 85040, Tel: 602-437-1520, FAX: 602-437-9120; FSC No.: 54230; Empl.: 105; *Sls. Mgr.:* Dan Hurd, Steve McComb

WHITMOR WIRE & CABLE, 27737 Ave. Hopkins, Valencia, CA 91355, Tel: 805-257-2400, FAX: 805-257-2495; FSC No.: 15851; Empl.: 29; *Sls. Mgr.:* Mark Lee; *Dist. Mgr.:* Mark Lee

WHITSO, 9326 Byron St., Schiller Pk., IL 60176, Tel: 708-678-5200, FAX: 708-678-0711; Empl.: 170

WHITTAKER CORP., Electronic Resources Div., 1955 N. Surveyor Ave., Simi Valley, CA 93063, Tel: 805-584-4100, TWX: 910-498-2751, FAX: 805-584-9157; FSC No.: 72152; Empl.: 200

WHITTAKER CORP., Providence Chemicals Div., King Philip Rd., P.O. Box 16069, E. Providence, RI 02916, Tel: 401-434-1770, TELEX: 92-7652, FAX: 401-434-8090; Empl.: 25

WICKMANN USA, INC., Wickmann-Werke GmbH, 3800 Camp Creek Pkwy.,Bldg. 2600,Suite 120, Atlanta, GA 30331, Tel: 404-699-7820, TELEX: 269 115 JIC UR, FAX: 404-691-2843; Empl.: 600-650; *Sls. Mgr.:* Michael V. Nagle; *Dist. Mgr.:* Michael V. Nagle ..... **B•1392-1394**

Local Sales Offices & Reps

AL	Athens, WLA & Assocs., Inc.	205-233-7894
CA	Laguna Hills, Bart Budge Assocs.	714-582-8720
CA	San Jose, Kottmeier Assocs., Inc.	408-371-8700
CO	Denver, West Inc.	303-477-8180
IL	Palatine, Goldbeck & Milota Assoc., Inc.	708-705-0602
MD	Baltimore, Manay Sls. Assocs.	301-484-6376
MA	Needham Hgts., Rosen & Assocs.	617-449-4700
MI	Grand Rapids, R.P.Urban & Assocs.	616-245-0511
MN	Minneapolis, RK Sls.	612-571-1001
TX	Dallas, Rem Comps.	214-234-1069

Local Distributors

CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Van Nuys, Fuses Unlimited/ Fusecom	818-786-8111
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
IL	Cary, Gama Elctrns.	708-639-3424
MA	Hingham, Sager Elctrns.	617-749-6700
MN	Roseville, Parts 1	612-633-8079
NH	Salem, Sager Elctrns.	603-898-1348
NY	Hauppauge, Sager Elctrns.	516-348-1300
OH	Twinsburg, Schuster Elctrns.	216-425-8134
TX	Dallas, Fuses Inc.	214-341-6407
WI	Milwaukee, Progressive Image, Inc.	414-321-4722
Can	Ontario, PS Comps., Inc.	416-665-9546

WIDE BAND ENGINEERING CO., INC., Box 21652, Phoenix, AZ 85036, Tel: 602-254-1570; FSC No.: 58907; Empl.: 10

WIDE RANGE ELCTRNS. CORP., 174 Chesterfield Indl. Blvd., Chesterfield, Missouri 63005, Tel: 314-532-5887, FAX: 314-532-5492; Empl.: 11; *Sls. Mgr.:* Donald Toone

WIELAND INC., 466 Main Street, New Rochelle, NY 10801, Tel: 914-633-0222, TELEX: 646-186, FAX: 1-800-572-0057; *Sls. Mgr.:* Carl Gruenberg, V.P. Sls. & Mktg.; *Dist. Mgr.:* Steve Vineis

WILBRECHT ELECTRONICS

FAX: 612-222-7639

WILBRECHT ELECTRONICS, 346 Chester St., St. Paul, MN 55107, Tel: 612-222-2791; Empl.: 200; *Sls. Mgr.:* Laurie Wilbrecht ..... **A•2077; B•1211-1213, 1793**

Local Sales Offices & Reps

AL	Huntsville, DTM Inc.	205-539-1485
AZ	Phoenix, Toward Engr. Assoc., Inc.	602-955-3193
CA	Chatsworth, Wes K/ Raltech Inc.	818-700-0933
CA	Milpitas, Advanced Tech., Sls., Inc.	408-946-3208
CO	Broomfield, Connors Co.	303-466-9628
FL	St. Petersburg, JCS Assoc.	813-343-2679
GA	Duluth, DTM Inc.	404-381-5592
IL	Arlington Hgts., Dytec/Central	708-394-3380
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MA	Sudbury, KSA of New England	617-443-5881
MN	St. Paul, Wilbrecht Elctrns.	612-222-2791
NJ	Morristown, Andrews & Andrews Inc.	201-569-8800
NY	Huntington, Andrews & Andrews	516-692-8686
WA	Bellevue, Caruso & Co.	206-455-8811
NC	Raleigh, DTM Inc.	919-781-7004
OH	Cincinnati, Stegman Blaine	513-729-1969
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Austin, THT Sls. Co.	512-835-2796
Can	Thornhill, Ont., EMX Entprs. Ltd.	416-889-1204

WILCO

FAX: 317-293-9462

WILCO CORP., 6451 Saguaro Court, Indianapolis, IN 46268, Tel: 317-293-9300 ..... **A•1280-1283, 2464**

Local Sales Offices & Reps

CA	San Jose, The Mktg. Co.	408-272-6836
IL	Arlington Heights, M.B. Sls.	708-392-9499
MI	Madison Heights, DEM Elctrn. Sls.	313-583-1500

WILCO WIRE & CABLE CO., INC., 1921 Las Plumas Ave., San Jose, CA 95133, Tel: 408-926-8880, FAX: 408-251-0508; Empl.: 52; *Sls. Mgr.:* Joe Shepherd; *Dist. Mgr.:* Sylvia Neal

WILCOXON RESEARCH, 2096 Gaither Rd., Rockville, MD 20850, Tel: 301-330-8811, FAX: 301-330-8873; Empl.: 90; *Sls. Mgr.:* Bob Haggerson ..... **B•1959**

WILKINSON, P.O. Box 4558, Westlake Village, CA 91359, Tel: 818-889-0050, 800-822-4653, FAX: 818-889-3810; Empl.: 40; *Sls. Mgr.:* R. Cook; *Dist. Mgr.:* R. Cook

W.L. WILLIAMSON & ASSOC., LTD., 528 S. Extension Rd., Mesa, AZ 85210, Tel: 602-833-5202; Empl.: 3

WILLIAMSON CORPORATION, 70 Domino Dr., Concord, MA 01742, Tel: 508-369-9607, FAX: 508-369-5485; FSC No.: 92-3343 WILIAMSON WCRD; Empl.: 25; *Sls. Mgr.:* William R. Barron

WILMAR ELECTRONICS, INC., 2430 Amsler St., Torrance, CA 90505, Tel: 213-326-6668, FAX: 213-326-9147; FSC No.: 25248; Empl.: 25; *Sls. Mgr.:* Zev Heifetz

WILMINGTON RESEARCH & DEVELOPMENT, 461-Boston Road B-3, Topsfield, MA 01983, Tel: 508-887-2501, FAX: 508-887-3249; Empl.: 6

WILMORE ELECTRONICS CO., INC., Box 1329, Hillsborough, NC 27278, Tel: 919-732-9351, TELEX: 292617, FAX: 919-732-9359; Empl.: 48; *Sls. Mgr.:* J. L. Harris ..... **D•2136-2139, 2230-2231**

WILSON COMPANY-SYSTEMS DIVISION, 16301 Addison Road, Dallas, TX 75248, Tel: 214-931-8666, 800-325-4436, FAX: 214-248-1177; Empl.: 9; *Sls. Mgr.:* Dave Pellerin; *Dist. Mgr.:* Dave Pellerin

WILSON, H. F., ENGINEERING CO., 475 Taft Ave., Glen Ellyn, IL 60137, Tel: 708-469-7473, FAX: 708-469-8663; Empl.: 21; *Sls. Mgr.:* Robert W. Carroll

WILSON ELECTRONICS, See Regency Land Mobile, Inc.

WILTRON, 490 Jarvis Dr., Morgan Hill, CA 95037-2809, Tel: 408-778-2000, TELEX: 285227 WILTRON MH, FAX: 408-778-0239; FSC No.: 20944; Empl.: 800; *Sls. Mgr.:* W. Baxter

THE WINATIC CORP., Electro-Technik Industries, Inc., 409 Commerce Rd., Vestal, NY 13850, Tel: 607-729-6318, FAX: 607-729-6446; Empl.: 125; *Sls. Mgr.:* Ted Zaparzynski

WINSYSTEMS, INC., 715 Stadium DR.,Ste. 100, Arlington, TX 76011, Tel: 817-274-7553, FAX: 817-548-1358; FSC No.: 1AU87

WINTEK CORP., 1801 South St., Lafayette, IN 47904-2993, Tel: 317-448-1903, 800-742-6809, TELEX: 15-624-6480 Wintek, FAX: 317-448-4823; Empl.: 13 ..... **D•1122-1123**

WIREBENDERS, INC., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021-2824, Tel: 602-861-1856, FAX: 602-870-9242; FSC No.: 5950;FSCS/CAGE 1DA26; Empl.: 22; *Sls. Mgr.:* Charles Middleton

THE WIREMOLD COMPANY, 60 Woodlawn Street, W. Hartford, CT 06110, Tel: 203-233-6251, FAX: 203-232-2062; Empl.: 900; *Sls. Mgr.:* F. D. Casteel

WIRE-PRO, INC., 23 Front Street, Salem, NJ 08079, Tel: 609-935-7601, 609-935-7651, TWX: 510-680-4750, FAX: 609-935-0102; FSC No.: FSCN 50738; Empl.: 225; *Sls. Mgr.:* Russell Morgan, Sls. & Svc. Mgr.; *Dist. Mgr.:* Phil Negrin, Mktg. Mgr.

WIRING ANALYZERS, INC., P.O. Box 417, Edmonds, WA 98020-0417, Tel: 800-221-5979 (excl. CA); Empl.: 15; *Sls. Mgr.:* Norman Wartell

WOLFRAM RESEARCH, INC., 100 Trade Center Drive, Champaign, IL 61820-7237, Tel: 217-398-0700, FAX: 217-398-0747; Empl.: 100; *Sls. Mgr.:* Stuart Ariewitz

WONTRONICS, 3048 N. Coolidge Ave., Los Angeles, CA 90039, Tel: 213-660-6230, FAX: 213-913-2299; *Sls. Mgr.:* Frank Phillips

WORLDNET MARKETING INC., 3187 F Airway Ave., Costa Mesa, CA 92626, Tel: 714-545-7118, TELEX: 3781824, FAX: 714-540-9138; Empl.: 7; *Sls. Mgr.:* Frank Buday; *Dist. Mgr.:* Frank Buday

WP®

FAX: 707-996-3380

WORLD PRODUCTS INC., 19654 8th St. East, Sonoma, CA 95476, Tel: 707-996-5201, TELEX: Worldpro snom 171715, FAX: 707-996-3380; FSC No.: 410966309; Empl.: 445; *Sls. Mgr.:* Mark Beynon; *Dist. Mgr.:* Jim Corbett ..... **A•1153, 2011, 2128-2129; B•1030**

Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.	205-534-0044
AZ	Scottsdale, American Mktg.	602-948-2778
CA	Mission Viejo, Jay Mktg.	714-581-1211
CA	Mt. View, Straube Assocs. Inc.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890
FL	Tampa, Electramark Florida Inc.	813-889-7775
GA	Norcross, The Novus Grp., Inc.	404-263-0320
IL	Arlington Heights, KMA Sls. Co.	708-398-5300
IA	Marion, Associated Elctrn. Mktg., Inc.	319-377-1129
MA	Burlington, Bob Dean Inc.	617-229-6800
MI	Holland, Comtek Sls. Inc.	616-392-7100
MN	Minneapolis, Tecteam Sls. Inc.	612-854-6616
MO	St. Louis, AEM, Inc.	314-298-9900
NJ	West Caldwell, Grimm. Siegel Assoc.	201-575-9300
NM	Albuquerque, Suntech	505-266-7951
NC	Cary, The Novus Grp., Inc.	919-460-7771
OH	Cincinnati, F.J. Campisano Co.	513-574-7111
OR	Portland, Caruso & Assocs.	503-246-5439
PA	Broomhall, L.D. Lowery	215-356-5300
PA	Coraopolis, F.J Campisano Co.	412-264-5151
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Bellevue, Caruso & Assocs.	206-455-8811
WI	Milwaukee, KMA Sls. Co.	414-259-1771

Local Distributors

AL	Huntsville, Reptron Elctrns. Inc.	205-722-9500
CA	Anaheim, Compumech Elctrns.	714-939-9100
CA	Del Mar, Compumech Elctrns.	619-792-7800
CA	Milpitas, Compumech Elctrns.	408-945-9100
CA	San Diego, All American	619-268-1505
CA	San Diego, Neuman	619-695-3005
CA	San Jose, All American Semiconductor Inc.	408-943-1200
CA	Santa Clara, Trinity Elctrns.	408-980-9011
CA	Torrance, All American Semiconductor Inc.	213-320-0240
CA	Yorba Linda, Target Elctrns.	714-692-1630
FL	Melbourne, Pridmore	407-727-2491
FL	Miami, All American Semiconductor Inc.	305-621-8282
FL	Sunrise, All American Semiconductor Inc.	305-572-7999
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Augusta, Dixie Elctrns.	404-722-2055
GA	Norcross, Reptron Elctrns.	404-446-1300
ID	Boise, Radar Elctrn.	208-336-2227
IL	Lisle, Comps. Inc.	708-852-7707
IL	Schaumburg, Reptron Elctrns.	708-882-1700
MD	Rockville, All American Semiconductor Inc.	800-426-0420,301-251-1205
MA	Norwood, Emtel	617-769-9500
MA	Wakefield, All American Semiconductor Inc.	617-246-2300
MI	Livonia, Reptron Elctrns.	313-525-3209
MN	Eden Prairie, All American Semiconductor Inc.	800-342-7364
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Fenton, Beckwith Elctrns.	314-343-6463
NM	Albuquerque, Betatron	505-821-1122
NY	Canadaigua, Advacom Technlg.	716-396-9050
NY	Ronkonkoma, All American Semiconductor	800-874-2830
NC	Charlotte, Dixie Elctrns.	704-377-4348
NC	Raleigh, Reptron Elctrns.	919-870-5189
NC	Winston-Salem, Dixie Elctrns.	919-727-5961
OH	Columbus, Reptron Elctrns.	614-436-6675
OH	Solon, Reptron Elctrns.	216-349-1415
OH	Stow, Advacom, Inc.	216-688-5311
OR	Portland, Radar Elctrns.	503-232-3404
PA	Harrisburg, Cumberland Elctrns.	717-238-5999
PA	McKean, Advacom Inc.	800-678-0512
SC	Columbia, Dixie Elctrns.	800-868-2236
SC	Greensville, Dixie Elctrns.	800-868-2260
SC	No. Charleston, Dixie Elctrns.	803-868-3336
TN	Gray, Dixie Elctrns.	615-477-3838

TN	Oakridge, Dixie Elctrns.	615-481-3393
TX	Austin, Omni Pro Elctrns.	512-794-9200
TX	Dallas, All American Semiconductor Inc.	800-541-1435
TX	Dallas, Omni Pro Elctrns.	214-233-0500
TX	Houston, Omni Pro Elctrns.	713-270-1700
VA	Charlottesville, Virginia Elctrn. Comp.	804-296-4184
WA	Richland, Radar Elctrns.	509-943-8336
WA	Seattle, Radar Elctrns.	206-282-2511
WA	Spokane, Radar Elctrns.	509-747-3053
Can	Calgary, Alb., Zentronics	403-295-8838
Can	Missisuga, Ont., Zentronics	613-226-8840
Can	Nepean, Ont., Zanin Elctrns.	613-596-2911
Can	Nepean, Ont., Zentronics	613-226-8840
Can	Richmond, B.C., Zentronics	604-273-5575
Can	St. Foy, Que., Zanin Elctrns.	418-681-1262
Can	St. Laurent, Que., Zanin Elctrns.	514-342-6211
Can	St. Laurent, Que., Zentronics	514-737-9700
Can	Toronto, Ont., Zanin Elctrns.	416-695-6850
KS	Lenexa, Associated Elctrn. Mktg., Inc.	913-888-0022

WORLD PRODUCTS INC., Systems Devices Grp., 19654 8th St. E., Sonoma 95476, Tel: 707-996-5201; Empl: 50 ..... **A•1153, 2010-2011, 2128-2129; B•1030**

Local Sales Offices & Reps

AZ	Tempe, Spectrum Assocs.	602-966-1788
CA	Los Angeles, SPA Elctrn. Sls.	714-863-1193
CA	San Jose, Signet Tech. Sls.	408-453-0611
CO	Denver, Donohue Sls., Co.	303-455-1719
FL	Melbourne, R-Rep Co., Inc.	407-242-9800
IL	Arlington, KMA Sls. Co.	312-398-5300
IN	Fort Wayne, Berberich Assoc.	219-486-0673
MN	Minneapolis, Holmgren Assocs.	612-786-7641
NJ	Livingston, Avemark Tech. Mktg.	201-992-5331
OH	Dayton, Berberich Assocs. Inc.	513-433-0342
OR	Beaverton, Luscombe Engrg./N.W.	503-636-6664
PA	Hatboro, AQS Electro	215-674-4421
TX	Dallas, Southwestern Tech. Sls.	214-369-0977
VA	Herndon, Stinson Assocs.	703-620-1332
WA	Bellevue, Luscombe Engrg./N.E.	206-643-1463
WI	Milwaukee, KMA Sls. Co.	414-259-1771
Can	Montreal, ELI Manis Inc.	514-484-2923

'WORLD' TEST SYSTEMS, INC., P. O. Drawer 1428, Waynesboro, VA 22980, Tel: 703-949-6753, FAX: 703-943-3826; *Sls. Mgr.:* Buford H. Baber

WOVEN ELECTRONICS, Woven Electronics Corporation, 1001 Old Stage Rd., Simpsonville, SC 29681, Tel: 803-963-5131, TWX: 810-963-5131, FAX: 803-963-1761; Empl.: 400; *Sls. Mgr.:* Tommy Little

WYLE LABS, See Electronic Enclosures

XCEL CORPORATION, See Digitran and Computron Display Sys. Divs.

XCEL CONTROLS INC., 1600 W. 6th, Mishawaka, IN 46544, Tel: 219-259-7804, FAX: 219-259-5769; Empl.: 40; *Sls. Mgr.:* Bruce Shepard

XCP, INC., 40 Elm St, P.O. Box 819, Dryden, NY 13053, Tel: 607-844-9143; *Sls. Mgr.:* Diane Rademacher

XEDAR CORP., 2500 Central Ave., Boulder, CO 80301, Tel: 303-443-6441, FAX: 303-443-6444; *Sls. Mgr.:* Andy Zeidler

XELTEK, 764 San Aleso Ave., Sunnyvale, CA 94086, Tel: 408-745-7974, FAX: 408-745-1401; Empl.: 17; *Sls. Mgr.:* Andrew Choi; *Dist. Mgr.:* John Kim

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XENON CORP., 20 Commerce Way, Woburn, MA 01801, Tel: 617-938-3594, FAX: 617-933-8804; Empl.: 45; *Sls. Mgr.:* Louis R. Panico

XENOTRONIX INC., 26074 Ave., Hall No. 10, Valencia, CA 91355, Tel: 805-257-4793, FAX: 805-257-1093; *Sls. Mgr.:* Jeffrey Frotton; *Dist. Mgr.:* Loria Geery

Xentek

FAX: 619-727-8926

XENTEK, INC., Taiyo Yuden USA, Inc., 760 Shadowridge Drive, Vista, CA 92083, Tel: 619-727-0940, TELEX: 910-322-1155; FSC No.: 53279; Empl.: 220; *Sls. Mgr.:* Chuck Henry ..... **D•2140-2143, 2232-2233**

Local Sales Offices & Reps

AL	Madison, Lamons Sls. Co.	205-461-7886
CA	Glendale, Halbar Assocs.	818-246-8263
CA	Huntington Bch., Regan/Munro Sls., Inc.	714-841-1411
CA	San Jose, Richards Assocs.	408-452-8171
CA	San Jose, Ruppert Sls. & Eng.	408-998-8717
FL	Casselberry, Symco, Inc.	407-695-6010
FL	Indian Harbor Bch., Post Mktg.	407-777-0994
GA	Norcross, Lamons Sls. Co.	404-242-2610
IL	Itasca, LTD Technlgs., Inc.	312-773-2900
IA	Cedar Rapids, Midtec Assocs.	319-395-0028
KS	Lenexa, Midtec Assoc.	913-541-0505
NJ	Medford, Mech-Elec. Sls.	609-654-8209
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Nashua, Bell Controls	603-882-6984
NC	Raleigh, Lamons Sls. Co.	919-846-1652
UT	Salt Lake City, Pro Rep Mktg.	801-268-3434
NY	Syracuse, M. M. Hare	315-457-6859
OH	Cincinnati, Tri-State Mktg.	513-761-7993
OR	Oregon City, Halbar, PNW	503-656-3714
TN	Greenville, Lamins Sls. Co.	615-639-8711
TX	Austin, Allied Comps.	512-331-4494
TX	Dallas, Allied Comps.	214-238-0408
TX	Houston, Allied Comps.	713-974-1903
TX	Hurst, Allied Comps. Co.	817-589-0456
VA	Richmond, Mech-Elec Sls.	804-231-4006
WA	Redmond, Halbar PNW, Inc.	206-882-0990
WI	Milwaukee, LTD Technlgs.	414-774-1000
Can	Mississauga, Altus Technlgs.	416-858-8509

XERCON, INC., P.O. Box 554, Portland, OR 97207, Tel: 503-292-8682, FAX: 503-292-8697; Empl.: 6; *Sls. Mgr.:* G. Osgood

XEROX CORPORATION, Xerox Square, 0-5, Rochester, NY 14644, Tel: 800-832-6979; Empl.: 100,367

XEROX IMAGING SYSTEMS, INC., Xerox Corp., 535 Oakmead Parkway, Sunnyvale, CA 94086, Tel: 408-245-7900, 800-248-6550, TELEX: 701994 DATACOPY UO, FAX: 415-965-3474; Empl.: 235; *Sls. Mgr.:* Joe Burroughs

XERTEX CORP., See Rosemont Corp., Sensall National Sonics

XETEL CORPORATION, 8100 Cameron Rd., Austin, TX 78753, Tel: 512-834-2266, FAX: 512-834-9250; Empl.: 300; *Sls. Mgr.:* Mark Trutna

EXICO

FAX: 818-709-5235

XICO, INC., 9737 Eton Ave., Chatsworth, CA 91311, Tel: 818-709-4403, TELEX: 709577, ESYLNK: 62253150; Empl.: 21; *Sls. Mgr.:* Ralph Reccia ..... **D•1118**

XICON CAPACITORS, P.O. Box 170537, Arlington, TX 76003, Tel: 800-628-0544, FAX: 817-561-1480; *Sls. Mgr.:* Drey Hayford; *Dist. Mgr.:* A.T. White

XICOR, INC., 851 Buckeye Court, Milpitas, CA 95035, Tel: 408-432-8888, TWX: 910-379-0033, FAX: 408-432-0640; FSC No.: 60395; Empl.: 1010; *Sls. Mgr.:* Bruce Mattern,VP Sls.; *Dist. Mgr.:* Bruce Mattern

XITRON TECHNOLOGIES, 10225 Barnes Canyon Rd., San Diego, CA 92121, Tel: 619-458-9852, FAX: 619-458-9213; Empl.: 10; *Sls. Mgr.:* Stephen Merrill

XKD CORPORATION, 101 Cooper Court, Los Gatos, CA 95030, Tel: 408-395-3700, TELEX: 171946, FAX: 408-354-2606; *Sls. Mgr.:* Skip McLaughlin

XL MICROWAVE, 5811 Racine St., Oakland, CA 94609, Tel: 415-428-9488, FAX: 415-428-9469; Empl.: 6; *Sls. Mgr.:* William J. Artz

XSIS ELECTRONICS, INC., 12620 W. 63rd St., Shawnee, KS 66216, Tel: 913-631-0448, TELEX: 437227, FAX: 913-631-1170; FSC No.: 57051; *Sls. Mgr.:* Jerry Dehnert ..... **A•1491**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Western High Tech. Mktg.	602-266-2070
CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CA	Mission Viejo, Chaparrah Elctrn. Sls.	714-582-2950
CT	Cheshire, Ashworth Assocs.	203-968-0656
IL	Schaumberg, Sieger Assocs.	312-310-8844
KS	Lenexa, Midtec Assoc. Inc.	913-541-0505
KY	Ft. Mitchell, G. W. Thelen Co.	606-341-8181
MD	Ellicott City, VPI, Inc.	301-461-2525
MA	Shrewsbury, Ashworth Assocs.	617-845-9688
MN	Eden Prairie, Aldridge Assocs., Inc.	612-944-8433
MO	St. Louis, Midtec Assoc., Inc.	314-275-8666
NJ	Wayne, Ramar Assoc.	201-942-0480
NM	Albuquerque, Western High Tech Mktg.	505-884-2256
NY	E. Syracuse, R. D. Sherman	315-433-1165
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Montgomeryville, Rufo Sys. Comps.	215-368-8495
TX	Sherman, Repmaster	214-247-6236
EXP	NY, Great Neck, Ad Auriema	516-487-0700

XYLOG CORP., 83 Hobart St., Hackensack, NJ 07601, Tel: 201-489-4040, FAX: 201-489-6745; Empl.: 30; *Sls. Mgr.:* Milton Frank

XYLOGICS, INC., 53 Third Ave., Burlington, MA 01803, Tel: 800-225-3317, FAX: 617-273-5392; Empl.: 200; *Sls. Mgr.:* David Padley; *Dist. Mgr.:* Joe Twardy

XYZ ELECTRONICS, 4700 N. 600 W, McCordsville, IN 46055, Tel: 317-335-2128, FAX: 317-335-2128; Empl.: 5; *Sls. Mgr.:* Gary Bannister

YAMAICHI ELECTRONICS, INC., Yamaichi Electronics Co., Ltd., 1420 Koll Circle, Ste.B, San Jose, CA 95112, Tel: 408-452-0797, FAX: 408-452-0799; Empl.: 19; *Sls. Mgr.:* Bob Million; *Dist. Mgr.:* Jim Bennett

YARDNEY TECHNICAL PRODUCTS, INC., 82 Mechanic St., Pawcatuck, CT 06379, Tel: 203-599-1100, TELEX: 6813114, TWX: 710-470-0260; FSC No.: 87362; Empl.: 250; *Sls. Mgr.:* Rene DuBois

YELLOW SPRINGS INSTRUMENT CO., Box 279, Yellow Springs, OH 45387, Tel: , , , 800-343-4357, TELEX: 205437, FAX: 513-767-9353; Empl.: 359; *Sls. Mgr.:* Michael Flora

YEW CORP., See Yokogawa Corp. of America

YORK METAL PRODUCTS, INC., 34-20 12th St., Long Island City, NY 11106, Tel: 718-932-3660, FAX: 718-932-0007; Empl.: 45

YORK TECHNOLOGY, INC., 210 N. Glenoaks Blvd., Ste. C, Burbank, CA 91502, Tel: 818-955-8927, TELEX: 990-968 York CA, FAX: 818-955-9728; *Sls. Mgr.:* Bradley E. Sousa

YSI INCORPORATED, P.O. Box 279, Yellow Springs, OH 45387, Tel: 513-767-7241, TELEX: 205437, FAX: 513-767-9353; Empl.: 300; *Sls. Mgr.:* Michael Flora; *Dist. Mgr.:* Michael Flora

YUASA BATTERY

FAX: 213-949-5527

YUASA BATTERY (AMERICA), INC., 9728 Alburtis Ave., Santa Fe Springs, CA 90670, Tel: 213-949-4266; Empl.: 5,000; *Sls. Mgr.:* Ron Alonso, Ed Stone; *Dist. Mgr.:* Greg Rapp ..... **D•1499**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Chandler, Lindberg	602-786-9115
AZ	Tempe, Westrep	602-820-9932
CA	San Diego, West Elctrns.	619-233-0236
CA	Santa Clara, Novatronix	408-727-9530
CA	Westminster, West Elctrns.	714-898-0120
CO	Denver, Lindberg Co.	303-758-9033
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, Over & Over	407-332-1222
FL	Coral Springs, Over & Over	305-753-7050
FL	Tampa, Over and Over	813-626-9100
GA	Norcross, Over & Over	404-449-6205
GA	Norcross, Over and Over	404-449-6205
IL	Arlington Heights, Brainard Nielsen	708-437-2700
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IA	Cedar Rapids, R.W. Kunz & Assocs.	319-396-5386
KS	Prairie Vlg., R.W. Kunz & Assocs.	913-648-3535
MD	Lisbon, Samual K. MacDonald	301-982-1088
MN	St. Louis Park, Elctrn. Innovators	612-922-2945
MO	St. Louis, R.W. Kunz & Assocs.	314-966-4977
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NJ	Cherry Hill, Samuel K. MacDonald	609-482-2666
NM	Albuquerque, Lindberg	505-881-1006
NC	Charlotte, Over and Over	704-542-9111
NC	Raleigh, Over & Over	919-876-7338
OH	Columbus, McFadden Sls.	614-761-3177
OR	Beaverton, Westmark Elctrns.	503-641-8780
PA	Monroeville, Samuel K. MacDonald	412-373-1723
TX	Austin, Barry Sls.	512-837-3616
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
UT	Salt Lake City, Lindberg	801-484-8689
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Waukesha, Brainard Nielsen	414-797-7940
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Mississauga, Ont., Tech-Trek Ltd.	416-238-0366
Can	Nepean, Ont., Tech-Trek Ltd.	613-225-5161
Can	Richmond, B.C., Tech-Trek Ltd.	604-276-8735
Can	St. Laurent, Que., Tech-Trek Ltd.	514-337-7540

Local Distributors

AZ	Glendale, Lynntronics	602-931-5981
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Costa Mesa, House of Batteries	714-642-8222
CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	Miami, Elctrn. Equip.	305-871-3500
GA	Norcross, Applied Power	404-263-0421
HI	Honolulu, Elctrl. Equip.	808-533-3881
IL	Downers Grove, Jarbo Battery	312-964-9358
MD	Beltsville, Mark Elctrns.	301-595-5040
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Brighton, Applied Power	313-229-6550
MN	Minneapolis, Bergquist Co.	612-835-2322
NH	Salem, Cronin Elctrns.	603-898-4440
NJ	Clifton, Engrd. Assemblies	201-340-0600
NY	Farmingdale, Battery Expeditors	516-752-0111
NY	Flushing, W & W Assocs.	718-961-2103
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Engrd. Assemblies	919-790-9700
OH	Columbus, Whitehead Elctrns.	614-224-1186
OH	Solon, Repco Elctrns.	216-248-8900
OR	Portland, Standard Batteries of Portland	503-234-7251
TX	Allen, Prime Distrbg.	214-231-0170
WA	Redmond, Priebe Elctrns.	206-881-2363
EXP	National & Canada, Newark Elctrns.	800-367-3573
Can	Brampton, Ont., Zentronics	416-451-8445

YUASA BATTERY (AMERICA) INC., Eastern Regional Office, 131 Industrial Ave., Hasbrouck Hgts., NJ 07604, Tel: 201-641-5900, FAX: 201-641-8720; *Sls. Mgr.:* Ed Stone/Cindy Werts; *Dist. Mgr.:* Toshio Hirai

ZAKI CORPORATION, 420 Maple St., Marlboro, MA 01752, Tel: 508-480-0201, FAX: 508-481-0595; *Sls. Mgr.:* Steven Sotsky

ZAMBRE CO., INC., 2134 Old Middlefield Way, Mountain View, CA 94043, Tel: 415-968-9176, FAX: 415-968-4851; FSC No.: 58758; 5950; Empl.: 20 Average

ZAX CORP., 2572 White Road, Irvine, CA 92714, Tel: 800-233-9817, 800-421-0982, FAX: 714-474-0159; Empl.: 25; *Sls. Mgr.:* Robert J. Parente, Dir. of Sls. & Mktg.

Z COMMUNICATIONS, INC., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, Tel: 305-735-1000, FAX: 305-735-1094; FSC No.: 1564A; Empl.: 20; *Sls. Mgr.:* Devang Patel

ZEBRA TECHNOLOGIES CORPORATION, 333 Corporate Woods Pkwy., Vernon Hills, IL 60061-3109, Tel: 708-634-6700, TELEX: 206230, FAX: 708-913-8766; Empl.: 175; *Sls. Mgr.:* Kevin O'Donnell

ZEHNTEL SYSTEMS, Div.of Teradyne Inc., 2625 Shadelands Dr., Walnut Creek, CA 94598, Tel: 415-932-6900, FAX: 415-934-0540; Empl.: 350; *Sls. Mgr.:* David Bernstein

CARL ZEISS, INC., One Zeiss Drive, Thornwood, NY 10594, Tel: 914-747-1800, TELEX: RCA 221834, TWX: WV64-6928

ZENDEX CORP., 6780 Sierra Court, Ste. A, Dublin, CA 94568, Tel: 415-828-3000, TWX: 910-389-4009, FAX: 415-828-1574; Empl.: 50; *Sls. Mgr.:* John Marceca

ZENITH

FAX: 708-391-7078

ZENITH MAGNETICS, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025-2493, Tel: 708-391-7733; *Sls. Mgr.:* Bob Cunningham; *Dist. Mgr.:* Allan Parker ..... **D•2145**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg. Assoc., Inc.	205-883-9630
AL	Huntsville, Pen-Tech Assoc.	205-881-9298
AZ	Phoenix, Howe & Howe Sls, Inc.	602-264-7971
CA	Laguna Hills, Electro Venture-s	714-581-9244
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Tech Rep Sls.	303-758-7031
CT	Cheshire, Nesco	203-272-0368
FL	West Palm Bch., Pen-Tech Assoc.	407-640-0800
IL	Arlington Hts., Hill Sls. Corp.	708-255-4400
KS	Roeland Pk., MSB Assocs. Inc.	913-432-2131
MA	Franklin, OEM Mktg. & Sls.	508-528-4983
MI	Ann Arbor, S-Tek	313-572-0516
MN	Minneapolis, Comstrand Inc.	612-788-9234
NH	Salem, OEM Mktg. & Sls.	603-893-1197
NJ	Fairfield, Metro Logic Corp.	201-575-5585
NY	Rochester, Micro-Tech Mktg. Inc.	716-426-0806
NC	Raleigh, Prime Components, Inc.	919-850-9866
OH	Cleveland, S-Tek	216-468-0413
OR	Portland, Jos. V. Beluski CO.	503-222-4279
PA	Willow Grove, Tech Sls. Assoc.	215-784-0170
TX	Dallas, REM Comps.	214-234-1069
TX	Houston, REM Comps.	713-589-9721
VA	Front Royal, Eltron Sls.	703-635-7201

ZERCOM CORPORATION, P.O. Box 84, Zercom Drive, Merrifield, MN 56465-0084, Tel: 218-765-3151, FAX: 218-765-3900; *Sls. Mgr.:* Jeff Zernov

ZERO CORPORATION

FAX: 818-841-5618

ZERO ENCLOSURES, Zero Corp., 777 Front St., Burbank, CA 91503, Tel: 818-846-4191, 818-841-1825; Empl.: 1400; *Sls. Mgr.:* Doug Griffith, V.P. ..... **C•1130-1144**

Local Sales Offices & Reps

AL	Huntsville, BJR Mfrs. Reps.	205-881-3569
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
AZ	Phoenix, Shefler/Kahn	602-581-0884
CA	Burbank, Zero-West Div.	818-846-4191
CA	Los Angeles, Landa & Assocs., Inc.	213-879-0770
CA	San Diego, Luscombe Engrg. Co.	619-292-4337
CO	Boulder, Component Prod. Sls. Co. Inc.	303-530-2800
FL	Maitland/Pompano Beach, Hutto Hawkins Assocs., Inc.	407-831-2474
FL	Pinellas Park, P & M Tech. Sls.	813-546-4175
GA	Norcross, Hollingsworth & Still, Inc.	404-447-1700
IL	Elk Grove Village, Carlson Elctrns. Sls.	708-956-8240
IN	Indianapolis, L.M. DeVoe Co.	317-842-3245
IA	Cedar Rapids, Carlson Elctrns. Sls.	319-378-1450
MD	Baltimore, Marktron	301-628-1111
MA	Monson, Zero-East Div.	413-267-5561
MN	Bloomington, Elctrn. Sls. Agcy.	612-884-8291
MS	Jackson, S. L. Welch	601-856-5471
MO	St. Louis, Cadon Techn. Sls.	314-645-8670
NY	Commack, MTR, Inc.	516-462-9580
NM	Albuquerque, Fry-Gates	505-262-1525
NY	East Syracuse, Fountain Young & Co.	315-437-7733
NC	Apex, Engineering Reps Assoc.	703-632-2365
OH	Cincinnati, K.C. Hoffman Co.	513-931-1686
OR	Tigard, RTS, Inc.	503-244-4123
PA	Boswell, B.E. Gibson	814-629-6772
PA	Huntingdon Valley, Inacker Sls.	215-947-5660
SC	Greenville, Engineering Reps Assoc.	703-632-2365
TX	Austin, Tesco, Inc.	512-834-8374
TX	Dallas, Tesco Inc.	214-553-1200
TX	Houston, Tesco, Inc.	703-690-4909
TX	Richardson, Barry Sls., Inc.	214-234-0255
UT	Salt Lake City, Effective Sls.	801-266-9617
MD	Rockville, Marktron	301-251-8990
WA	Vashon, RTS, Inc.	206-285-1363
Can	Iberville, Que., Lhotellier Canada Inds.	514-358-4376

ZERO CORP., Zero East Div., 288 Main St., Monson, MA 01057, Tel: 413-267-5561, FAX: 413-267-5569; FSC No.: 19178; Empl.: 380; *Sls. Mgr.:* Roger St. Martin ..... **C•1130**

Local Sales Offices & Reps

AL	Huntsville, BJR Mfg. Reps.	205-881-3569
CT	Monson, Zero-East Div.	413-267-5561
IN	Indianapolis, C.C. Electro Sls.	317-355-1508
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
MD	Rockville, Marktron, Inc.	301-251-8990
MA	Monson, Zero-East Div.	413-267-5561
MA	Palmer, Benoit-Senecal Co.	413-283-8384
MI	Grosse Pointe Pk., Greiner Assocs., Inc.	313-499-0188
MS	Jackson, S. L. Welch & Assocs.	601-932-5534
NY	Commack, MTR, Inc.	516-462-9580
NY	Syracuse, Fountain Young Co.	315-437-7733
NC	Martinsville, Engrg. Reps Assocs.	703-632-2365
OH	Columbus, Tom Mulligan & Assoc.	614-457-2242
PA	Boswell, B. E. Gibson	814-629-6772
PA	Huntingdon Valley, Inacker Sls.	215-947-5660
SC	Martinsville W. VA, Engrg. Reps Assocs.	703-632-2365
Can	Islington, Ont., Pipe-Thompson Ltd.	416-236-2355

ZERO PLASTICS, A UNIT OF ZERO CORP., 672 Fuller Rd., Chicopee, MA 01020, Tel: 413-267-5561 Ext. 432, FAX: 413-592-5018; Empl.: 100; *Sls. Mgr.:* Brian Nichols

ZETA GRAPHICS CORP., 777 Arnold Drive, Martinez, CA 94553, Tel: 415-372-7568; Empl.: 138; *Sls. Mgr.:* Richard Howell, Natl. Sls. Mgr.

ZETEX, INC., Zetex plc., 87 Modular Avenue, Commack, NY 11725, Tel: 516-543-7100, FAX: 516-864-7630; *Sls. Mgr.:* Joseph M. DeBlasio

ZEUS INDL. PRODS. INC., P.O. Box 2167, Orangeburg, SC 29116, Tel: 803-531-2174, 800-526-3842, TWX: 710-480-9346, FAX: 803-533-5694; FSC No.: 32039; Empl.: 280; *Sls. Mgr.:* Wally Bernardo, OEM Sls. Mgr.; *Dist. Mgr.:* Heather Bernardo, Distr. Sls. Mgr.

ZEVATECH, INC., 2700 Gateway Centre Blvd. Ste., Morrisville, NC 27560, Tel: 919-460-0111, FAX: 919-469-0480; Empl.: 110; *Sls. Mgr.:* Bob Black; *Dist. Mgr.:* Bob Black

ZEXCO, 5526 Murietta Ave., Van Nuys, CA 91401, Tel: 818-997-7895

ZIATECH, 3433 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-0488, FAX: 805-541-5088; Empl.: 65; *Sls. Mgr.:* Ron Giovannelli

ZIERICK MANUFACTURING CORP., 56 Radio Circle, Mt. Kisco, NY 10549, Tel: 914-666-2911, 800-882-8020, TWX: 710-571-2143, FAX: 914-666-0216; Empl.: 120; *Sls. Mgr.:* L. T. Noyes; *Dist. Mgr.:* Jack Becker

ZIPPERTUBING CO., Box 61129, Los Angeles, CA 90061, Tel: 213-321-3901, FAX: 213-321-3086; Empl.: 60; *Sls. Mgr.:* Mike Sullivan

ZIRMEX, See Degussa Electronics, Hybrid Div.

ZI-TECH INSTRUMENT CORP., P.O. Box 391567, Mountain View, CA 94039-1567, Tel: 415-966-8484, TELEX: 334-447, FAX: 415-966-8201; Empl.: 15; *Sls. Mgr.:* J. Ziman

zitel

FAX: 408-262-6754

ZITEL CORPORATION, 630 Alder Drive, Milpitas, CA 95035, Tel: 408-946-9600, 800-622-5020, TELEX: 171607, TWX: 910-338-0567; Empl.: 145; *Sls. Mgr.:* Don Olker; *Dist. Mgr.:* Don Olker ..... **D•1119, 2239**

Local Sales Offices & Reps

CA	Granada Hills, West Coast Reps.	818-368-7385
CA	La Habra, West Coast Reps.	213-690-9960
CA	Meadow Vista, West Coast Reps.	916-878-7454
CA	Milpitas, Zitel	408-946-9600
CA	Norco, West Coast Reps.	714-261-5313
CA	Palo Alto, West Coast Reps.	415-325-6097
CA	San Diego, West Coast Reps.	619-581-2406
CT	Wallingford, Northern Computer Sales, Inc.	203-294-1004
FL	Cocoa Beach, Zitel	407-799-1000
IL	Hoffman Estates, Panatek	708-519-0867
MA	Canton, Northern Computer Sls, Inc.	617-821-2180
MI	Warren, Dietrich & Assocs.	313-751-4990
MN	Plymouth, James R. Johnson & Assocs.	612-478-9442
MO	St. Louis, Panatek Tech. Sls.	314-993-5088
NY	Elmont, Crane & Egert, Inc.	516-872-0800
NY	Fairport, Northern Computer Sls, Inc.	716-377-2650
OH	Cincinnati, Dietrich & Assocs.	513-984-8924
OH	Independence, Dietrich & Assocs.	216-642-7965
OK	Tulsa, Milco Mktg. Inc.	918-664-2188
PA	New Kensington, Zitel	412-795-0900
PA	Pittsburgh, Dietrich & Assocs.	412-892-2992
TX	Austin, Milco Mktg, Inc.	512-835-5359
TX	Houston, Milco Mktg, Inc.	713-469-5156
TX	Plano, Milco Mktg, Inc.	214-578-1996
WA	Snohomish, West Coast Reps.	206-483-5300

Z-LINE POWER CONTROLLERS, See Pulizzi Engineering, Inc.

ZMAN MAGNETICS, 7633 South 180th, Kent, WA 98032, Tel: 206-251-8064, FAX: 206-251-6264; Empl.: 35; *Sls. Mgr.:* Mark Mennella

Z-WORLD ENGINEERING, 1340 Covell Blvd. 101, Davis, CA 95616, Tel: 916-753-3722, FAX: 916-753-5141; Empl.: 9; *Sls. Mgr.:* Carrie Evanoff

ZYLAB CORPORATION, 100 Lexington Dr., Buffalo Grove, IL 60089, Tel: 708-459-8000, FAX: 708-459-8054; Empl.: 21; *Sls. Mgr.:* Beth Harvey

ZYTRON, Zytronics, 70 Tirrell Hill Road, Bedford, NH 03102, Tel: 603-623-8888, FAX: 603-623-4009; Empl.: 100; *Sls. Mgr.:* Jan St. Pierre

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

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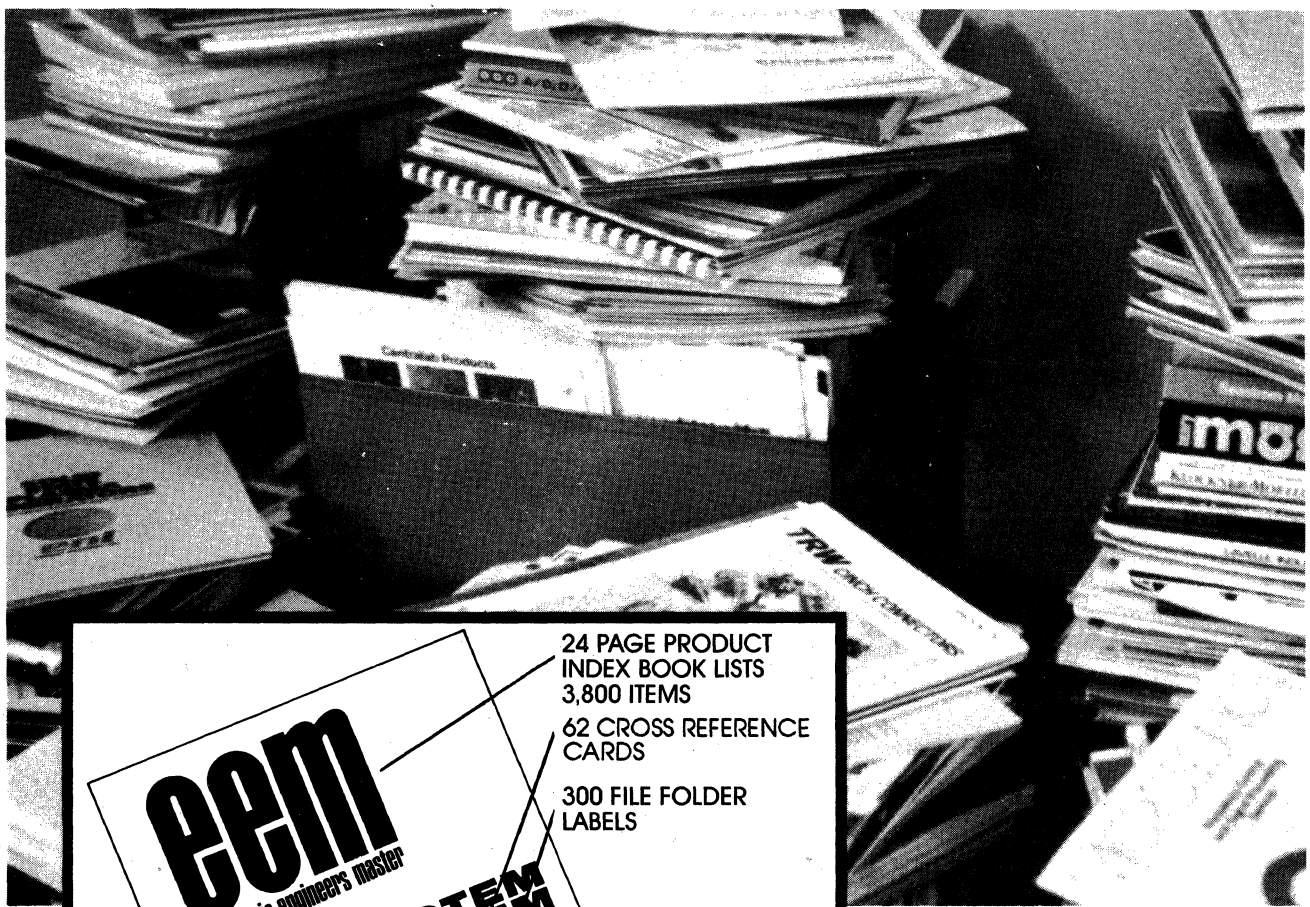

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eem SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

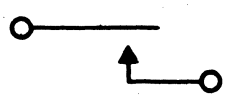
United States Underwriters Laboratories Inc.

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

MINIGLOSSARY
RELAY CONTACT FORMS

A
Make
SPST-NO



B
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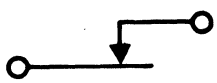

C
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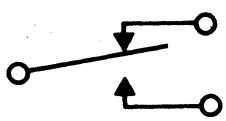
SPDT



D
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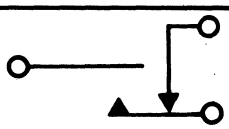
Transfer)



E
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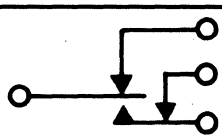

F
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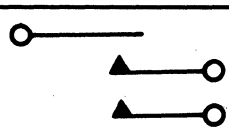
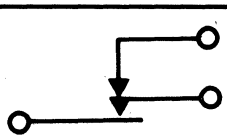
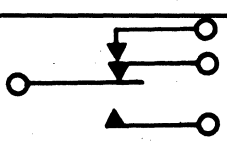
Make



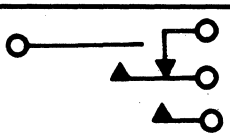
G
Break,
Make



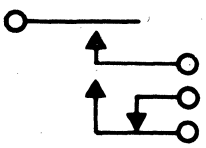
H
Break,
Break,
Make



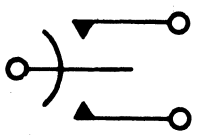
I
Make,
Break,
Make



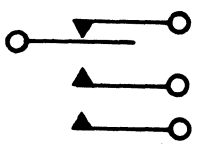
J
Make,
Make,
Break



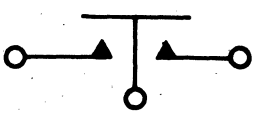
K
Center off
SPDT



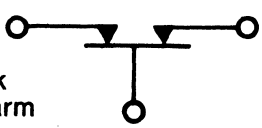
L
Break,
Make,
Make



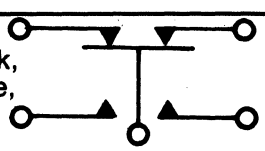
U
Double
make
Contact
on arm



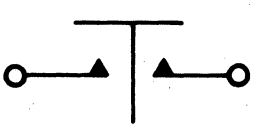
V
Double break
Contact on arm



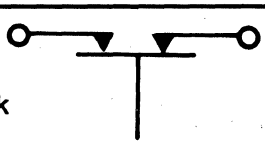
W
Double break,
Double make,
Contact
on arm



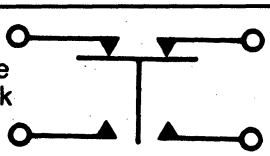
X
Double
make



Y
Double break



Z
Double make
Double break
SPDT-DB



CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-temperature	NA	S	2.1	685	1.8	200	[h]
	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

eem MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

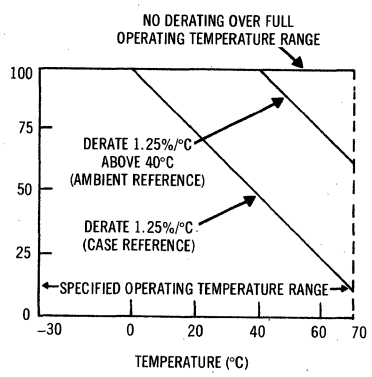


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

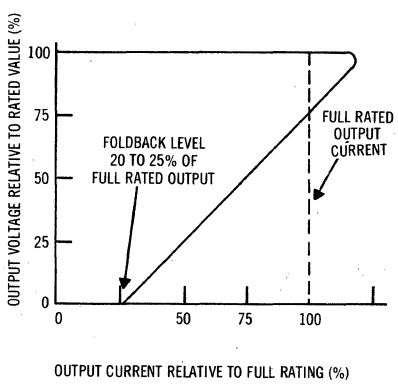


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

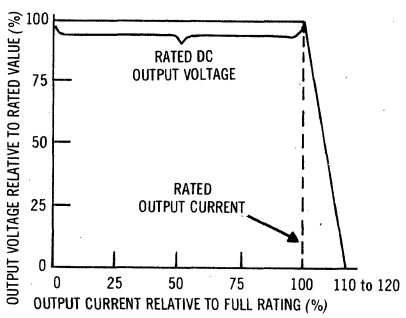


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

THERMAL CONDUCTIVITY OF DIELECTRICS AT ROOM TEMPERATURE

Material	Thermal Conductivity, J/ (m.K)
Diamond	658
BeO	167
Graphite	117-200
Bonded SiC	42
MgO	42
Al_2O_3	33
TiC	33
BN	28
Mullite	6.3
Titania	3.3-4.2
Porcelain	1.7
Fused silica glass	1.5
Soda-lime glass	0.8
Cast epoxies	0.17-1.3
Wood	0.5-2.5
Melamines	0.3-0.7
Mica	0.3-0.7
Phenolics (molded)	0.17-0.67
Polyethylenes	0.33
Nylons	0.17-0.25
TFE fluorocarbons	0.25
Elastomers	0.08-0.17
Foams	0.003-0.04

SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1,\varphi_1,\alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

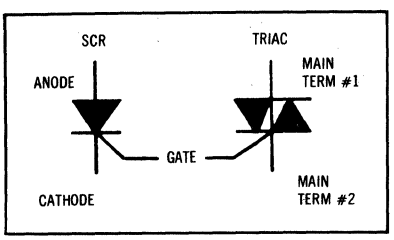
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

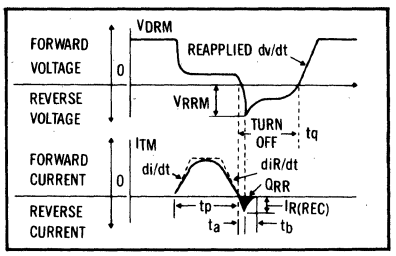


Fig. 1. Concurrent voltage and current waveforms

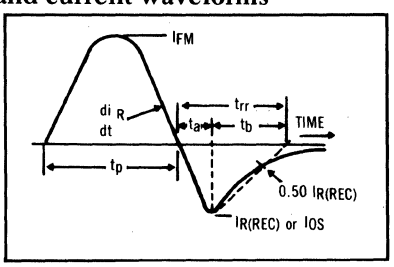


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature.*

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

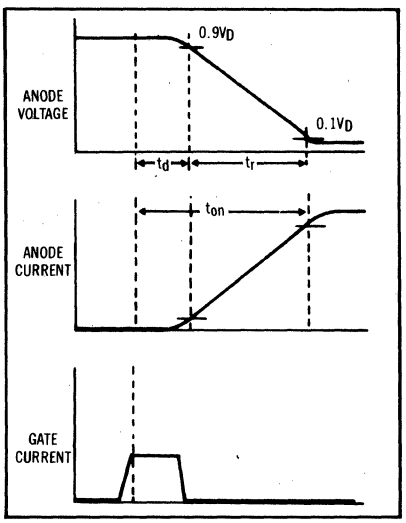


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time.* Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise.* The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

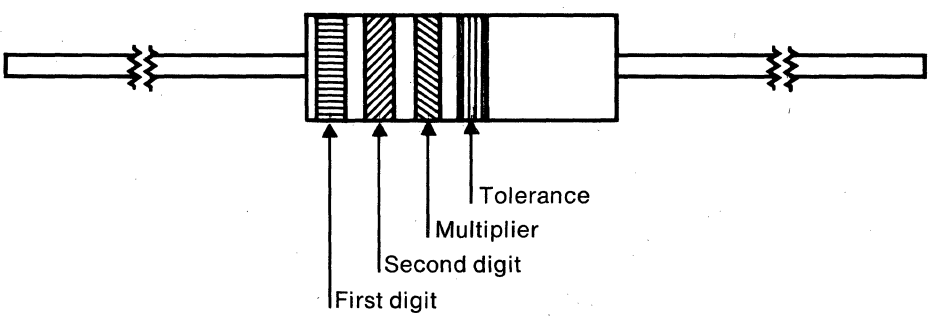
Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

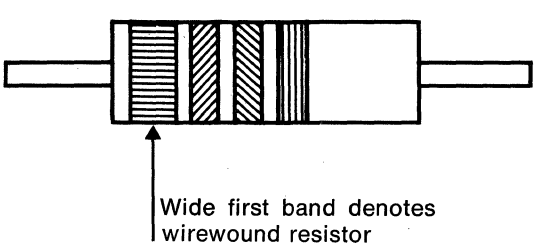
Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

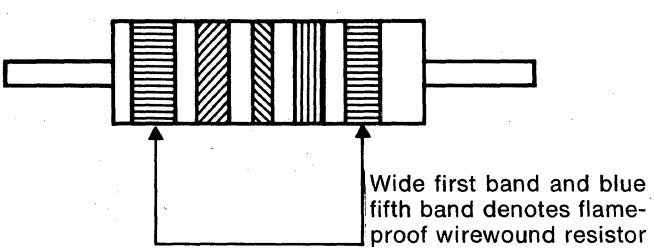
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

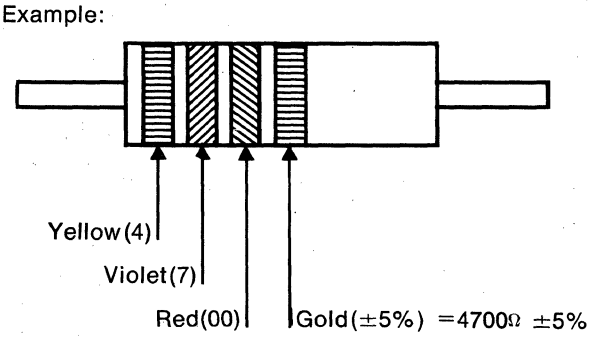




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



MINIGLOSSARY TIMERS

Accuracy
The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

Adjustability
The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

Contact Rating
The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

Delayed Interval Timing Function
Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

Also called: single shot.

Delay-On-Operate Timing Function
Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

Also called: Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

Delay-On-Release Timing Function
Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

Also called: Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

Frequency Sensor
A device that monitors a predetermined overfrequency and/or underfrequecy condition, and changes output state when these conditions exist.

Hysteresis
The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

Interval Timer Timing Function
Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

Also called: Delay Interval, One Shot.

Output Control
The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

Phase Sensor
A device that monitors for proper phase rotation in 3-phase systems.

Programmability
Ability to modify function, time delay or input voltage of a timer.

Recovery Timer
(Delay-On-Operate/Interval Timer)
The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

(Delay-On-Release)
The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

Recycle Time
(Delay-On-Operate or Interval Timer)
The minimum time that input voltage must be interrupted after the timing cycle is completed to assure a successive timing cycle within the repeatability specified.

(Delay-On-Release)
The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

Repeat Cycle Timer Timing Function
Application of power automatically initiates continuous off-on cycling of the output relay.
Also called: flasher, intervalometer

Reset Time
The time required for the contacts to return to normal position when power is removed.

Reverse Polarity Protection
Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

Tolerance
The difference between specified and actual timing or sense point (factory setup tolerance).

Transient Protection
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

Trip Point
The predetermined point at which a sensing device is set to change the output state.

Voltage Sensor
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.

MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

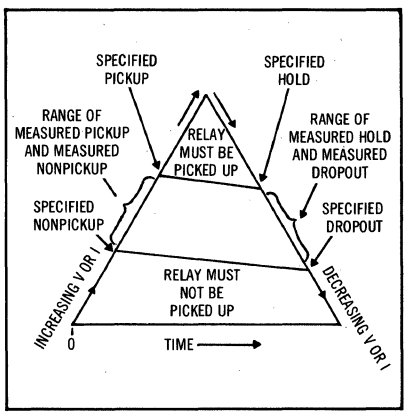
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.



Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

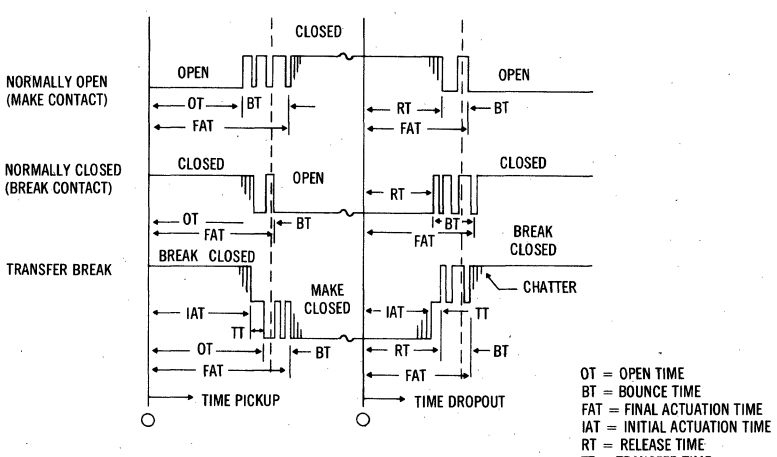


Fig. 2. Typical time vs. current (non-inductive load)

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

EEM MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

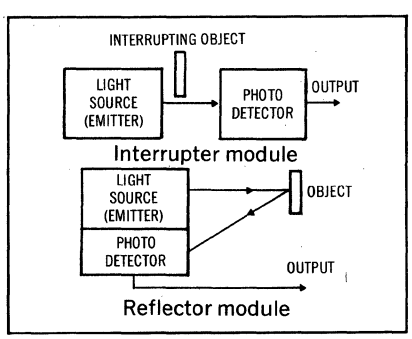
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

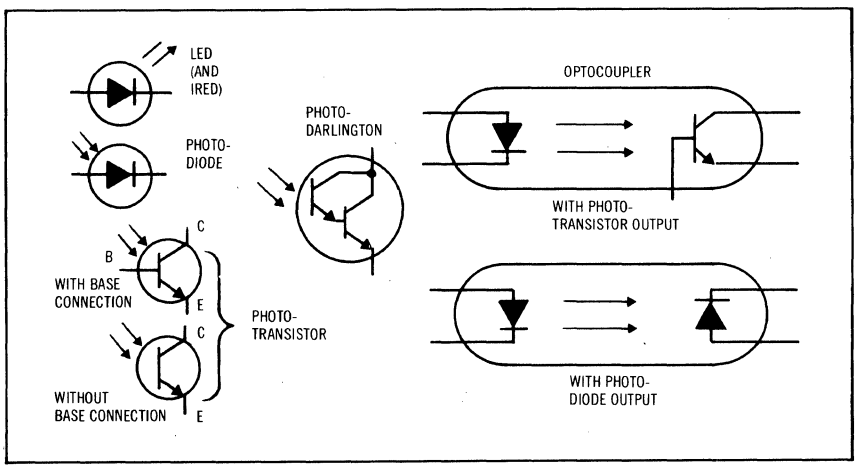
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

eem

MINIGLOSSARY
BASIC ASCII CODE

					b7	0	0	0	0	1	1	1	1
					b6	0	0	1	1	0	0	1	1
					b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1			0	1	2	3	4	5	6	7
0	0	0	0	0		NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1		SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2		STX	DC2	"	2	B	R	b	r
0	0	1	1	3		ETX	DC3	#	3	C	S	c	s
0	1	0	0	4		EOT	DC4	$	4	D	T	d	t
0	1	0	1	5		ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6		ACK	SYN	&	6	F	V	f	v
0	1	1	1	7		BEL	ETB	'	7	G	W	g	w
1	0	0	0	8		BS	CAN	(	8	H	X	h	x
1	0	0	1	9		HT	EM	)	9	I	Y	i	y
1	0	1	0	10		LF	SUB	*	:	J	Z	j	z
1	0	1	1	11		VT	ESC	+	;	K	[	k	{
1	1	0	0	12		FF	FS	,	<	L	\	l	|
1	1	0	1	13		CR	GS	-	=	M	]	m	}
1	1	1	0	14		SO	RS	.	>	N	^	n	~
1	1	1	1	15		SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

(CC) Communication Control
(FE) Format Effector
(IS) Information Separator

Special Graphic Characters

SP	Space	<	Less Than
!	Exclamation Point	=	Equals
|	Logical OR	>	Greater Than
"	Quotation Marks	?	Question Mark
#	Number Sign	@	Commercial At
$	Dollar Sign	[	Opening Bracket
%	Percent	\	Reverse Slant
&	Ampersand	]	Closing Bracket
'	Apostrophe	^	Circumflex
(	Opening Parenthesis	¬	Logical NOT
)	Closing Parenthesis	_	Underline
*	Asterisk	`	Grave Accent
+	Plus	{	Opening Brace
,	Comma	¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
-	Hyphen (Minus)		
.	Period (Decimal Point)		
/	Slant	}	Closing Brace
:	Colon	~	Tilde
;	Semicolon		

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CDM

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multiplier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Significant Figure	Multiplier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
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Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
Relays, Product Selection Guide **B**•1397
Resistor Color Codes **A**•1924
Resistors, Product Selection Guide **A**•1835
Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
Solenoids, Product Selection Guide **B**•1614
Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

qualified products lists-2440

"Qualified Products Lists" are issued periodically by the U.S. Government as a guide for the procurement of electronic components by government contractors. Each list contains every separately designated part that has qualified under the latest Military Specification for its class and the name(s) of the manufacturer(s) of each

EEM is publishing the names of those North American companies that are qualified producers of one or more products in each of the lists that apply to a selected group of electronic products normally cataloged in these pages. Addresses for these companies will be found in the EEM Yellow Pages.

For the complete QPLs and update information write or call:
Naval Publications and Forms Center
5801 Tabor Ave.
Philadelphia, PA 19120
(215) 697-3321

MIL-A-6752 FSC 6625
Ammeters, Voltmeters, and Loadmeters; DC

Astro Lable Co., Inc.
Bach-Simpson Ltd.
Coaxial Dynamics
General Electric Co., Cincinnati, OH
Hickok Electrical Inst. Co.
Ideal Precision Meter Co.
International Microelectronics
International Instruments Div., Sigma Instruments
Non-Linear Systems
Sencore, Inc.
Sutton Designs, Inc.
Westcon, Inc.

MIL-B-81757 FSC 6140
Batteries and Cells, Storage Nickel-Cadmium

Alexander Batteries
Avex Electronics Corp.
Eagle Pitcher Industries
General Electric Co., Gainesville, FL
Marathon Battery Co.
National Custom Enterprises
Rebling Plastics Co.
SAFT America, Inc.
Tauber Electronics Corp.

MIL-B-23071 FSC 4140
Blowers, Miniature, for cooling electronic equipment (10 to 500 CFM)

Eastern Air Devices, Inc.
EG&G Rotron, Inc.
Globe Industries
IMC Magnetics Corp., Westbury, NY
TRW Motor Div.

MIL-B-5423 FSC 5930
Boots, Dust and Water Seal (for toggle and pushbutton switches and rotary-actuated parts)

APM Hexseal Division
Machine Components Corp.
Multi-Flex Seals, Inc.
Roanwell

MIL-C-915 FSC 6145
Cable and Cord, Electrical

Anaconda-Ericsson, Inc., Continental Wire & Cable
Carol Cable
Daburn Electronics
BIW Cable Systems, Inc.
Brand-Rex Company
Brim Electronics Inc.
Carol Cable Co. West
Cerro Wire & Cable Co.
Chester Cable Corp.
Collyer Insulated Wire Co.
Consolidated Products Corp.
General Cable Corp.
ITT Surprenant Div.
Marine Industrial Cable Corp.
Mohawk Wire & Cable Corp.
Monroe Wire & Cable Corp.
The Okonite Co.
Phalo Corp.
Pirelli Cable Corp.
Plastoid Corporation
Rome Cable Corporation
Teledyne Thermatics
Times Wire & Cable Co.
Vector Cable Co.

MIL-C-49055 FSC 6145
Cable, Power, Electrical(Flexible, Flat, Unshielded), (Round Conductor)

Electronic Products Div./3M
W.L. Gore & Assocs.
Tempflex Cable

MIL-C-7974 FSC 5935
Cable Assemblies and Attachable Plugs, external electrical power, aircraft

Anderson Power Products
Carol Cable
Burton Electrical Engineering
FKC Engineering Co.
General Cable Co., Cornish Products Div.

MIL-C-17 FSC 6145
Cables, Radio Frequency: Flexible & Semirigid

Adams Russell Electronics Co. Inc.
Astro Cable Co., Inc.
Brim Electronics Inc.
Cablewave Systems, Inc.
Carol Cable
Champlain Cable Corp.
Cooper Inds./Belden Div.
Daburn Electronics
Harbour Ind. Ltd., Canada
ITT Surprenant
Montrose Products Co.
Penstock Inc.
Phalo Corp.
Plastoid Corp.
Precision Tube Co., Inc.
Saxton Wire and Cable
Storm Products Co.
Teledyne Thermatics
Tensolite Co.
Thermax Wire Corp.
Times Fiber Communications, Inc.
Uniform Tubes, Inc.

MIL-C-22442 FSC 5965
Cable Assembly, Aircraft Audio

Astrocom Electronics, Inc.
Hiltronics Corp.
Roanwell
Telephonics

MIL-C-13777 FSC 6145
Cable, Special Purpose

Astro Cable Co., Inc.
BIW Cable Systems, Inc.
Brand-Rex Company
Brim Electronics Inc.
ITT Surprenant
Rome Cable Corp.

MIL-C-27500 FSC 6145
Cable, Electrical, Shielded and Unshielded, Aerospace

Astro Cable Co., Inc.
Cable USA, Inc.
Brim Electronics Inc.
Cooper Inds./Belden Div.
Harbour Ind., Ltd., Canada
Judd Wire
Philadelphia Ins. Wire
Teledyne Thermatics

MIL-C-55681 FSC 5910
Capacitors, Chip, Multiple Layer, Unencapsulated, Ceramic Dielectric

American Technical Ceramics
AVX Ceramics Corp.
Kemet Electronics
Microcap Inc.
Monolithic Components Corp.
Murata Erie NA
Republic Electronics Corp.
San Fernando Electric Mfg. Co.
Sprague Electric Co.
Union Carbide Corp., Greenville, SC
Unitrode Corp.
U.S. Microtek Components
Vitramon Inc.

MIL-C-83439 FSC 5910
Capacitors, Fixed, Feedthrough, EMI Suppression, (AC, DC, and AC-DC, Hermetically Sealed in Metal Cases)

F-Dyne Electronics, Inc.
Murata Erie, Canada
Sprague Electric Co.

MIL-C-27287 FSC 5910
Capacitors, Fixed, Plastic Dielectric, DC (Nonmetallic Cases)

ASC (formerly TRW)
Del Electronics Corp.
F-Dyne Electronics, Inc.
Mepco/Electra Inc., Columbia, SC
Midwec Corp.
San Fernando Electric Mfg. Co. (see also WES-CAP)
Sprague Electric Co.
TRW Capacitor Div.

MIL-C-55514 FSC 5910
Capacitors, Fixed, Plastic (or Metallized Plastic) Dielectric, in Nonmetal Cases

Electronic Concepts, Inc.
F-Dyne Electronics, Inc.
Kemet Electronics
Sprague Electric Co.
Union Carbide Corp., Greenville, SC

MIL-C-39022 FSC 5910
Capacitors, Fixed, Metallized, Paper-Plastic Film, or Plastic Film Dielectric, DC and AC (Hermetically Sealed in Metal Cases)

Acushnet Capacitor Co., Inc.
Alissa Manufacturing Co.
Component Research Co., Inc.
Del Electronics Corp.
F-Dyne Electronics Inc.
Kemet Electronics
Sprague Electric Co.
TRW Capacitors
Union Carbide Corp., Greenville, SC
West-Cap Arizona

MIL-C-39018 FSC 5910
Capacitors, Fixed, Electrolytic (Aluminum Oxide)

Cornell-Dubilier, Sangamo Components, Sanford, NC
Mepco/Electra, Inc., Columbia, SC
Sangamo Capacitor Div.
Sprague Electric Co.

MIL-C-39006 FSC 5910
Capacitors, Fixed, Electrolytic, Tantalum, Solid-Electrolyted

Acushnet Electronics Co.
Mallory Capacitor Co.
Mepco/Centralab
Mepco/Electra, Inc., West Palm Beach, FL.
Sprague Electric Co.
Transitor Electronics Inc.
Union Carbide Corp., Greenville, SC

MIL-C-3965 FSC 5910
Capacitors, Fixed, Electrolytic, (Nonsolid Electrolyte), Tantalum

Cornell-Dubilier Electronics, Sanford, NC
Hunter-Stanley Electronics, Inc.
Mallory Capacitor Co.
Mepco/Centralab
Mepco/Electra, Inc., West Palm Beach, Fl.
Mepco/Electra, Inc., Columbia, SC
Philips Comps./Discrete Prods.
Sprague Electric Co.
Tansitor Electronics, Inc.

MIL-C-19978 FSC 5910
Capacitors, Fixed, Plastic (or Paper-Plastic), Dielectric (Hermetically sealed in Metal, Ceramic, or Glass Cases)

ASC (formerly TRW)
Chicago Condenser Corp.
Del Electronics Corp.
High Energy Corp.
Philips Comps./Discrete Prods.
Sprague Electric Co.
Stone City Products Co.
TRW Capacitor Div.
West-Cap Arizona

MIL-C-11272 FSC 5910
Capacitors, Fixed, Glass-Dielectric

American Technical Ceramics Div.
AVX Electronics Corp.
Corning Glass Works, Raleigh, NC
Murata Erie NA
Republic Electronics Corp.
Vitramon Inc.

MIL-C-11015 FSC 5910
Capacitors, Fixed, Ceramic-Dielectric (General Purpose)

Automation Components, Inc.
AVX Ceramics Corp.
Centralab, Los Angeles, CA
Cera-Mite Corp.
Corning Glass Works, Raleigh, NC
Kemet Electronics
Murata Erie, NC
Republic Electronics Corp.
San Fernando Electric Mfg. Co.
Sprague Electric Co.
Tusonix, Inc.

Union Carbide Corp., Greenville, SC
Vitramon, Inc.

MIL-C-123 FSC 5910
Capacitors, Fixed, Ceramic Dielectric, (Temperature Stable & General Purpose)

AVX Electronics Corp.
Kemet Electronics
San Fernando Electric Mfg. Co.

MIL-C-62 FSC 5910
Capacitors, Fixed, Electrolytic (DC, Aluminum, Dry Electrolyte, Polarized)

Sprague Electric Co.

MIL-C-5 FSC 5910
Capacitors, Fixed, Mica-Dielectric

Acushnet Capacitor Co., Inc.
ADI Electronics, Inc.
Cornell-Dubilier, Sangamo Components
Del Electronics Corp.
Kahgan Electronics Corp.
Sangamo Capacitor Co.
Silvered Electronic Mica Co., Inc. (SEMCO)
Soshin Electric Ltd. (Distr. by Multi Products Intl.)

MIL-C-23269 FSC 5910
Capacitors, Fixed, Glass Dielectric

Corning Glass Works, Raleigh, NC
Vitramon, Inc.

MIL-C-14409 FSC 5910
Capacitors, Variable, (Piston-Type, Tubular Trimmer)

Johanson Mfg. Corp.
Murata Erie, NA
Sprague-Goodman Electronics, Inc.
Voltronics Corp.

MIL-C-81 FSC 5910
Capacitors, Variable, Ceramic Dielectric

Johanson Mfg. Corp.
Murata Erie, NA
Tusonix, Inc.

MIL-C-7079 FSC 5925
Circuit Breakers, Non Trip Free

Potter & Brumfield Div., AMF Inc., Gainesville, GA

MIL-C-55629 FSC 5925
Circuit Breakers, Magnetic, Unsealed or Panel Seal, Trip Free

Airpax Corp., Cambridge, MD
Heinemann Electric Co., Lawrenceville, NJ

MIL-C-5809 FSC 5925
Circuit Breakers, Trip Free

E-T-A Circuit Breakers
Mechanic Products Inc.
Texas Insts./Metallurgical Materials

MIL-C-15305 FSC 5950
Coils, Fixed and Variable, Radio Frequency

Cambridge Thermionic Corp.
Dale Electronics, Inc., Columbus Div.
Delevan, SMD, Div. of API Inc.
Jeffers Electronics, Inc.
Nytronics Components Group, Inc.
Piconics, Inc.
Torotel Products, Inc.
TRW Inductive Products Div.
Vanguard Electronic Co., Inglewood, CA
West-Cap Arizona
Zambre Co. Inc.

MIL-C-22992 FSC 5935
Connectors, Electrical Waterproof, Quick Disconnect, Heavy Duty Type, & Accessories

Amphenol, Wallingford, Conn.
Bendix Corp., Electrical Components Div.
Burndy/Berco
Coaxial Dynamics, Inc.
ITT Cannon Electric

MIL-C-21097 FSC 5935
Connectors, Electrical, Printed Wiring Board

AMP Incorporated
Amphenol, Broadview, IL
Cinch Connectors
EDAC, Incorporated
Elco Corp., Connector Div.
Paladin Corp.
TRW Connector Div., Elm Grove Village, IL
Winchester Electronic Div., Litton Industries

MIL-C-24308 FSC 5935
Connectors, Electric Rectangular, Miniature Polarized Shell, Rack Panel

ADI Electronics, Inc.
AMP, Inc.
Amphenol, Wallingford, Conn.
Cinch Connectors
CW Industries
General Connector Corp.
ITT Cannon Electric, Fountain Valley, CA
Matrix Science Corp.
Positronic Industries, Inc.
Souriau, Inc., Valencia, CA
TRW Connectors Div., Elk Grove Village, IL

MIL-C-81703 FSC 5935
Connectors, Electric, Circular, Miniature, Rack & Panel or Push-Pull Coupling

Connector Industries of America
Deutsch Elec., Component Div.
Sealtron, Inc.

MIL-C-83503 FSC 6145
Connector, Electrical, Flat Cable, and/or Printed Wiring Board, Non-environmental

CW Industries
AMP, Incorporated
Electronic Products Div./3M
T & B Ansley

MIL-C-25516 FSC 5935
Connector, Electrical, Miniature

Paladin Corp.
TRW Electronic Components, Minneapolis, MN

MIL-C-26500 FSC 5935
Connectors, General Purpose, Electrical, Miniature, Circular

Amphenol, Wallingford, Conn.
Array Connector Corp.
Glenair, Inc.
Hermetic Seal Corp.
Pyle-National Co.
TRW Connectors, Minneapolis, MN

MIL-C-28748 FSC 5935
Connectors, Electrical, Rectangular, Rack & Panel, Solder Type, & Crimp Type Contacts

AMP Incorporated
Continental Connector Corp.
Dale Electronics Inc., Columbus, NE
Hughes Aircraft Co., Connecting Devices Div., Irvine, CA
Positronic Industries, Inc.
Star-Tron Corp.
U.S. Components, Inc.
Winchester Electronics, Div. Litton Industries, Inc.

MIL-C-28804 FSC 5935
Connectors, Electric, Rectangular, High Density, Polarized Center Jackscrew

CW Industries
Hughes Aircraft Co., Connecting Device Div., Irvine, CA

MIL-C-39012 FSC 5935
Connectors, Coaxial, Radio Frequency

Adams Russell Electronics Co. Inc.
AMP, Inc.
Amphenol, Wallingford, Conn.
Automatic Connector, Inc.
Bendix Corp., Electrical Components Div.
Cablewave Miniature Products
Delta Electronics Mfg. Corp.
ITT Cannon Electric, Phoenix, AZ
Kings Electronics Co., Inc.
M/A COM OMNI Spectra, Inc., Microwave Connector Div.
Midwest Microwave
Penstock Inc.
Radiall
Sealectro Corp.
Solitron/Microwave
Speciality Connector Co.

MIL-C-3098 FSC 5955
Crystal Units, Quartz

American Time Products
Bliley Electric
Cinox Corp.
Croven Ltd.
CTS Knights
Electronic Crystals
Electronic Research
McCoy Electronics
M-Tron Electronics
Murata Erie North America
Philips Electronics
Quartztek
Reeves-Hoffman
C.R. Snelgrove
Tadiran
U.S. Crystal
Valpey-Fisher Corp.

MIL-D-83532 FSC 5999
Delay Lines, Active

Technitrol

MIL-D-83531 FSC 5999
Delay Lines, Passive

Technitrol

MIL-D-3954 FSC 5985
Dummy Load, Electrical, Waveguide

Antenna Specialists: The Allen Group
Coaxial Dynamics
Struthers Electronics Corp.

MIL-E-1 FSC 5960
Electron Tubes

Amperex Electronic Corp., Hicksville Div.
Beam Tube Corp.
Cetron Electronics
EG & G, Inc., Electro-Optic Div.
GEC Technology Corp.
General Atronics Corp.
General Electric Co., Microwave Tube Operation
General Electric Co., MIDPS
Imaging and Sensing Technology Corp.
ITT Electron Tube Div.
Litton Industries, Electron Tube Div., Williamsport, PA
LND, Inc.
Machlett Labs., Inc.
Microwave Assoc., Inc., Burlington, MA
M.U. Incorporated
National Electronics, Inc.
OMNI-Wave Electronics Corp.
Philips ECG, Inc., Altoona, PA
Raytheon Co., Quincy, MA
Raytheon, Waltham, MA
RCA Corp., Lancaster, PA
TGM Detectors, Inc.
Thomas Electronics, Inc.
Thomson-CSF Comps. Corp., Dover, NJ
Varian Assoc., Palo Alto, CA
Varian Canada, Inc., Georgetown, Ont.
Varo Electron Devices, Inc.
Watkins-Johnson Co., Stewart Div.
Western Electric Co., Inc.
Westinghouse Electric Corp., Electronic Tube Div.

MIL-F-15733 FSC 5915
Filters, Radio Interference

BG Electronics
Captor Corp.
Centre Engineering, Inc.
Coaxial Dynamics
Fil-Coil Co., Inc.
Murata Erie NA
Oxley Inc.
RFI Corporation
San Fernando Electric Mfg. Co.
Spectrum Control, Inc.
Sprague Electric Co. Filter Div., North Adams, MA
Tusonix Inc.

MIL-F-18327 FSC 5915
Filters: High Pass, Low Pass, Band Suppression & Dual Functioning

ADC Products
AMP Incorporated
Alpha Components Inc.
BG Electronics
Coaxial Dynamics
Conolog Corp.
Damon Corp.
OPT Industries, Inc.
Piezo Technology
TRW Inductive Products Div.
Zambre Co. Inc.

MIL-F-23419 FSC 5920
Fuses, Instrument Type

Bussmann Mfg. Div., McGraw-Edison Co.
Littelfuse, Inc.

MIL-I-46058 FSC 5970
Insulating Compound, Electrical

Ausimont
Capsulated Systems, Inc.
Co-Polymer Chemicals Inc.
Conap Inc.
Dow Corning Corp.
General Electric Co./Silicon Prods.
Glenro Inc.
Humiseal Div./Columbia Chase
Hysol Div./Dexter Corp.
Loctite Corp.
M & T Chemicals Inc.
McGhan Nusil Corp

Paraline Products/Union Carbide
Polyfibron Div./W. R. Grace & Co.
Products Research & Chemical Corp.
SWS Silicons Corp.
Westinghouse Electric Corp.
3M/Commercial Chemicals Div.

MIL-I-83287 FSC 6625
Indicators, Fault Locating

Minelco, Inc.

MIL-I-1361 FSC 6625
Instrument Auxiliaries, Electrical Measuring: Shunts, Resistors, & Transformers

Brown Boveri Electric, Inc., West Columbia, SC.
Crompton Metermaster Inc.
Electromagnetic Industries, Inc.
Jonard Inds. Corp.
Rod-L Electronics Inc.
Sencore, Inc.
Starlust-Martin
Sutton Design
Westcon, Inc.

MIL-I-27273 FSC 6130
Inverter, Power, Static

Hamilton Standard Div., United Technologies Corp.
Magnetika, Inc.

MIL-J-641 FSC 5935
Jacks, Telephone

ADC Products
Kings Electronics Co., Inc.
Paladin Corp.
Switchcraft, Inc.

MIL-L-3661 FSC 6210, 6250
Lampholders, Indicator Lights, Indicator Light Housings, & Indicator Light Lenses

Cutler Hammer Grp., Eaton Corp., Aerospace Controls/Systems Div.
Dialight
General Instrument Corp., Lamp Div.
Littelfuse, Inc.
Oak Switch Systems

MIL-M-3971 FSC 6644
Meters, Time Totalizing, Non-hermetially Sealed, Electrical

Datcon Instrument Co.
Redington Counters, Inc./Stemco Insts
Stewart Warner Corp./Hobbs Div.
Veeder-Root, Inc.

MIL-M-10304 FSC 6625
Meters, Electrical Indicating, Panel Type, Ruggedized

A&M Instrument, Inc.
Arga Controls
Bach-Simpson, Ltd.
Coaxial Dynamics
Crompton Metermaster Inc.
Hersey Measurement Corp.
Ideal Precision Meter Co., Inc.
International Microelectronics
International Instruments
JBT Instruments
Non-Linear Systems
Phaoston Instruments & Electronic Co.
Simpson Electric Co.
Triplett Corp.
Westcon, Inc.

MIL-O-55310 FSC 5955
Oscillators, Crystal

Damon Corp.
Greenray Industries
McCoy Electronics Co.
Monitor Products
Oscillatek Corp.
Piezo Technology
Q-TECH Corp.
Spectrum Tehnology, Inc.
Vectron Labs., Inc.
Xsis Electronics, Inc.

MIL-P-26517 FSC 6130
Power Supply, Transformer-Rectifier, Aircraft

Brandt Electronics
Del Electronics Corp.
International power
Powercube Corp.
Varian Microwave Equipment Div.
Wagner Electric Corp., Tung-Sol Div.
Westinghouse Electric Corp., Aerospace Electrical Division

MIL-R-28803 FSC 6240
Readouts, Segmented

Master Specialties
Starlust-Martin

MIL-R-19648 FSC 5945
Relays, Time Delay, Thermal

Amperite Co., Inc.
Warren Communications
Warren G-N

MIL-R-83726 FSC 5945
Relays, Time Delay, Electric & Electronic

Anders Inc.
Deutsch Relays, Inc.
Hi-G Co. , Inc., Windsor Locks, CT
Leach Corp., Control Products Div.
Struthers-Dunn, Inc.
Tempo Instrument, Plainview, NY

MIL-R-83407 FSC 5945
Relays, Reed (Mercury Wetted)

Mepco/Centralab
Struthers-Dunn, Inc.

MIL-R-39016 FSC 5945
Relays, Electromagnetic

Branson Corp.
Communications Instruments, Inc.
Deutsch Relays, Inc.
Electronics Specialty Div.
GENICOM Corp. (General Electric Co.), Waynesboro, VA
Gould Inc., Allied Control Division, Plantsville, CT
Hi-G Co., Inc., Windsor Locks, CT
Teledyne Relays

MIL-R-28750 FSC 5945
Relays, Solid State

Film Microelectrionics
Hi-G Co., Inc., Windsor Locks, CT
Teledyne Solid State, Div. of Teledyne Relays

MIL-R-94 FSC 5905
Resistors, Variable, Composition

Allen-Bradley Co.
Angstrom Precision Inc.
Clarostat Mfg. Co., Inc.
Elliott/Jordan
Ohmite
Precision Electronic Components
Vishay Resistive Systems Group
CAL-R, Inc.
Dale Electronics, Inc., Columbus, NE

E-Systems, Inc., Memcor, Div.
Memcor-Truohm Group Inc.
Nytronics Components Group Inc.
Ohmite Mfg. Co.
Pacific Resistor Co.
RCL/Shallcross, Inc.
TEL-Labs, Inc.
Tepro of Florida, Inc.
Ultronix, Inc.
Vishay Resistive Systems Group
Ward Leonard Electric Co.

MIL-R-22 FSC 5905
Resistors, Variable (Wirewound, Power Type)

Angstrom Precision Inc.
Elliott/Jordan
E-Systems, Inc., Memcor Div.
Memcor-Truohm Group Inc., Litton Potentiometer Div.
Ohmite Mfg. Co.
Vishay Resistive Systems Group

MIL-R-55342 FSC 5905
Resistors, Fixed, Film, Chip

Angstrom Precision Inc.
Dale Electronics, Inc., Columbus, NE
Elliott/Jordan
Film Microelectronics
Mepco/Electra, Inc., Morristown, NJ
Mini-Systems, Inc.
Solitron Devices Inc.
Solitron/Microwave
State of the Art, Inc.
Vishay Resistive Systems Group

MIL-R-83401 FSC 5905
Resistor Networks, Fixed Film

Allen-Bradley Co.
Angstrom Precision Inc.
Bourns, Inc.
Dale Electronics, Inc., Columbus, NE
California Micro Devices, Inc.
Elliott/Jordan
Hycomp Inc.
KDI Pyrofilm Corp.
Mepco/Electra, Inc., Morristown, NJ
Solitron Devices Inc.
Solitron/Microwave
Sprague Electric Co.
Techno-Comps. Corp.
TRW Resistors
Ultronix Inc.
Vishay Resistive Systems

MIL-R-39008 FSC 5909
Resistors, Fixed, Composition (Insulated)

Allen-Bradley Co.
Ohmite Mfg. Co.

MIL-S-19500 FSC 5961
Semiconductor Devices, General

Alpha Industries, Inc.
API Electronics Inc.
BKC Int'l Electronics
Codi Semiconductor Inc.
Compensated Devices Inc.
FEI Microwave/Frequency Electronics, Inc.
Fenwal Electronics/Amer. Power Devices
General Instrument Corp.
General Semiconductor Industries, Inc.
Germanium Power Devices Corp.
Hewlett-Packard/Microwave Semiconductor Div./Optoelectronics Div.
Int'l Rectifier/Semiconductor Div.
Intersil Semiconductors/GE/RCA
Knox Semiconductor Inc.
Micropac Industries Inc.
Microsemi Corp.
Motorola Semiconductor Products, Inc.
New England Semiconductor
Optek Technology
Powerex Inc.\
PowerTech Inc.
PPC Products Corp.
Raytheon/Semiconductor Div.
Sensitron Semiconductor/RSM Electron Power
Semicoa
Semicon Components Inc.
Semtech Corp.
Silicon General/Semiconductor Group
Silicon Transistor Corp.
Siliconix Inc.
Solid Power Corp.
Solid State Devices Inc.
Solitron Devices/Semiconductor Group
ST Semiconductors of Indiana Inc
Teledyne Crystalonics
Texas Instruments/Semiconductor Products
Unitrode Corp.
Voltage Multipliers Inc.

MIL-S-22432/9 FSC 6105
Servomotor, Type 18SM4c

Astromec, Inc.
Starlust-Martin, Inc.
Tachtronic Instruments, Inc.

MIL-S-12883 FSC 5935
Sockets & Accessories for Plug-in Electronic Components

Augat, Inc.
Deutsch Relays, Inc.
Eby Company

MIL-S-3786 FSC 5930
Switches, Rotary, Selector

Cole Instruments Corp.
Janco Corp., Burbank, Ca
Grayhill, Inc.
ITW Switches
Oak Switch Systems Inc.

MIL-S-3928 FSC 5985
Switches (Coaxial), RF Transmission Line

Amphenol, RF Operations
M/A COM OMNI Spectra Inc.
RLC Electronics Inc.
Transco Products, Inc.

MIL-S-6807 FSC 5930
Switches, Rotary, Selector

Electro Switch Corp.

MIL-S-8805 FSC 5930
Switches & Switch Assemblies, Sensitive & Push (Snap Action)

C&K/Ultimax
Conductive Rubber Technology
Eaton Corp. Aerospace Controls/ Systems Div.
Haydon Switch & Instrument, Inc.
ITW Switches
Korry Electronics
Licon Div.
Machine Components Corp.
Master Specialties Co.
Micro Switch
Nexus
Otto Engineering
Roanwell
Saint Switch, Inc.
Stacoswitch
Texas Instruments, Inc., Materials & Controls Grp.
Unimax Switch Corp.
VIZ Mfg. Co., Inc.

MIL-S-9395 FSC 5930
Switches, Pressure (Absolute, Gauge & Differential)

Consolidated Controls Corp.
Electro-National Corp.
Hydra-Electric Co.
Pressare Controls
Roanwell
Scott Aviation
Sigma-Netics, Inc.

MIL-S-22885 FSC 5930
Switches, Pushbutton, Illuminated

Aerospace Optics, Inc.
APM Hexseal Div.
C&K/Ultimax
Eaton Corp., Aerospace/Commercial
Electro-Mechcomps., Inc.
Controls Division
Conductive Rubber Technology
Jay-El Products, Inc.
Korry Mfg. Co.
Licon Div.
Master Dynamics Corp.
Master Specialties Co.
Micro Switch
Precision Molded Products
Roanwell
Stacoswitch
Unimax Switch Corp.

MIL-S-22710 FSC 5930
Switches, Rotary (Printed Circuit), (Thumbwheel, Inline & Pushbutton)

Digitran Div., Xcel Corp.
EECO, Inc.
Janco Corp.
Roanwell

MIL-T-23648 FSC 5905
Thermistor, (Thermally Sensitive, Resistor) Insulated

Ametick, Inc., Rodan Div.
Fenwal Electronics/APD,
Ketema-Rodan Div.
Quality Thermister, Inc.
Thermometrics, Inc.
Unitrode Corp.
Victory Engineering Corp.

MIL-T-27 FSC 5950
Transformers & Inductors (Audio, Power, & High-Power Pulse)

Abbott Technologies Inc.
AC Transformer
ADC Products
Adec, Inc.
AEL-EMTECH Corp., Lansdale, PA
American Aerospace Controls Inc.
AMI/Coast Magnetics
Berkshire Transformer Corp.(Preferre Electronics)
Beta Transformer Technology Corp.
B.G. Laboratories, Inc.
Coast Magnetics
Del Electronics Corp.
Dytek Laboratories, Inc.
Electronic Transformer Corp.
Epsey Mfg. & Electronics Corp.
EWC, Inc.
Fernwood Transformer Co.
Freed Transformer Co., Inc.
Hadley, Robert M., Co., Inc.
Magnetico
Microtran Co., Inc.
Midland-Ross Corp., Grimes Division
Onan Power/Electronics
OPT Industries, Inc.
Pico Electronics, Inc.
Sigmapower, Inc.
Stagenes Industries Inc.
Texas Transformer Corp.
Titan Transformer Co.
Torotel Prods.
Torwico Electronics, Inc.
Transformer Design, Inc.
TRW Inductive Products
Vanguard Electronics Co., Inc.
Wayne Transformer Co.
Zambre Co. Inc.
Zenith Transformer Co., Inc.

MIL-T-27535 FSC 5950
Transformer, Power, Isolation, Series Circuit

AC Transformer
Amerace Corp., Elastimold Div.
Crouse Hinds/Sepco Corp.
Del Electronics Corp.
Texas Transformer Corp.
Zambre Co. Inc.

MIL-T-21038 FSC 5950
Transformers, Pulse, Low Power

AC Transformer
Del Electronics Corp.
Epsey Mfg. & Electronics Corp.
JB Electronic Transformers Inc.
Magnetico
OPT Industries
Technitrol Inc.
Texas Transformer Corp.
TRW Inductive Products
Zambre Co. Inc.

MIL-V-9999 FSC 6625
Voltmeters, Electronic

Ballantine Laboratories
Hewlett-Packard Co., Loveland, CO
International Microelectronics
Sencore Inc.
Non-Linear Systems
Westcon, Inc.

MIL-W-16878 FSC 6145
Wire, Electric, Polyvinyl Chloride Insulated

Astro Cable Co., Inc
Brim Electronics
Cable USA, Inc.
Card Cable
Cooper Inds./Belden Div.
Daburn Electronics & Cable
Harbour Ind., Ltd., Canada
Judd Wire
National Wire & Cable
Teledyne Thermatics

MIL-W-22759 FSC 6145
Wire, Electric, Crosslinked, Fluoro-polymer Insulated, Modified ETFE, Normal Weight, Nickle Coated, High Strength Copper Alloy, 200 Deg. C, 600 Volt

Astro Cable Co., Inc.
Brim Electronics Inc.
Cable USA, Inc.
Cooper Inds./Belden Div.
Electro Insulation Corp.
Harbour Ind., Ltd., Canada
Judd Wire
Letco
Philadelphia Ins. Wire Co., Inc.
Teledyne Thermatics

MIL-W-81381 FSC 6145
Wire, Electric, Polymide-Insulated, Copper or Copper Alloy

Barcel Wire & Cable Corp.
Brim Electronics Inc.
Champlain Cable Corp.
Independeent Cable Corp.
Teledyne Thermatics
Tensolite Co.
Thermax Wire Corp.

Hearst Engineering Software



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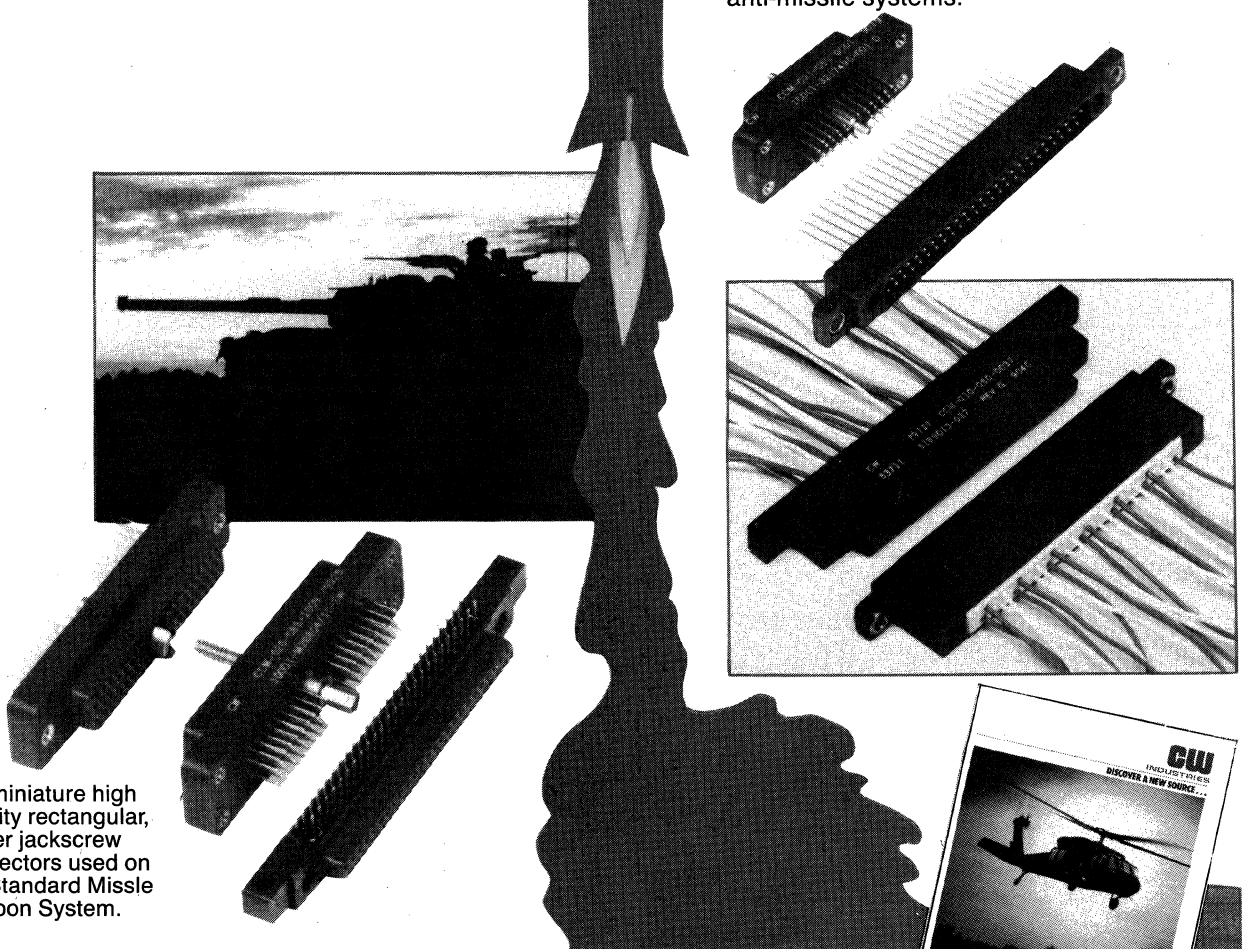

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MILITARY CROSS REFERENCE

MIL-C-83503 MIL-C-24308 MIL-C-28804

LISTED QPL MIL-C-83503

Military P/N	CW P/N	Military P/N	CW P/N	Military P/N	CW P/N	Military P/N	CW P/N
M24308/27-01	CWR-281-09-0022	M28804/8-5X	CCM-024-132-1022	M83503/20-17	CWN-312-34-0022	M83503/24-06	CWN-522-14-0022
M24308/27-01F	CWR-281-09-0036	M28804/8-5Y	CCM-024-132-1023	M83503/20-18	CWN-322-34-0022	M83503/24-07	CWN-502-16-0022
M24308/27-02	CWR-281-15-0022	M28804/8-5Z	CCM-024-132-1024	M83503/20-19	CWN-302-40-0022	M83503/24-08	CWN-512-16-0022
M24308/27-02F	CWR-281-15-0036	M28804/11-2N	CCM-020-038-1001	M83503/20-20	CWN-312-40-0022	M83503/24-09	CWN-522-16-0022
M24308/27-03	CWR-281-25-0022	M28804/11-2V	CCM-020-038-1002	M83503/20-21	CWN-322-40-0022	M83503/24-10	CWN-502-20-0022
M24308/27-03F	CWR-281-25-0036	M28804/11-2W	CCM-020-038-1003	M83503/20-22	CWN-302-50-0022	M83503/24-11	CWN-512-20-0022
M24308/27-04	CWR-281-37-0022	M28804/11-2X	CCM-020-038-1004	M83503/20-23	CWN-312-50-0022	M83503/24-12	CWN-522-20-0022
M24308/27-04F	CWR-281-37-0036	M28804/11-2Y	CCM-020-038-1005	M83503/20-24	CWN-322-50-0022	M83503/24-13	CWN-502-26-0022
M24308/28-01	CWR-280-09-0022	M28804/11-2Z	CCM-020-038-1006	M83503/20-25	CWN-302-60-0022	M83503/24-14	CWN-512-26-0022
M24308/28-01F	CWR-280-09-0036	M28804/11-3N	CCM-020-088-1007	M83503/20-26	CWN-312-60-0022	M83503/24-15	CWN-522-26-0022
M24308/28-02	CWR-280-15-0022	M28804/11-3V	CCM-020-088-1008	M83503/20-27	CWN-322-60-0022	M83503/24-16	CWN-502-34-0022
M24308/28-02F	CWR-280-15-0036	M28804/11-3W	CCM-020-088-1009	M83503/21-01	CWN-352-10-0022	M83503/24-17	CWN-512-34-0022
M24308/28-03	CWR-280-25-0022	M28804/11-3X	CCM-020-088-1010	M83503/21-02	CWN-362-10-0022	M83503/24-18	CWN-522-34-0022
M24308/28-03F	CWR-280-25-0036	M28804/11-3Y	CCM-020-088-1011	M83503/21-03	CWN-372-10-0022	M83503/24-19	CWN-502-40-0022
M24308/28-04	CWR-280-37-0022	M28804/11-3Z	CCM-020-088-1012	M83503/21-04	CWN-352-14-0022	M83503/24-20	CWN-512-40-0022
M24308/28-04F	CWR-280-37-0036	M28804/11-5N	CCM-020-132-1019	M83503/21-05	CWN-362-14-0022	M83503/24-21	CWN-522-40-0022
M28804/7-2N	CCM-022-038-1001	M28804/11-5V	CCM-020-132-1020	M83503/21-06	CWN-372-14-0022	M83503/24-22	CWN-502-50-0022
M28804/7-2V	CCM-022-038-1002	M28804/11-5W	CCM-020-132-1021	M83503/21-07	CWN-352-16-0022	M83503/24-23	CWN-512-50-0022
M28804/7-2W	CCM-022-038-1003	M28804/11-5X	CCM-020-132-1022	M83503/21-08	CWN-362-16-0022	M83503/24-24	CWN-522-50-0022
M28804/7-2X	CCM-022-038-1004	M28804/11-5Y	CCM-020-132-1023	M83503/21-09	CWN-372-16-0022	M83503/24-25	CWN-502-60-0022
M28804/7-2Y	CCM-022-038-1005	M28804/11-5Z	CCM-020-132-1024	M83503/21-10	CWN-352-20-0022	M83503/24-26	CWN-512-60-0022
M28804/7-2Z	CCM-022-038-1006	M83503/6-01	CWR-130-14-0002	M83503/21-11	CWN-362-20-0022	M83503/24-27	CWN-522-60-0022
M28804/7-3N	CCM-022-088-1007	M83503/6-02	CWR-130-16-0002	M83503/21-12	CWN-372-20-0022	M83503/25-01	CWN-552-10-0022
M28804/7-3V	CCM-022-088-1008	M83503/6-03	CWR-210-24-0022	M83503/21-13	CWN-352-26-0022	M83503/25-02	CWN-562-10-0022
M28804/7-3W	CCM-022-088-1009	M83503/7-01	CWR-210-10-0022	M83503/21-14	CWN-362-26-0022	M83503/25-03	CWN-572-10-0022
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M28804/7-5X	CCM-022-132-1022	M83503/7-10	CWR-210-50-0022	M83503/21-21	CWN-372-40-0022	M83503/25-10	CWN-552-20-0022
M28804/7-5Y	CCM-022-132-1023	M83503/7-11	CWR-210-60-0022	M83503/21-22	CWN-352-50-0022	M83503/25-11	CWN-562-20-0022
M28804/7-5Z	CCM-022-132-1024	M83503/20-01	CWN-302-10-0022	M83503/21-23	CWN-362-50-0022	M83503/25-12	CWN-572-20-0022
M28804/8-2N	CCM-024-038-1001	M83503/20-02	CWN-312-10-0022	M83503/21-24	CWN-372-50-0022	M83503/25-13	CWN-552-26-0022
M28804/8-2V	CCM-024-038-1002	M83503/20-03	CWN-322-10-0022	M83503/21-25	CWN-352-60-0022	M83503/25-14	CWN-562-26-0022
M28804/8-2W	CCM-024-038-1003	M83503/20-04	CWN-302-14-0022	M83503/21-26	CWN-362-60-0022	M83503/25-15	CWN-572-26-0022
M28804/8-2X	CCM-024-038-1004	M83503/20-05	CWN-312-14-0022	M83503/21-27	CWN-372-60-0022	M83503/25-16	CWN-552-34-0022
M28804/8-2Y	CCM-024-038-1005	M83503/20-06	CWN-322-14-0022	M83503/23-02	CWR-142-10-0042	M83503/25-17	CWN-562-34-0022
M28804/8-2Z	CCM-024-038-1006	M83503/20-07	CWN-302-16-0022	M83503/23-04	CWR-142-20-0042	M83503/25-18	CWN-572-34-0022
M28804/8-3N	CCM-024-088-1007	M83503/20-08	CWN-312-16-0022	M83503/23-06	CWR-142-26-0042	M83503/25-19	CWN-552-40-0022
M28804/8-3V	CCM-024-088-1008	M83503/20-09	CWN-322-16-0022	M83503/23-08	CWR-142-34-0042	M83503/25-20	CWN-562-40-0022
M28804/8-3W	CCM-024-088-1009	M83503/20-10	CWN-302-20-0022	M83503/23-10	CWR-142-40-0042	M83503/25-21	CWN-572-40-0022
M28804/8-3X	CCM-024-088-1010	M83503/20-11	CWN-312-20-0022	M83503/23-12	CWR-142-50-0042	M83503/25-22	CWN-552-50-0022
M28804/8-3Y	CCM-024-088-1011	M83503/20-12	CWN-322-20-0022	M83503/24-01	CWN-502-10-0022	M83503/25-23	CWN-562-50-0022
M28804/8-3Z	CCM-024-088-1012	M83503/20-13	CWN-302-26-0022	M83503/24-02	CWN-512-10-0022	M83503/25-24	CWN-572-50-0022
M28804/8-5N	CCM-024-132-1019	M83503/20-14	CWN-312-26-0022	M83503/24-03	CWN-522-10-0022	M83503/25-25	CWN-552-60-0022
M28804/8-5V	CCM-024-132-1020	M83503/20-15	CWN-322-26-0022	M83503/24-04	CWN-502-14-0022	M83503/25-26	CWN-562-60-0022
M28804/8-5W	CCM-024-132-1021	M83503/20-16	CWN-302-34-0022	M83503/24-05	CWN-512-14-0022	M83503/25-27	CWN-572-60-0022

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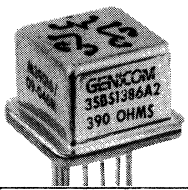
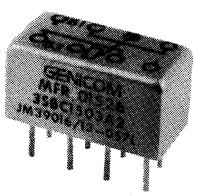
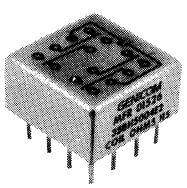
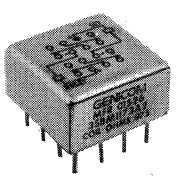
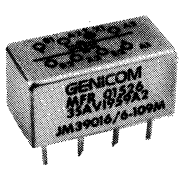
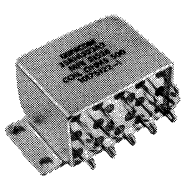
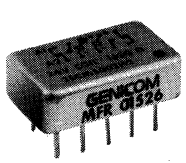
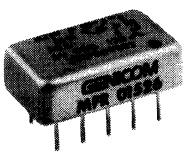
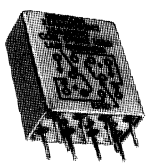
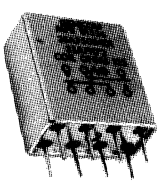
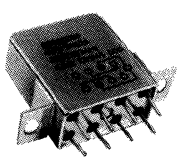
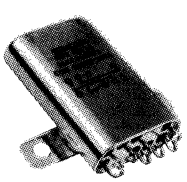
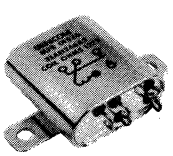
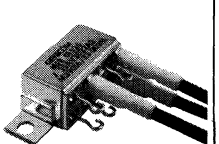
SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE NO MOUNT L" × W" × H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SBS Transistor Size Relay		2PDT	1A DC Res .2A DC Ind Low Level	10^5 / 10^6	Size .37 × .37 × .275 Weight 0.09	120 mW	39016/9 39016/15 39016/20	100G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBC 1/5 Size Two Pole 150 Grid Hybrid		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5-AC Low Level	10^5 / 10^6	Size .61 × .31 × .32 Weight 0.13	135 mW	39016/13 39016/37 39016/38	100G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBH 1/5 Size Four Pole 150 Grid Hybrid		4PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 / 10^6	Size .61 × .61 × .32 Weight 0.24	250 mW	39016/14	100G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBM 1/2 Size 150 Grid Latching Hybrid		4PDT	2A DC Res .5A DC Ind .5A-DC Low Level	10^5 / 10^6	Size .61 × .61 × .32 Weight 0.28	100mW Single Coil or 180mW Dual Coil	39016/31 39016/35 39016/36	150G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SAV Half-Size Sensitive R.F.		2PDT	2A DC Res .5A DC Ind .75 A-AC Low Level	10^5 / 10^6	Size .80 × .40 × .40 Weight 0.30	100mW to 260mW	39016/6 39016/22 39016/33 39016/44	100G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SAH Four Pole Grid		4PDT	2A DC Res .5A DC Ind 1A-AC Low Level	2×10^5 at 2A dc at 1A AC / 2×10^6	Size 1.01 × .61 × .81 Weight 1.0	400 mW	39016/39	50G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SCM DeciGrid® Mag-Latch 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 / 10^6	Size .575 × .350 × .170 Weight .075	2.0 mJ at 5ms	39016/47	100G @ 6ms	30G 55-3000 Hz	−65C +125C

*Single-phase load, case not grounded

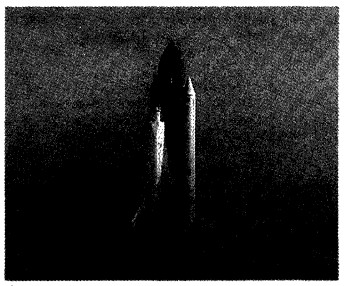
GENICOM®

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE L" × W" × H" & WEIGHT (OZ.) NO MOUNT	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SCP DeciGrid® Mono-stable 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 10^6	Size .575 × .350 × .170 Weight .075	68 mW	39016/48	100G @ 6ms	30G 55-3000 Hz	−65C +125C
3SAM Mag-Latch Grid-Space		2PDT	2A DC Res .5A DC Ind 1A-AC Low Level	10^5 at 2A DC at 1A AC 10^6	Size .80 × .40 × .90 Weight 0.60	50mW Single Coil 75mW Dual Coil	39016/32	150G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SAF Grid Spaced Micro Crystal Can		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC 10^6	Size .80 × .40 × .90 Weight 0.50	300 mW	5757/10	100G @ 11 ms	30G 55-2000 Hz	−65C +125C
3SBK Power Relay		2PDT	5A DC 2A AC 2A DC Ind Low Level	10^5 10^6	Size .80 × .40 × .90 Weight 0.7 max	300 mW	5757	90G @ 11ms	30G 55-2000 Hz	−65C +125C
3SAC Crystal Can "S" Header		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × 1.187 Weight .090	200 mW	5757/10	50G @ 11ms	10G 55-500 Hz	−65C +125C
3SAE Crystal Can "S" Header		2PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × .875 Weight 0.45	330mW	5757/10	100G @ 11ms	20G 55-2000 Hz	−65C +125C
3SAV-RF with Co-ax Cables		2PDT 1PDT	25 Watts 10 Watts	10^5 10^6	Size .86 × .40 × .46 Weight .35 oz. max	260 mW 100 mW	39016/33	100G @ 11ms	30G 55-3000Hz	−65C +125C

*Single-phase load, case not grounded

Continued on next page.

Genicom Produces The Relays People Rely On.



For decades, Genicom has been a leader in the miniature relay field. In the past, Genicom relays have consistently been a part of most major military, aerospace and commercial aircraft programs... even NASA's space shuttle.

Today, Genicom combines decades of experience with the most advanced manufacturing techniques to create state of the art, precision sealed relays.

At Genicom, the most exacting quality controls are applied to insure you get nothing less than the best relay for your application. Quality is the first priority from raw materials to finished product.

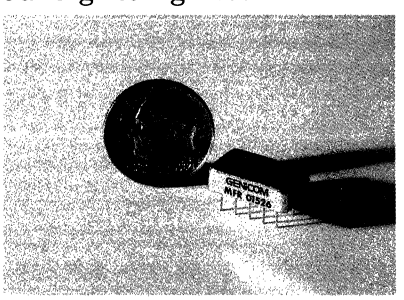
We're the experts in the specialized processing technologies that help make Genicom relays the first choice for operations in hostile environments or anywhere consistent reliability is vital.

Precision laser beam sealing, specially selected contact materials, super clean room environments and rigorous high tech cleaning processes all help insure the Genicom standard of quality and performance upon which our customers depend.

In testing, the latest automated equipment submits each relay to rigid and exacting operational standards.

Most important, our experienced engineering staff stands ready to discuss your needs and solve your problems. We have an engineering model shop and test equipment to meet unique application requirements.

If your application has a special need, Genicom stands ready to respond with proven, quality relays.



The DeciGrid is less than 3/16 of an inch high, allowing circuit boards to be stacked on 1/4 inch centers.

At Genicom, our every effort is directed toward a single objective. In research and development, design engineering, quality control, manufacturing and testing, we seek only to meet your needs with the best relays available today.

We believe each relay in this catalog is testimony to our success in that quest for quality.

Relays You Can Rely On.



Super clean room environments insure the Genicom standard of quality and performance.

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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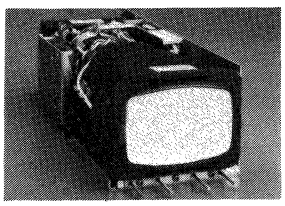
DISPLAY SYSTEMS TECHNOLOGIES

CRT DISPLAYS

FOR LAND • SEA • AIR BASED SYSTEMS

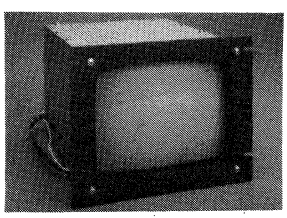
- **Responsive to your needs**
- **Cost effective and price competitive**
- **Limited quantity and large volume production**

U.S. Army Communications Jamming System



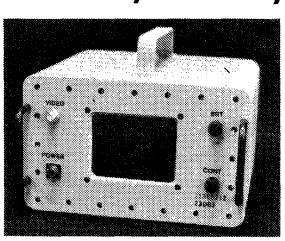
XY05-M-21
5" diagonal CRT; electrostatic stroke deflection; MIL qualified; 2MHz vertical response; 28vdc

U.S. Army Radar Bomb Training System



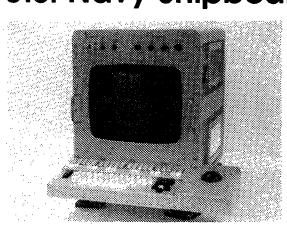
RD12-M5-145
12" diagonal raster CRT; MIL compliant; 15.75KHz horizontal scan; ruggedized unit; EMI/antireflective bonded face panel; 115V 60Hz

U.S. Army Hawk System



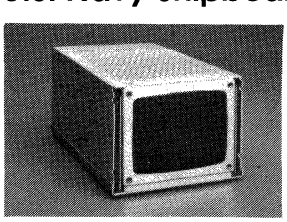
RD06-M5-280
6" diagonal raster CRT; MIL compliant, 15.75KHz horizontal scan; sunlight readable; high resolution; 28vdc

U.S. Navy Shipboard Computer Display



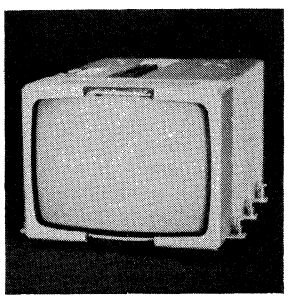
RD17-M10-214
17" diagonal raster CRT; 45MHz video BW; high resolution; MIL compliant; 50kHz horizontal scan; 115V 60Hz

U.S. Navy Shipboard Test Set



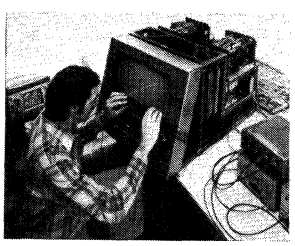
RD06-M5-138
6" diagonal raster CRT; MIL compliant; 15.75KHz horizontal scan; sunlight readable; high resolution; 15 vdc

U.S. Navy Active Emission Sonar Display



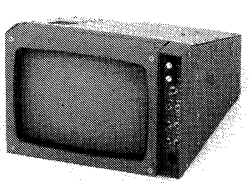
RD09-M8-238
9" diagonal raster; MIL compliant; 26.25KHz horizontal scan; 25MHz video BW; 115V 3Ø 60Hz

U.S. Navy Automated Carrier Landing Display



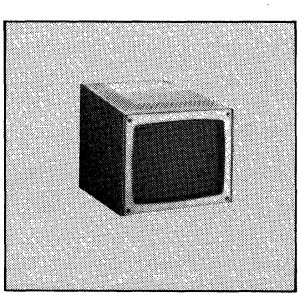
XY21-M-135
21" diagonal; both electrostatic and magnetic deflection system for vector, character and radar display; MIL qualified; 10MHz vertical, 3.5MHz horizontal scan response; 208V 3Ø 60Hz

NASA Space Shuttle Simulator Display



RD09-J5-160
9" diagonal raster CRT; ruggedized unit; 15.75KHz horizontal scan; sunlight readable; 28vdc

U.S. Air Force F-16 Training Simulator



RD07-J5/8-140
7" diagonal raster CRT; 15.75KHz and 26.25KHz horizontal scan rates; internal sensing of incoming line rate and automatic switching of scan to match incoming rate; 20MHz video BW; high resolution; 28vdc

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DISPLAY SYSTEMS TECHNOLOGIES

ELECTROLUMINESCENT DISPLAY SYSTEMS

Presenting the State-of-the-Art in Electroluminescent Glass Panel Technology.

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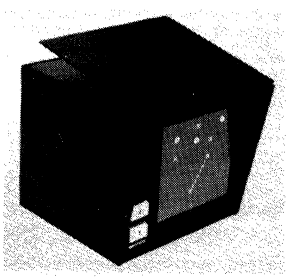
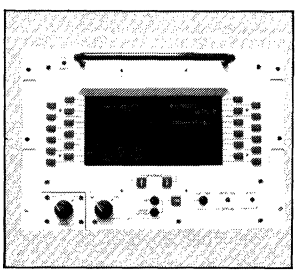
- Integrated IR Touch System
- Alpha numeric and graphics up to 38K baud rate
- Keypads and keyboard
- Custom Design available

U.S. Army Vulcan Gun



EL66M44
High brightness; Custom interface; Used in rugged conditions: dust, rain & vibration

U.S. Air Force Joint Tactical Information Display



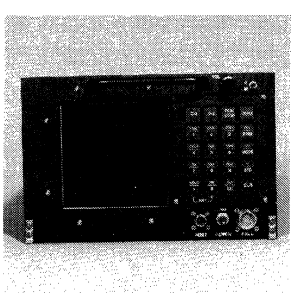
EL66M48M-049
Standard bright; TTL interface

U.S. Marine Corp. Ground Mobile Jamming Equipment



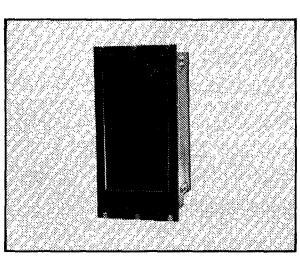
EL66J44A-062
High brightness; alpha numeric and graphic controller

U.S. Navy EA6B Communication Jamming System



EL66J44A-064
High brightness; alpha numeric and graphic controller

U.S. Navy Electronic Surveillance System



EL66M48
High brightness; 4 level gray scale; MIL STD 1553B compatible; integral alphanumeric controller

Infodex has leading technology in EL displays either panel or complete system

MODEL	DISPLAY RESOLUTION	TOTAL PIXELS	PEAK LUMINANCE*	CASE DIM. (METRIC)	ACTIVE PANEL AREA (METRIC)
EL66M44	256x256	65,536	110 FT-L	6"x6"x5" (150X150X130mm)	4"x4"(3.838x3.838) (97.5x97.5mm)
EL66M48	256x512	131,072	100 FT-L	6"x10"x3" (150x250x75mm)	4"x8"(3.838x7.676) (97.5x195mm)

*Unfiltered

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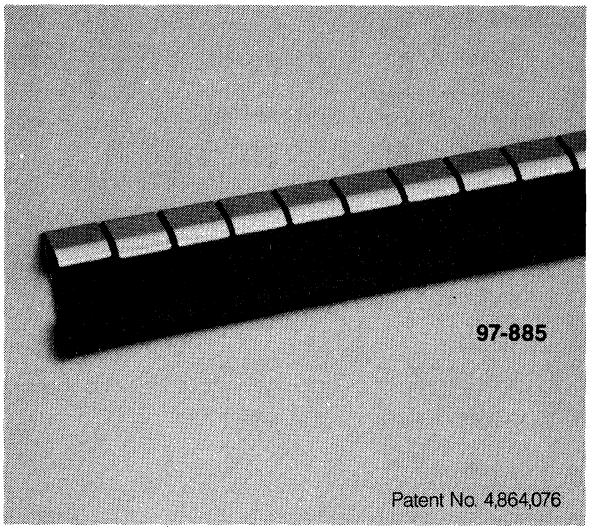
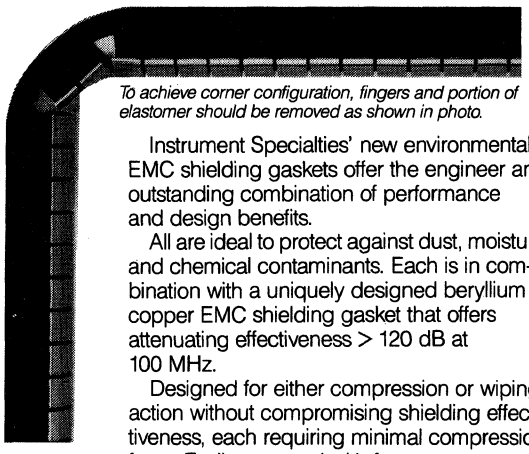
Shielding Environmental Low-Compression Gaskets



Environmental EMC shielding gaskets offer low compression force, high attenuation, and flexibility of design.



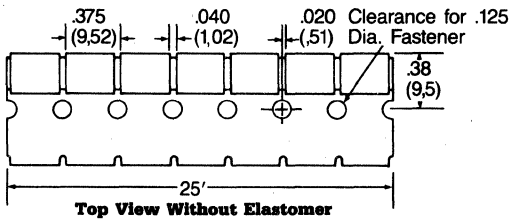
To achieve corner configuration, fingers and portion of elastomer should be removed as shown in photo.

Instrument Specialties' new environmental EMC shielding gaskets offer the engineer an outstanding combination of performance and design benefits.

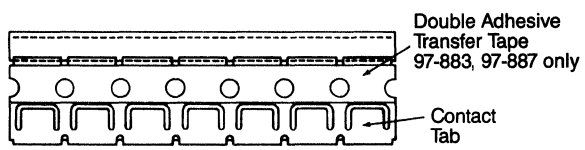
All are ideal to protect against dust, moisture, and chemical contaminants. Each is in combination with a uniquely designed beryllium copper EMC shielding gasket that offers attenuating effectiveness > 120 dB at 100 MHz.

Designed for either compression or wiping action without compromising shielding effectiveness, each requiring minimal compression force. Easily mounted with fasteners or optional Sticky Fingers® adhesive tape.

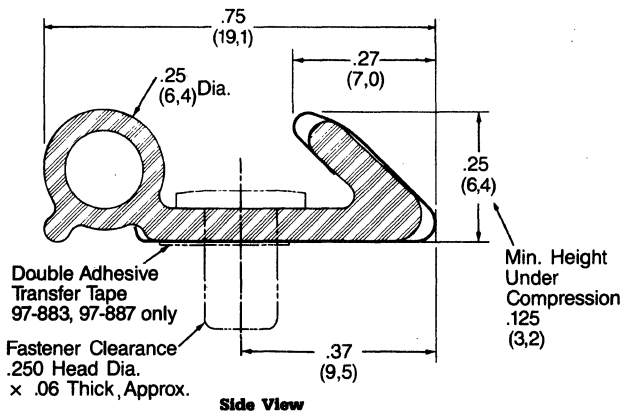
Both Series have been successfully tested on NEMA 12 enclosures and are UL 94 and UL 508 rated. Gaskets to meet NEMA 4 and other special requirements are available upon request.



Top View Without Elastomer



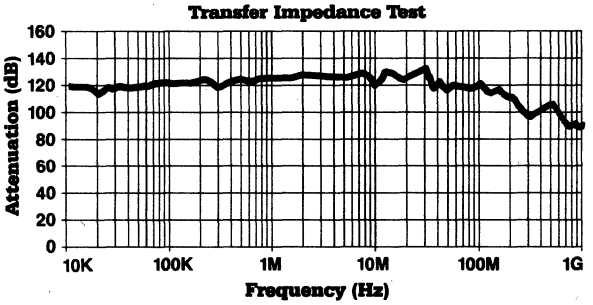
Bottom View With Elastomer

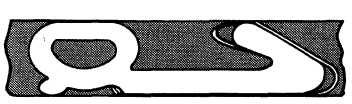


Side View

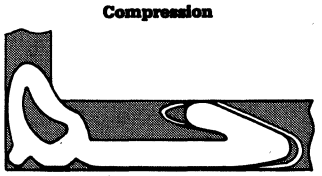
Assemblies	97-880	97-883	97-885	97-887
190 BE CU Strip	•	•	•	•
Silicone Gasket (Gray)	•	•		
1/4" Tape		•		•
Neoprene Gasket (Black)			•	•
Punched Holes	•		•	

Transfer Impedance Test





Compression



Wiping

Metric units are indicated in parentheses.

Instrument Specialties
Headquarters
Delaware Water Gap, PA 18327-0136
TEL: 717-424-8510 FAX: 717-424-6213
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Where shielding is a science.

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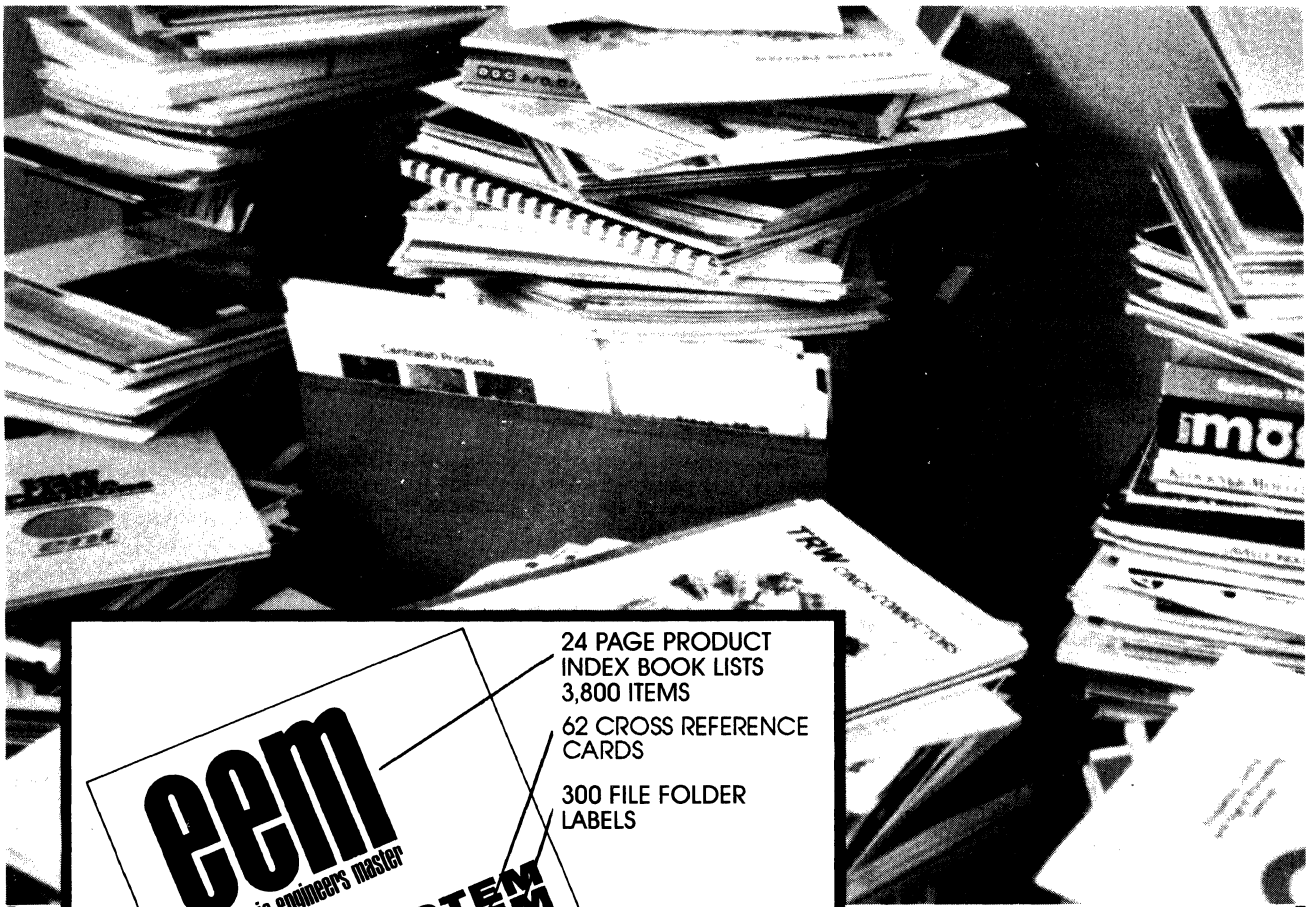
Please see our Standard Shielding products in the Shields and Shielding Section, Vol. C, Section 4525.



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Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with the System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

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TURNER FALLS, MA
Tel: 413-863-4357 & 800-545-5833
Fax: 413-863-2305 & 413-863-3516

SAN MARCOS, CA
Tel: 619-744-7720 & 800-245-4421
Fax: 619-744-6089

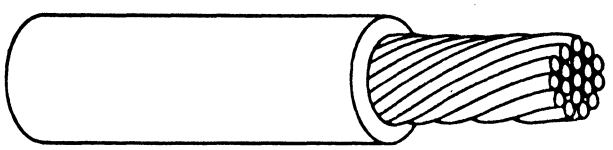
Pioneer in Irradiated Wire

Judd Wire is a high technology wire company, specializing in the use of electron beam cross-linked thermosets for wire insulation. By applying irradiation cross-linking technology to insulating materials, Judd Wire meets the needs of the wire and cable industry for economical, high performance products.

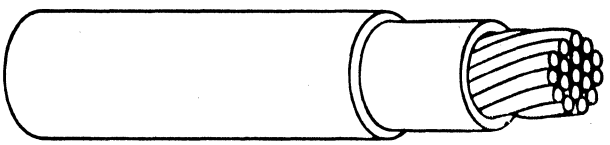
Judd Wire Manufactures electronic wire and cable over 100 styles recognized by Underwriters Laboratory, Canadian Standards and/or Military Specifications.

ZELRAD® (150°C & 200°C XLETFE)
AIRFRAME WIRE

Single Insulation



Dual Insulation



Zelrad 600V airframe wire features an irradiation cross-linked modified ethylenetetrafluoroethylene (ETFE) insulation that meets or exceeds the stringent requirements of MIL-W-22759.

Available with either dual insulation (.010" nominal thickness) or single insulation (.006" nominal thickness), ZELRAD is ideal for airframe, avionic, aerospace and similar applications requiring a high temperature, high durability wire.

ZELRAD cables are comprised of wires that meet or exceed QPL military specification MIL-C-27500. Data bus or other multiconductor cables that require special electrical, shielding or testing capabilities are available upon request.

- **Superior abrasion resistance.** ZELRAD dual extrusion airframe wire offers superior cut-through and scrape abrasion resistance, especially important in applications subject to installation damage or chafing. The inner and outer insulation layers have contrasting colors, creating a quick visual indicator of wear or chafing problems.
- **Outstanding high temperature ratings.** With the highest temperature rating of all standard Judd Wire products, ZELRAD may be specified with confidence where continuous operating temperatures reach 150°C or 200°C.
- **Excellent physical and chemical properties.** ZELRAD wire is small in size, lightweight and extremely flexible. It exhibits high resistance to flame, chemical attack, radiation and soldering iron contact.

ZELRAD Selection Guide

Mil Spec MIL-W-22759/	Insulation	Conductor	Temperature Rating, °C
32	Single	Tinned copper	150
33	Single	Silver-coated high-strength copper alloy	200
34	Dual	Tinned copper	150
35	Dual	Silver-coated high-strength copper alloy	200
41	Dual	Nickel-coated copper	200
42	Dual	Nickel-coated high-strength copper alloy	200
43	Dual	Silver-coated copper	200
44	Single	Silver-coated copper	200
45	Single	Nickel-coated copper	200
46	Single	Nickel-coated high-strength copper alloy	200

JUDD WIRE INC.

TURNER FALLS, MA
Tel: 413-863-4357 & 800-545-5833
Fax: 413-863-2305 & 413-863-3516

SAN MARCOS, CA
Tel: 619-744-7720 & 800-245-4421
Fax: 619-744-6089

ZELRAD® (150°C & 200°C XLETFE)
AIRFRAME WIRE

Products that are easy to select, customize, order and get

This page contains comprehensive listings of Judd Wire standard products, many of which are stocked in a variety of colors. For the stocking status of a specific product, please call Judd Wire.

All standard and special colors, stripes, solids, combinations and numerical codings are available on request. Judd Wire is also prepared to meet your requirements for continuous lengths, custom packaging, jacketing, shielding, different gauges or strands, etc. If you have a special need or unusual application, call us. We are not just a stock wire company, Judd Wire is your wire and cable problem solver!

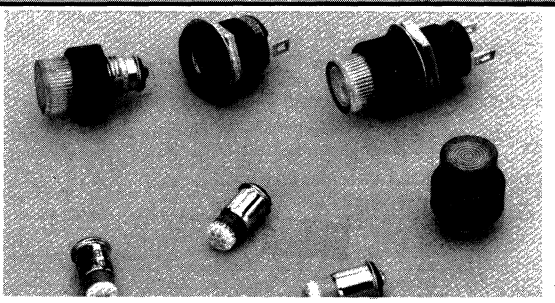
AWG Sizes	Stranding	Nominal Inches	Dia. mm	Judd Part No.
MIL-W-22759/32				
30	7/38	.024	.610	H3832302
28	7/36	.027	.686	H3832282
26	19/38	.032	.813	H3832264
24	19/36	.037	.940	H3832244
22	19/34	.043	1.092	H3832224
20	19/32	.050	1.270	H3832204
18	19/30	.060	1.524	H3832184
16	19/29	.068	1.727	H3832164
14	19/27	.085	2.159	H3832144
12	37/28	.103	2.616	H3832126
MIL-W-22759/33				
30	7/38	.024	.610	H3833302
28	7/36	.027	.686	H3833282
26	19/38	.032	.813	H3833264
24	19/36	.037	.940	H3833244
22	19/34	.043	1.092	H3833224
20	19/32	.050	1.270	H3833204
MIL-W-22753/34				
24	19/36	.045	1.143	H3834244
22	19/34	.050	1.270	H3834224
20	19/32	.058	1.473	H3834204
18	19/30	.070	1.778	H3834184
16	19/29	.077	1.956	H3834164
14	19/27	.094	2.388	H3834144
12	37/28	.111	2.819	H3834126
10	37/26	.134	3.404	H3834106
8	133/29	.195	4.953	H3834088
6	133/27	.241	6.121	H3834068
4	133/25	.310	7.874	H3834048
2	665/30	.405	10.287	H3834029
1	817/30	.445	11.303	H3834019
1/0	1045/30	.485	12.319	H3834109
2/0	1330/30	.545	13.843	H3834209
MIL-W-22759/35				
26	19/38	.040	1.016	H3835264
24	19/36	.045	1.143	H3835244
22	19/34	.050	1.270	H3835224
20	19/32	.058	1.473	H3835204
MIL-W-22759/41				
26	19/38	.040	1.016	H3841264
24	19/36	.045	1.143	H3841244
22	19/34	.050	1.270	H3841224
20	19/32	.058	1.473	H3841204
18	19/30	.070	1.778	H3841184
16	19/29	.077	1.956	H3841164
14	19/27	.094	2.338	H3841144
12	37/28	.111	2.819	H3841126
10	37/26	.134	3.404	H3841106
8	133/29	.195	4.953	H3841088
6	133/27	.241	6.121	H3841068
4	133/25	.310	7.874	H3841048
2	665/30	.405	10.287	H3841029
1	817/30	.445	11.303	H3841019
1-0	1045/30	.485	12.319	H3841109
2-0	1330/30	.545	13.843	H3841209

AWG Sizes	Stranding	Nominal Inches	Dia. mm	Judd Part No.
MIL-W-22759/42				
26	19/38	.040	1.016	H3842264
24	19/36	.045	1.143	H3842244
22	19/34	.050	1.270	H3842224
20	19/32	.058	1.473	H3842204
MIL-W-22759/43				
26	19/38	.040	1.016	H3843264
24	19/36	.045	1.143	H3843244
22	19/34	.050	1.270	H3843224
20	19/32	.058	1.473	H3843204
18	19/30	.070	1.778	H3843184
16	19/29	.077	1.956	H3843164
14	19/27	.094	2.388	H3843144
12	37/28	.111	2.819	H3843126
10	37/26	.134	3.404	H3843106
8	133/29	.195	4.953	H3843088
6	133/27	.241	6.121	H3843068
4	133/25	.310	7.874	H3843048
2	665/30	.405	10.287	H3843029
1	817/30	.445	11.303	H3843019
1-0	1045/30	.485	12.319	H3843109
2-0	1330/30	.545	13.843	H3843209
MIL-W-22759/44				
28	7/36	.027	.686	H3844282
26	19/38	.032	.813	H3844264
24	19/36	.037	.940	H3844244
22	19/34	.043	1.092	H3844224
20	19/32	.050	1.270	H3844204
18	19/30	.060	1.524	H3844184
16	19/29	.068	1.727	H3844164
14	19/27	.085	2.159	H3844144
12	37/28	.103	2.616	H3844124
MIL-W-22759/45				
28	7/36	.027	.686	H3845282
26	19/38	.032	.813	H3845264
24	19/36	.037	.940	H3845244
22	19/34	.043	1.092	H3845224
20	19/32	.050	1.270	H3845204
18	19/30	.060	1.524	H3845184
16	19/29	.068	1.727	H3845164
14	19/27	.085	2.159	H3845144
12	37/28	.103	2.616	H3845126
MIL-W-22759/46				
28	7/36	.027	.686	H3846282
26	19/38	.032	.813	H3846264
24	19/36	.037	.940	H3846244
22	19/34	.043	1.092	H3846224
20	19/32	.050	1.270	H3846204

LEDTRONICS, INC.
TEL (213) 549-9995 • FAX (213) 549-4820 • TLX: 4945454

FEATURES FOR T1¾ MIDGET FLANGE LED AND RELAMPABLE PILOT LIGHT

- DIRECTLY REPLACES STANDARD INCANDESCENTS.
- LONG LIFE 100,000 HRS. 10 YEARS PLUS AVG.
- SOLID-STATE, HIGH SHOCK/VIBRATION RESISTANCE.
- BUILT-IN CURRENT LIMITING RESISTOR FOR DIRECT AC OR DC VOLTAGES. FROM 2V TO 60V DC OR 120V AC.
- HIGH INTENSITY ILLUMINATION. CHOICE OF 7 COLORS.
- LOW CURRENT, POWER SAVINGS 100 TO 500% & MORE.
- IDEAL FOR 2/4 LAMP LIGHTED PUSH BUTTON SWITCHES ANNUNCIATORS, RELAMPABLE PANEL INDICATORS.
- NVG/SECURE LIGHTING COMPATIBLE, BURN IN AVAILABLE.



FEDERAL STOCK NOS (FSN) ASSIGNED TO F206 SERIES. LIST AVAIL.
REPLACES MIL-STD. #: 25237-327, 25237-328, 25237-330, 25237-387 ETC.
ACCESSORIES: RELAMPABLE PANEL MOUNT LAMPHOLDERS AND ACCESSORIES IN RFI/EMI, WATERPROOF OR STANDARD TYPE, SPECIAL FLUTED REPLACEMENT LENS CAPS.

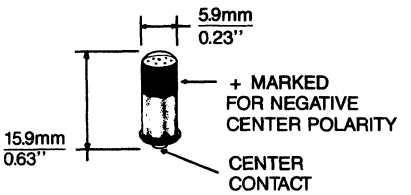
REPLACES INCAND. #327, 328, 382, 330, 269, 328, 344, 345, 349, 350, 367, 370, 376, 377, 380, 381, 385, 394, 459, 3150, 7332, 7333, 7335, 7341, 8918, C7A (NE2D), C9A (NE2J) ETC.

MULTICHIP (6-CHIP) CLEAR EXTRA WIDE ANGLE 160°

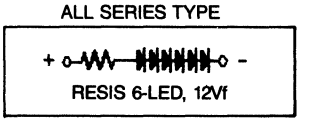
PART NO.: F206 C R6-28V/20-P

- **MODEL** F206=6-CHIP
- **LENS TYPE** C=CLEAR TRANSPARENT
- **LED COLOR** R=RED, O=ORANGE Y=YELLOW, LY=LIME YEL, G=GREEN PG=PURE GRN, RPG=RED/GRN BICOLOR W=WHITE, B=BLUE
- **CENTER CONTACT** P=POS. +, N= NEG.–, AC=VAC BP=BIPOLAR DUAL-POLARITY
- **VOLTS/CURRENT mA** 4Vf, 6Vf, 12Vf EXT. RESIS. RQD 5V/60, 12V/40, 14V/40, 24V/20, 28V/20, 36V/20, 48V/15 120VAC/8 ETC
- **OTHER VOLTS/mA AVAILABLE**
- **BRIGHTNESS CODE** 6=ULTRA HI-REL, 6C=COMM'L, 6J=LOW COST COMM'L 7=HI-ULTRA 660nm RED ONLY 3k=3k mcd RED **COMPARABLE TO 0.3 MSCP INCANDESCENT**

MODEL F206



INTERNAL CIRCUIT ALL SERIES TYPE



BRIGHTNESS: R7 RED [660nm]=85mcd, R6 RED [635nm]=45mcd, O6 ORANGE [610nm]=45mcd, Y6 YELLOW [585nm]=50mcd @20mA LY6 LIME YELLOW [567nm]=75mcd, PG6 PURE DEEP GREEN [555nm]=35mcd. G6 STD GREEN [567nm]=75mcd W6=WHITE=75 mcd, B6=BLUE 1470nm =327 mcd.

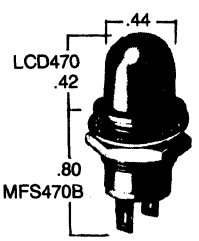
APPLICATIONS: 2 & 4 LAMP LIGHTED PUSH-BUTTON SWITCHES FROM STACO, JAYEL, MSC/EATON, KORRY, RELAMPABLE PANEL INDICATOR LIGHTS

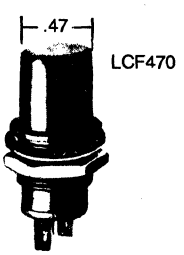
MULTICHIP (6-CHIP) RELAMPABLE LED PILOT LIGHT

RELAMPABLE LED LAMPHOLDERS & LENS CAPS

HOLDERS		MIL.TYPE
MFS470B	STANDARD, BLACK	LH73/1
MFS470B-WP	WATERPROOF, BLACK	LH89/1
RMM64YO	RFI/EMI SHIELDED	LH73/2
LENS CAPS		**MIL.TYPE**
LCF470-CXF	SPECIAL FLUTED CLR	——
LCF470-XX	FLAT TOP,DIFF/CLR	LC29XXX
LCD470-XX	STD DOME, DIFF/CLR	LC12XXX
LCD470W-XX	WATERPROOF DOME	LC35XXX
RM820XX	RFI/EMI SHIELDED	LC27XXX

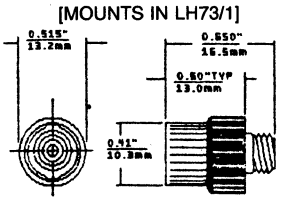
GENERAL SPECIFICATIONS:
MTG HOLE DIA=0.484"
MTG CENTERS=0.750"
PANEL THICKNESS=UP TO 0.265"





CALL FACTORY FOR STD LENS COLOR CODES.

SPECIAL FLUTED LENS CAP
PART NO.: LCF470-CXF
[MOUNTS IN LH73/1]



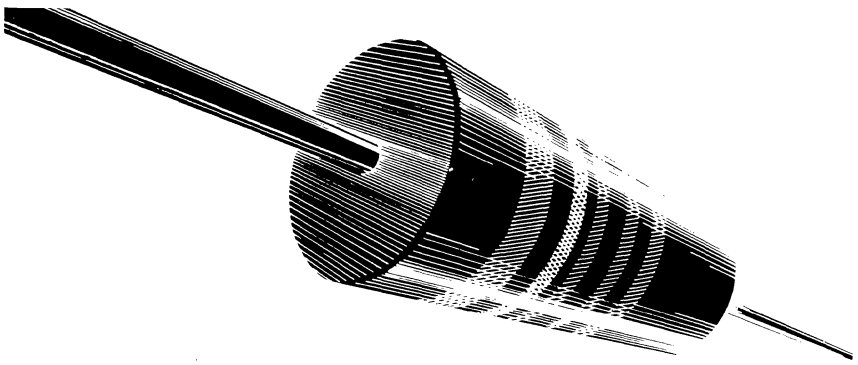
LENS COLORS

CWF = WATER CLEAR	CYF = YELLOW CLEAR
CRF = RED CLEAR	CGF = GREEN CLEAR
CAF = AMBER CLEAR	TWF = TRANS. WHITE

SPECIALS: • BICOLORS • BLINKING 5V • 3000mcd NARROW ULTRA REDS • 900mcd WIDE ULTRA REDS INFRAREDS • BIPOLARS • REDS • 2mA

4009 PACIFIC COAST HIGHWAY, TORRANCE, CALIFORNIA 90505

NYTRONICS INDUCTORS



HI-REL . . .
Nytronics Inductors are fully qualified to the established reliability spec MIL-C-39010 in styles /1 through /10. But, Nytronics Inductors also meet the requirements of a **higher authority!** They are widely used in heart pacers to provide RF protection. . . . It's a life or death matter. . . . Literally.

AVAILABILITY . . .
Off-the-shelf from a distributor near you.

NCG part number. The military part number shall consist of the letter "M", the basic document number, and an assigned dash number as shown in the following:

M	39010/02	A	1R0	K	S
Military designator	Document sheet number	Class	Inductance	Inductance tolerance	Failure rate level

Class. The classes of coils denoting the maximum operating temperatures are identified by a single letter in accordance with MIL-C-39010 slash sheets.

Maximum operating temperature

Class	Temperature
A ------	105°C
B ------	125°C

UPDATE

UNITS HOURS: 682, 900, 090
Date: 6-30-90

High Reliability Qualification	
MIL-C-39010-1	MIL-C-39010-6
MIL-C-39010-2	MIL-C-39010-7
MIL-C-39010-3	MIL-C-39010-8
MIL-C-39010-4	MIL-C-39010-9
MIL-C-39010-5	MIL-C-39010-10

BROAD LINE . . .

There's a Nytronics Inductor to meet every need from 0.10uH to 180kuH.

With sizes ranging from the world's smallest shielded inductor to the most complex variable inductor . . . shielded, unshielded and variable, in hundreds of off-the-shelf values . . . it makes good sense to check first with Nytronics or your local distributor.

FIXED SHIELDED INDUCTORS
Super Wee Ductor
MS75087, MS75088, MS75089
MS90537
Super Wee Wee Ductor MS21399-21401
Wee Ductor
Wee Wee Ductor
Pee Wee Ductor
Pee Cee Ductor
SDD

FIXED NON-SHIELDED INDUCTORS
Deci Ductor
Mili Ductor
MS75083, MS75084, MS75085
RFC-SS MS18130, MS14046, MS90538
RFC-S MS21389, MS21390
MS75008, MS75101, MS90539
RFC-M MS21388
RFC-L MS21380
Pee Dee Ductor
PL Inductors

VARIABLE INDUCTORS
Wee V-L (Shielded) MS21381, MS21402
H Wee V-L (Shielded) MS21381, MS21402
VIV (Non-Shielded)
VIH (Non-Shielded)

Distributed by Dale Electronics, Inc., through Nytron Inductors, Inc.
700 Orange Street, Darlington, SC 29532.
Phone: 803-393-5421 • Fax: 803-393-4123

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

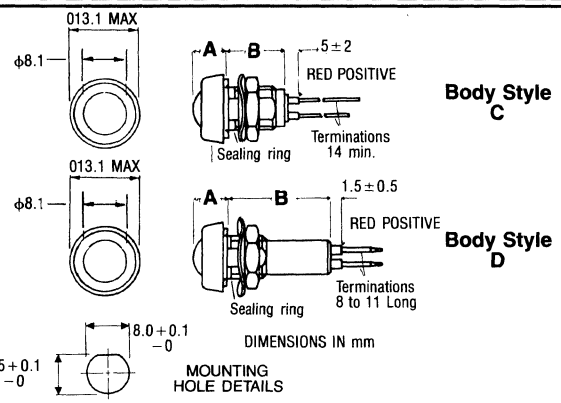
Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

OXLEY MILITARY COMPONENTS

Approved LED Indicators

- U.S. DoD DESC and EUROPEAN APPROVALS
- HIGH RELIABILITY, FULLY BURNT-IN TO MIL-S-19500
- SUNLIGHT READABLE TO 100,000 lux
- HIGH BRIGHTNESS
- E.M.I. and TEMPEST PROTECTION
- ENVIRONMENTALLY SEALED
- SECURE I.R. FREE AND N.V.G. COMPATIBLE
- PANEL SEALING
- RUGGED CONSTRUCTION



DESC PART NO. (SEE NOTE)	FEATURES								DIMENSIONS IN mm			OXLEY SIMILAR PART NO.
	HIGH BRIGHTNESS	SUNLIGHT READABLE	EMC MESH	SECURE IR FREE	WIDE ANGLE VIEWING	NARROW ANGLE VIEWING	REAR SEAL	ANTI-REFLECTION COATING	BODY STYLE	A	B	
85122-X01	●				●				C	6.5	11	PS/LH/8
85122-X02	●				●		●		D	6.5	19	STR/LH/8
85122-X03		●				●			C	5.5	11	PS/LH/8/RAF
85122-X04		●			●				C	5.5	11	PS/LH/8/RAPP
85122-X05		●				●	●		D	5.5	19	STR/LH/8/RAF
85122-X06		●			●		●		D	5.5	19	STR/LH/8/RAPP
85122-X07		●				●	●	●	D	5.5	19	STR/LH/8/HS/RAF
85122-X08		●			●		●	●	D	5.5	19	STR/LH/8/HS/RAPP
85122-X09		●	●			●	●	●	D	5.5	19	STR/LH/8/RAF/SES
85122-X10		●	●		●		●	●	D	5.5	19	STR/LH/8/RAPP/SES
85122-X11	●		●		●		●		D	6.5	19	STR/LH/8/SES
87019-X01		●		●			●	●	D	5.5	19	STR/LH/8/XIR
87019-X02		●	●	●			●	●	D	5.5	19	STR/LH/8/XIR/SES

NOTE: When ordering replace X in DESC No with letter to signify color R = Red, Y = Yellow, G = Green.

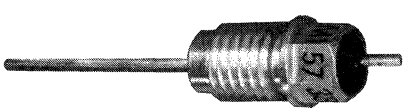
MIL-F-15733 Qualified EMI Suppression Filters

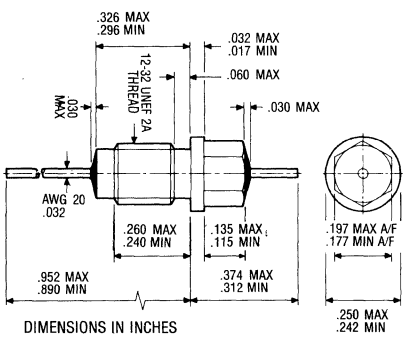
OXLEY chassis mounting pi-section EMI suppression filters are suitable for applications where high insertion loss is necessary from 10MHz to 10GHz, guaranteed over the military temperature range −55°C to 125°C. Fully qualified against MIL-F-15733 Revision G, all types are supplied with 168 hours burn-in (voltage conditioning) and 100% electrical testing, including insertion loss.

GENERAL CHARACTERISTICS

Dielectric	: CERAMOX K6000, : CERAMOX K3000
Body, Nut	: brass. QQ-B-626D
Finish	: silver to QQ-S-365
Lockwasher	: steel
Finish	: silver to QQ-S-365
Current rating	: 10A

When ordering please specify QPL designation eg. M15733/61-0007
Filters are supplied with lockwasher and hex nut.





QPL Designation (Style)	Oxley Type No.	Minimum Capacitance (pF)	Rated Voltage Vd.c.	Rated Voltage Vrms	Minimum Insertion Loss (dB) at 25°C 50 MHZ	100 MHz	200 MHz	500 MHz	1 GHz	10 GHz
M15733/61-0005	FLT8/P/1500	1500	200	140	32	45	58	70	70	70
M15733/61-0006	FLT8/P/1500	1500	200	140	32	45	58	70	70	70
M15733/61-0007	FLT8/P/5000	5000	100	70	50	65	70	70	70	70
M15733/61-0010	FLT8/P/5000	5000	100	70	50	65	70	70	70	70
M15733/61-0011	FLT8/P/5000/RP	5000	100	70	50	65	70	70	70	70

FOR OTHER OXLEY PRODUCTS SEE:

A•2750 EMI FILTERS Page **A**•1705
B•2460 INDICATOR LAMPS Page **B**•1179
B•3700 ELECTRO-OPTIC, THIN FILMS Page **B**•1335
C•2100 CONNECTORS, TEST POINTS Page **C**•1479

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OXLEY INC., 25 BUSINESS PARK DRIVE, PO BOX 814, BRANFORD CT 06405
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Philips Components

Discrete Products Division

A North American Philips Company

STANDARD RESISTOR MIL SPECIFICATION APPROVALS

RESISTORS:	RL standard military: 2% and 5% metal film resistor —RL07 (¼ watt) and RL20 (½ watt) —temperature coefficient: ±100 ppm/°C	MIL-R-22684
	RN standard military: 0.1% to 1% metal film resistor —RN50, RN55, RN60, RN65 styles	MIL-R-10509
	RLR established reliability: 1% and 2% metal film resistor —RLR05, RLR07 and RLR20 —temperature coefficient: ±100 ppm/°C —failure rate: S (.001% per 1000 hrs)	MIL-R-39017
	RNC established reliability: 0.1% to 1% metal film resistor —RNC50, RNC55, RNC60, RNC65 —resistance tolerance: ±0.1%, 0.5%, 1.0% —failure rate: S (.001% per 1000 hrs.) —temperature coefficient: K (±100 ppm/°C), H (±50 ppm/°C), J (±25 ppm/°C) —non-hermetic seal	MIL-R-55182
	RNR/RNN established reliability: 0.1% to 1% metal film resistor —RNR55, RNR60, RNR65 —resistance tolerance: ±0.1%, 0.5%, 1.0% —failure rate: S (.001% per 1000 hrs) —temperature coefficient: C (±50 ppm/°C, E (±25 ppm/°C) —glass hermetic seal	MIL-R-55182
TRIMMER RESISTORS:	RJ24/RJR24 cermet trimmer —multiturn, ⅜" square —resistance range: 100 ohm — 1M —resistance tolerance: ±10% —temperature coefficient: ±100 ppm/°C (standard) RJ24 RJR24—approved to Failure Rate R	MIL-R-22097/MIL-R-39035
	RJ26/RJR26 cermet trimmer —multiturn, ¼" square —resistance range: 100 ohm — 1M —resistance tolerance: ±10% —temperature coefficient: ±100 ppm/°C (standard) RJ26 RJR26—approved to Failure Rate R	MIL-R-22097/MIL-R-39035

Philips Components

Discrete Products Division

A North American Philips Company

STANDARD CAPACITOR MIL SPECIFICATION APPROVALS

TANTALUM:

Wet Slug		MIL-C-3965
CL14/CL16	hermetic seal, screw mount, cylindrical case	
CL17/CL18	hermetic seal, stud mount, cylindrical case	
CL55	hermetic seal, rectangular module	
CL64/CL65	elastomer seal, axial lead, tubular case	
CL66/CL67	hermetic seal, axial lead, tubular case	
Wet Slug, established reliability		MIL-C-39006
CLR10	extended range, axial lead, tubular case	
CLR14	extended range, cylindrical case, solder lug terminal	
CLR17	extended range, cylindrical case, solder lug terminal	
CLR65	glass-to-tantalum hermetic seal, axial lead, tubular case	
CLR79	hermetic seal, tantalum case, axial lead, tubular case	
CLR81	extended range, hermetic seal, tantalum case, axial lead, tubular case	
Wet Foil		MIL-C-3965
CL20/CL21	polar, etched foil, tubular case, axial lead	
CL22/CL23	non-polar, etched foil, tubular case, axial lead	
CL30/CL31	polar, plain foil, tubular case, axial lead	
CL32/CL33	non-polar, plain foil, tubular case, axial lead	
CL51	polar, plain foil, KSR, hermetic rectangular module	
CL52	non-polar, plain foil, KSR, hermetic rectangular module	
CL53	polar, etched foil, KSR, hermetic rectangular module	
CL54	non-polar, etched foil, KSR, hermetic rectangular module	
CL70/CL71	polar, high etched foil, tubular case, axial lead	
CL72/CL73	non-polar, high etched foil, tubular case, axial lead	
Wet Foil, established reliability		MIL-C-39006
CLR25	polar, etched foil, hermetic and non-hermetic, axial lead	
CLR27	non-polar, etched foil, hermetic and non-hermetic, axial lead	
CLR35	polar, plain foil, hermetic and non-hermetic, axial lead	
CLR37	non-polar, plain foil, hermetic and non-hermetic, axial lead	
CLR71	polar, high etched foil, hermetic and non-hermetic, axial lead	
CLR73	non-polar, high etched foil, hermetic and non-hermetic, axial lead	
Solid Slug		MIL-C-26655
CS12/CS13	hermetic seal, axial lead, tubular case	
Solid Slug, established reliability		MIL-C-39003
CSR09	polar, miniature, hermetic seal, axial lead, tubular case	
CSR13	polar, hermetic seal, axial lead, tubular case	
CSR21	polar, high frequency, hermetic, tubular case, axial lead	
CSR23	polar, extended range, hermetic seal, axial lead, tubular case	
CSR33	polar, extended range, hermetic seal, for low impedance application	
CSR91	non-polar, hermetic seal, axial lead, tubular case	
Solid Chip, established reliability		MIL-C-55365
CWR06	polar, hybrid tantalum chip	
CWR11	molded tantalum chip, polar	MIL-C-55365

For information on Mepco/Centralab's RESISTORS/CAPACITORS, SEE PAGES A•1981-A•1984, A•1120-A•1124

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105
FAX (215) 426-2836

TECHNITROL QPL ACTIVE DELAY LINES

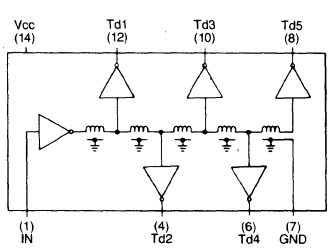
- Technitrol — the first delay line supplier to be QPL'd.
- Active 5 tap, 14-pin DIP delay lines qualified to Mil-D-83532.
- Established reliability assured through a fully approved program in accordance with Mil-Std-790.*
- Standard total delay values ranging from 25 to 500 nanoseconds and tap delay values from 5 to 100 nanoseconds.
- Other military part numbers with non-standard delay values available upon request.
- QPL JAN I.C's (in accordance with Mil-M-38510) incorporated in all active delay lines.

*Reliability Assurance Program for Electronic Parts Specifications.

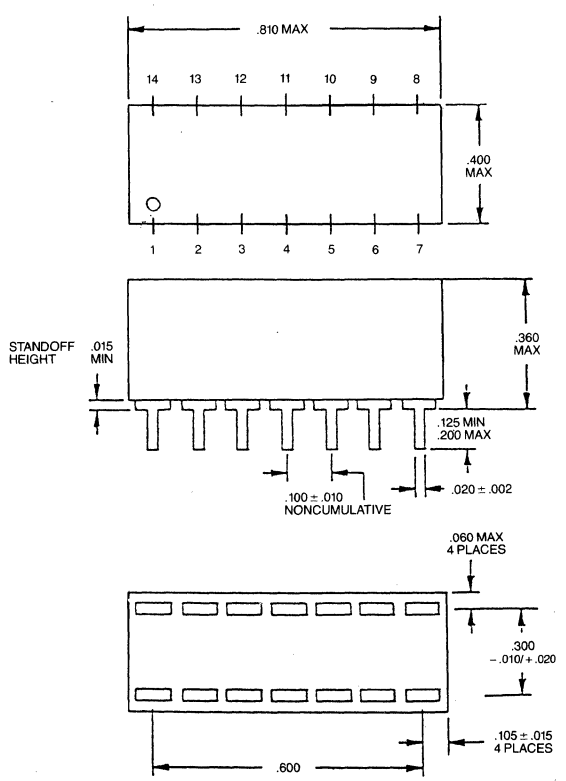
ACTIVE MIL-D-83532 QPL DELAY LINES (TTL LOGIC)

Military Part No.	Technitrol Part No.	NANOSECONDS T_D1	T_D2	T_D3	T_D4	T_D5	T_R+*
M83532/02A001A	TTLDL0257JY	5.0	10.0	15.0	20.0	25.0	4.0
M83532/02A006A	TTLDL0507JY	10.0	20.0	30.0	40.0	50.0	4.0
M83532/02A011A	TTLDL0757JY	15.0	30.0	45.0	60.0	75.0	4.0
M83532/02A014A	TTLDL1007JY	20.0	40.0	60.0	80.0	100.0	4.0
M83532/02A015A	TTLDL1257JY	25.0	50.0	75.0	100.0	125.0	4.0
M83532/02A016A	TTLDL1507JY	30.0	60.0	90.0	120.0	150.0	4.0
M83532/02A018A	TTLDL2007JY	40.0	80.0	120.0	160.0	200.0	4.0
M83532/02A020A	TTLDL2507JY	50.0	100.0	150.0	200.0	250.0	4.0
M83532/02A026A	TTLDL5007JY	100.0	200.0	300.0	400.0	500.0	5.0

NOTE: Additional slash numbers from 02A001A through 02A029A available upon request.
*Measured @5.0V Vcc with 50pf load to ground and 500 ohms to Vcc.



SCHEMATIC AND PIN-OUT



See Volume A for information on Technitrol surface-mount and pc-mount delay lines.

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105
FAX (215) 426-2836

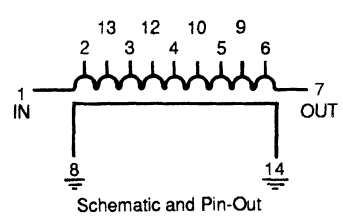
TECHNITROL QPL PASSIVE DELAY LINES

- Technitrol — the first delay line supplier to be QPL'd.
- Passive 10 tap, 14-pin DIP delay lines qualified to Mil-D-83531.
- Established reliability assured through a fully approved program in accordance with Mil-Std-790.*
- Standard impedance 100 ohms. Other values available.
- Standard total delay values ranging from 10 to 200 nanoseconds and tap delay values from 1 to 20 nanoseconds.
- All military part numbers from M83531/01-001 through M83531/01-425 available upon request.

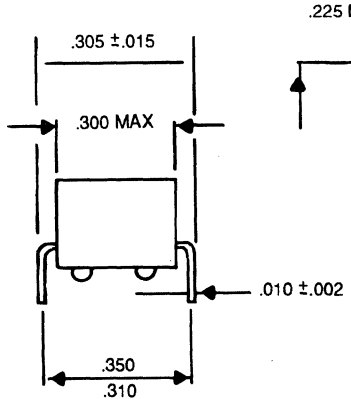
*Reliability Assurance Program for Electronic Parts Specifications.

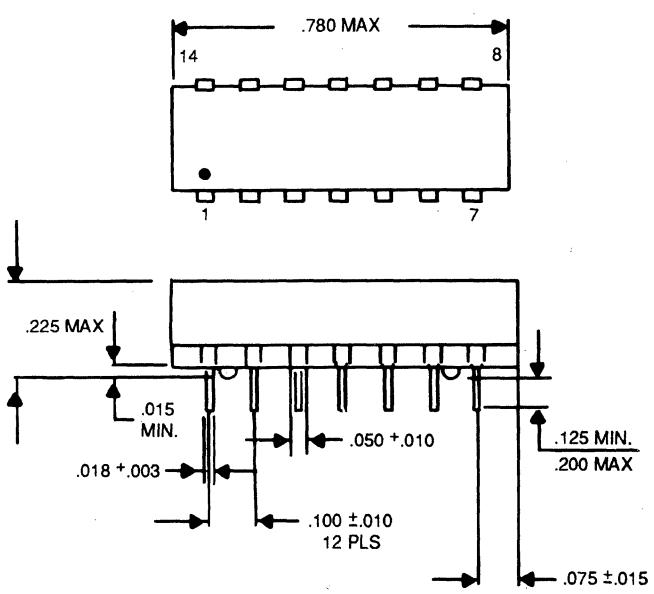
PASSIVE MIL-D-83531 QPL DELAY LINES

Military Designation No.	Technitrol Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	Impedance (Ohms) ±10%	DCR (Ohms Max.)
M83531/01-102	LF10D9	10	1.0	2.5	100	5.2
M83531/01-104	LF10F9	20	2.0	5.0	100	5.2
M83531/01-105	LF10G9	25	2.5	6.2	100	5.2
M83531/01-110	LF10K9	50	5.0	12.5	100	5.2
M83531/01-120	LF10M9	100	10.0	25.0	100	5.2
M83531/01-130	LF10Q9	200	20.0	50.0	100	5.2



Schematic and Pin-Out





See Volume A for information on Technitrol surface-mount and pc-mount delay lines.

W O R L D P R O D U C T S

SANKOSHA CORP. GAS TUBES

CERAMIC ARRESTER

Two Electrode: Y08U and Y08 Series
Three Electrode: 3YVJ

ELECTRICAL CHARACTERISTICS

1. INSULATION RESISTANCE
75–145V : DC 50V
230–400V : DC 100V
470–1000V : DC 250V
1500–2100V : DC 500V
2400V : DC 1000V

2. DC HOLDOVER VOLTAGE
Impulse: 10/1000μs .500A or 200A
DC Power Supply:
52V
80V
135V
150V
— 200mA
(Per REA)

Type Number		DC Breakdown Voltage	Impulse Breakdown Voltage		Insulation Resistance	Capacitance	DC Holdover Voltage	AC Follow-On Current	Impulse Life	Impulse Discharge Current 8/20μs		AC Discharge Current 60Hz	
		100V/s	100V/μs	10KV/μs	X 1	1 MHz	X 2	60 Hz 1/2 Cycle	10/1000μs 500A	Repeat 10 Times	Single	Repeat 10 Times	Single 11 Cycle
W/O Lead	W/Lead	Volts	Volts Max		MΩ Min	pF Max	Volts Min	Amp Peak	Times	Kilo Amp		Amp RMS	
Y08U - 75A	Y08U - 75B	75±20%	500	900	10,000	1.0	52	10	300	5	10	10/5 times	65
Y08U - 90A	Y08U - 90B	90±20%	500	900	10,000	1.0	52	10	300	5	10	10/5 times	65
Y08UZ-145A	Y08UZ-145B	145±20%	500	900	10,000	1.0	80	40	300	5	10	10/5 times	65
Y08UZ-230A	Y08UZ-230B	230±15%	600	900	10,000	1.0	135	80	300	5	10	10/5 times	65
Y08UZ-250A	Y08UZ-250B	250±15%	600	1,000	10,000	1.0	135	80	300	5	10	10	65
Y08UZ-300A	Y08UZ-300B	300±15%	700	1,000	10,000	1.0	150	80	500	5	10	10	65
Y08UZ-350A	Y08UZ-350B	350±15%	700	1,000	10,000	1.0	150	80	500	5	10	10	65
Y08UZ-400A	Y08UZ-400B	400±15%	700	1,000	10,000	1.0	150	80	500	5	10	10	65
Y08UZ-470A	Y08UZ-470B	470±15%	700	1,000	10,000	1.0	150	80	500	5	10	10	65
Y08UZ-600A	Y08UZ-600B	600±15%	800	1,200	10,000	1.0	150	80	500	5	10	10	65
Y08UZ-800A	Y08UZ-800B	800±15%	1,000	1,500	10,000	1.0	150	80	500	5	10	10	65

A TYPE 6.0±0.3 φ8.0±0.3 B TYPE 30±2 30±2 φ0.8 LEAD FINISH: TINNED

Y08Z-102A	Y08Z-102B	1,000±20%	1,500	2,000	10,000	1.0	150	80	200	3	10	1	5
Y08 -152A	Y08 -152B	1,500±15%	2,300	2,800	10,000	1.0	200	80	10	3	10	1	5
Y08 -212A	Y08 -212B	2,100±20%	2,700	3,200	10,000	1.0	200	80	10	3	10	1	5
Y08 -242A	Y08 -242B	2,400±20%	3,000	3,500	10,000	1.0	200	80	10	3	10	1	5
Y08 -302A	Y08 -302B	3,000±20%	4,000	5,000	10,000	1.0	200	80	10	1	5	1	5
Y08 -402A	Y08 -402B	4,000±20%	5,000	6,000	10,000	1.0	200	80	10	1	5	1	5
Y08 -602A	Y08 -602B	6,000±20%	8,000	10,000	10,000	1.0	200	80	10	1	5	1	5
Y08 -802A	Y08 -802B	8,000±20%	10,000	12,000	10,000	1.0	200	80	10	1	5	1	5
Y08 -103A	Y08 -103B	10K±20%			10,000	1.0	N/A						
Y08 -123A	Y08 -123B	12K±20%			10,000	1.0	N/A						
Y08 -143A	Y08 -143B	14K±20%			10,000	1.0	N/A						
Y08 -163A	Y08 -163B	16K±20%			10,000	1.0	N/A						

A TYPE L B TYPE φ8.0±0.3 30±2 30±2 φ0.8

L: Y08Z-102 : 8.0±0.3
Y08-152 \ – 402 : 8.5±0.3
Y08-602 \ – 103 : 13.0±0.5
Y08-123 \ – 163 : 17.0±0.5

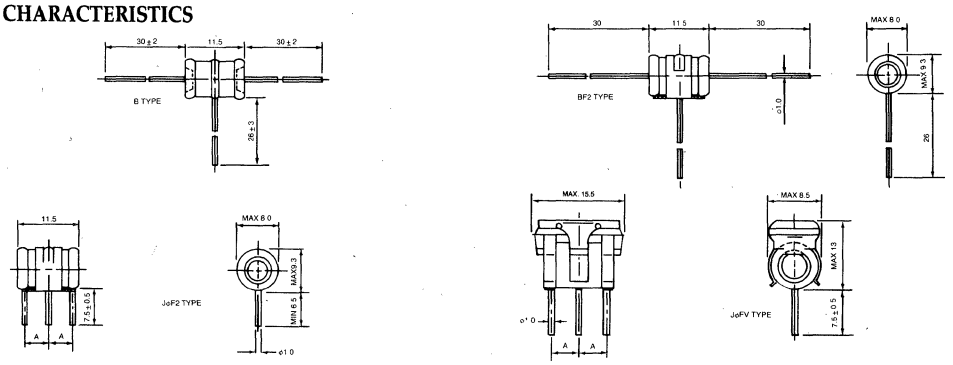
LEAD FINISH: TINNED

3YVJ- 90A	See Dimension Drawings For Lead Type Suffixes	90±20%	700	1,000	10,000	3.0	52	10×2	300/200A	5×2	10×2	5×2	65×2
3YVJ-145A		145±20%	700	1,000	10,000	3.0	52	10×2	300/200A	5×2	10×2	5×2	65×2
3YVJ-230A		230±20%	500	800	10,000	3.0	135	40×2	300/200A	5×2	10×2	5×2	65×2
3YVJ-250A		250±20%	500	800	10,000	3.0	135	40×2	300/200A	5×2	10×2	5×2	65×2
3YVJ-300A		300±20%	600	900	10,000	3.0	135	40×2	300/200A	5×2	10×2	5×2	65×2
3YVJ-350A		350±20%	600	900	10,000	3.0	150	40×2	300/200A	5×2	10×2	5×2	65×2
3YVJ-400A		400±20%	700	1,000	10,000	3.0	150	40×2	400	5×2	10×2	5×2	65×2

A TYPE 11.5±0.5 φ7.5±0.2 J TYPE φ1.0 7.5±0.5 4.4±0.3 4.4±0.3 LEAD FINISH: TINNED

A Dimension	
Type	A
J1	4.4=0.3
J2	4.7=0.3
J3	5.0±0.3

PHYSICAL CHARACTERISTICS



*Fall Safe: Option
-F2 TYPE ≤7 sec at 10A (AC)
-FV TYPE ≤7 sec at 10A (AC)
(With Vent-Safe)
* Lead Finish: Tinned

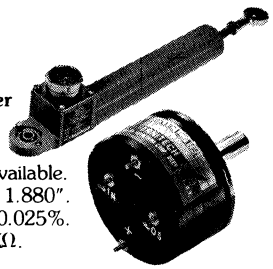
WORLD PRODUCTS INC.
19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380

VERNITECH

Division of VERNITRON CORPORATION

"TECHNOLOGY IN MOTION"

POTENTIOMETERS

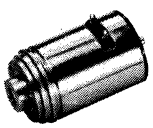


employing Vernitech's unique conductive film and precious metal wipers... respond to wiper motions as small as .000005".

Rotary Single Turn
Linear, non-linear, sine/cosine available.
Sizes 0.5", L 0.5" to Dia 5.0", L 1.880".
Linearity or conformity ±2% to 0.025%.
Resistance range 1KΩ to −250KΩ.

Rotary Multi-Turn
10 to 100 turns available.
Sizes Dia 0.5", L 1.5" to Dia 2.0", L 2.625".
Linearity or conformity ±0.5% to 0.015%.
Resistance range 1KΩ to 500KΩ.

Linear Motion
Electrical stroke lengths 1" to 60".
Linearity or conformity ±0.2% to 0.01%.
Resistance range 250Ω/in to 250KΩ/in.



CLUTCHES AND BRAKES

(electromagnetic)

hundreds of models and sizes available from stock.

Precision Instrument Type
Sizes 5, 8, 11, 13, 15, and 18.
Standard length and wafer types. Spring and magnetic.
Meet MIL-E-5272C. Zero backlash.
Torque 5 to 150 oz. in. Response time 5 to 142 ms.

Industrial Types — open frame
Sizes 8, 12, 17, 22, 26. Torque to 75 in. lb.
Response time 6-30 ms at rated voltage.

Industrial Types — enclosed frame
Hybrid or special units designed for particular applications when MIL-SPECS and close tolerances are not essential, but where having a complete "self-contained" unit is desirable: cassette tape decks, analog devices actuators, etc.

Fail Safe
Braking action occurs 10 ms after coil is de-energized or power fails. Sizes 8, 17, 30, and 45.
Torque up to 50 in. lb. Zero backlash. Adjustable to compensate for wear.



PRESSURE TRANSDUCERS

potentiometer type,

featuring infinite resolution, long life, and high reliability through the use of conductive film resistance elements, multiple wipers, and direct coupling of pressure sensing element to potentiometer wipers.

Pressure ranges from 0.1 to 10,000 psi in gage, absolute and differential types.
Linearity to ±0.3%. Air speed, altitude and low cost types available.

MOTORS

Many Standard Designs or Custom Designed to your requirements.



Synchronous — for laser scanning
Sizes 5, 8, 11, 15, 18, 20, 25, 35.
Speeds 100 to 48,000 rpm.
5 through 1600 Hz. 2, 4, 8, 12 poles.

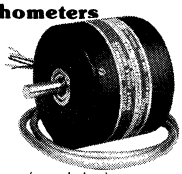
Servo
Viscous damped — sizes 8, 10, 11, 15, 18.
Speeds 3000 to 10,000 rpm.
Inertially damped — sizes 8, 11, 15, 18.
Speeds 3000 to 9500 rpm.

Stepper
Sizes 5, 8, 11, 15. Stepping angles 7.5°, 15°, 45°, 90°.
Stepping rates 100, 110, 125, 130, 175, 180, 225, 240, 260, 400, 725, 800, 1000 pps.

Precision Motor Generators Sizes 8, 10, 11, 15, 18, 23.

Integrating and Computer Motor Tachometers
Sizes 8, 10, 11, 15, 18, 23.

SHAFT ANGLE ENCODERS



featuring precision chrome on glass discs for highest accuracy.

Optical Incremental
VOE 005 — Dia. 0.500", 0.550"L. To 256 pulses (modular)
VOE 05 — Dia. 0.500", 0.85" L. To 256 pulses
VOE 11 — Dia. 1.062", L. 1.80". To 1024 pulses
VOE 015 — Dia. 1.510", L. 0.88". To 1080 pulses (modular)
VOE M15 "Dial Coder" — panel mounted, 1.500" dia., L. 1.08" 127-256 pulses
VOE 023 — Dia. 2.25", L. 80". To 1250 pulses (modular)
VOEL 023—Dia. 2.25", L. 88". To 1000 pulses (modular)
VOE 23 — Dia. 2.250", L. 1.875". To 1250 pulses (available sealed)
VOEL 23 "Thrift-Line" Dia. 2.250" L. 1.875". To 1024 pulses
VOE 25 — Dia. 2.500", L. 2.500". To 3000 pulses (available sealed)

Optical Absolute
VOE 23: Binary, Gray or BCD to 512 counts per turn.
Counting speed: 3000 rpm.
VOE 30: Single or multi-turn; Binary, Gray or BCD. To 1024 counts per turn. Max count (2^{19}) in 512 turns.
Counting Speed: 30KHz.

Contacting Absolute
Sizes 11, 18, 23, & 31. Binary, Gray, and BCD. Single or multi-turn. Max count (2^{19}) in 2048 turns. 64 to 1024 counts per turn. Operating speed 200 rpm max.

LINEAR ENCODERS



BINARY, GRAY OR B.C.D. OUTPUT CODES
1", 2", 4", 8", 12", 24", 36" and 48" STROKE LENGTHS
RESOLUTIONS TO 12 BITS. TTL COMPATIBLE OUTPUT



SUB-SYSTEMS AND ASSEMBLIES

Vernitech is a major manufacturer of Electro-Mechanical and Electro-Magnetic products which are supplied to the Commercial and Military markets for diverse applications. As a leading supplier of vital components, Vernitech is also providing high quality, well engineered assemblies and packages utilizing in-house designed and manufactured components that cover the entire spectrum of analog and digital controls.

Quality Control All VERNITECH products are manufactured to strictly monitored internal controls and with adherence to MIL-Q-9858A. All test equipment is maintained and calibrated per MIL-C-45662.

Special Design Capability VERNITECH has achieved a reputation for superior engineering, high reliability products, and on-time delivery. Unique innovations in product design and performance has given us the experience to meet the demanding needs of our customers and their requirements, with quality products at the lowest possible cost.

Custom designs available to your specifications.

Refer to sections 3500, 4750, 5500 for additional product listings.

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516-586-5100 • TWX 510-227-6089 • FAX 516-242-7940

DISPLAYS

Manufacturer	Starting EEM Page No.	Single Character	Multi-character	Multi-line	Height: 1/2" or less	Height: >1/2" <1in.	Height: 1 in. or more	Segmented	Dot Matrix	Graphics	Light Type: Electro-magnetic	Light Type: Incandescent	Light Type: LED	Light Type: LCD	Light Type: Plasma/ Planar Gas Discharge	Light Type: Vacuum Fluorescent	Light Type: Electro luminescent	Custom Design	CRT	Panels: Back/ Edge Lighted
Altair Exchange Corp.	B•1034	√	√	√	√	√	√	√	√	√			√			√		√		√
American Control Technology Inc.	B•1645	√	√	√	√	√	√	√	√	√			√	√			√	√		√
AND	B•1038	√	√	√	√	√	√	√	√	√			√	√				√		√
Apollo Display Tech.	B•1040		√	√	√	√	√	√	√	√				√		√	√	√		√
Babcock Display Prods.	B•1041		√	√	√			√	√	√					√	√		√		
Canyon Electronics	B•1043	√	√		√	√	√	√	√				√		√			√		
Cherry Elec. Prods.	B•1044	√	√	√	√	√	√	√	√	√					√		√	√		
Dale Electronics	B•1046		√	√	√	√	√	√	√	√					√		√			
Data Ray Corp.	B•1050																		√	
DCI Inc.	B•1054	√	√	√	√	√	√	√	√					√				√		
Densitron Corp.	B•1055	√	√	√	√	√	√		√	√				√	√		√	√		√
Digitran & Computron	B•1057																		√	
Dio-Rey/Info-Lite	B•1058	√	√	√		√	√	√	√	√		√	√				√	√		
Electronic Displays	B•1065	√	√	√			√	√	√			√	√					√		
Endicott Research Grp.	B•1066												√	√	√	√	√			
Excel Technology Int'l	B•1069	√	√	√	√	√	√	√	√					√			√	√		
Fema Electronics Corp.	B•1073	√	√	√			√	√	√	√		√	√	√			√	√		√
FP Electronics	B•1075	√	√	√			√	√	√	√	√							√		
Hantronix, Inc.	B•1078	√	√	√	√	√		√	√	√	√	√	√	√			√	√		√
Hitachi America Ltd.	B•1080		√	√		√	√		√	√				√				√		√
Homalite	B•1085	√			√	√	√		√				√	√		√	√			
IDEA Inc.	B•1086	√	√		√	√	√	√	√				√					√		
Industrial Electronic Engineers	B•1088	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√		√
Infodex Inc.	B•1090																√	√	√	
IVO Industries Inc.	B•1091	√	√	√		√	√	√					√					√		
Lite-On, Inc.	B•1092	√	√		√	√		√	√				√							
LXD Inc.	B•1097	√	√	√	√	√	√	√	√					√				√		
NEC Electronics	B•1100	√	√	√				√	√	√						√		√		√
Nissei Elect. Inc.	B•1103								√	√				√						√
Ocular Inc.	B•1106	√	√	√	√	√	√	√	√					√				√		√
Omnivision	B•1109																	√	√	
Optrex/Satori	B•1110	√	√	√	√	√	√	√	√	√				√				√		√
Philips Components Discrete Prod. Div.	B•1112		√	√				√						√					√	
Samsung Elect. Dev.	B•1114	√	√	√	√	√	√		√	√			√	√						
Seiko Instruments	B•1117	√	√	√	√	√	√		√	√			√	√			√	√		√
Sharp Electronics, Microelectronics Div.	B•1119		√	√	√				√	√				√						√
Shelly Associates	B•1122	√	√	√		√			√	√								√		√
Standish LCD	B•1125		√	√			√	√	√	√				√				√		
The Staver Co., Inc.	B•1127	√					√	√	√	√	√									
VL Electronics	B•1132	√	√	√	√	√	√	√	√	√				√				√		√
Wells Gardner	B•1133																		√	

MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

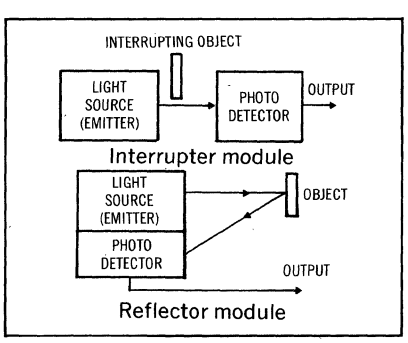
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

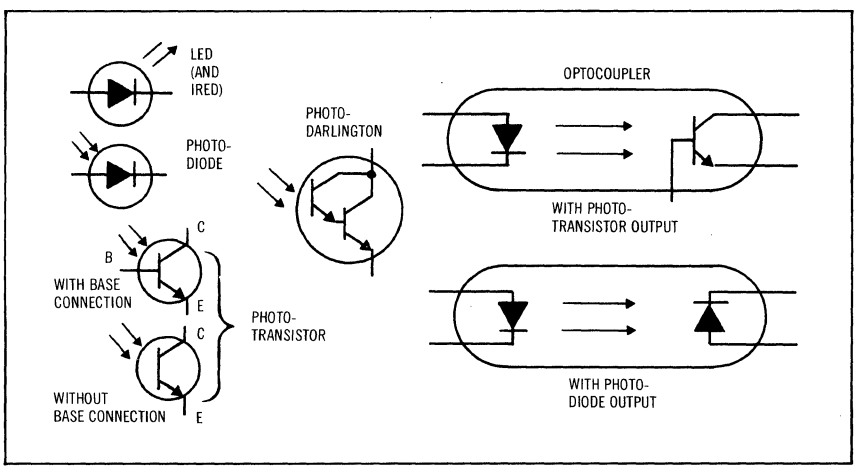
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

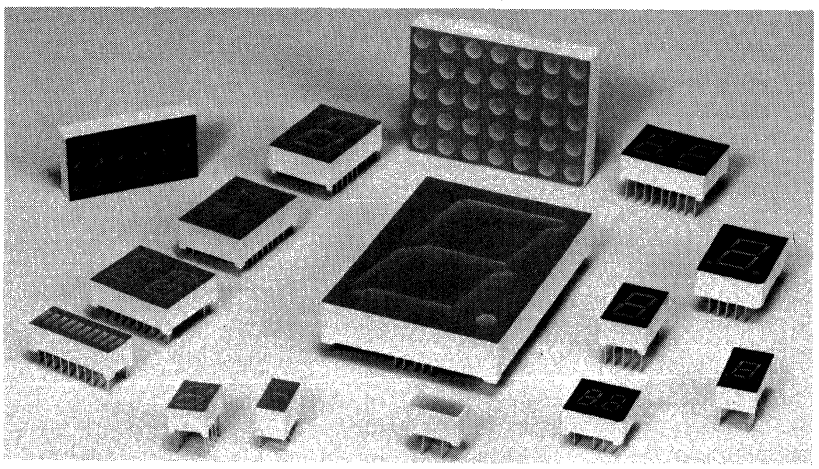
Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

ALTAIR™ CORPORATION

LED DISPLAYS
For More Information Call
Toll Free (800) 824-5620 or (818) 701-6977

ALTAIR offers a complete assortment of Numeric and Alphanumeric LED Displays compatible with most major manufacturers. All units are available in High-Efficiency Red, Standard Red (GaAsP or GaP), Green, Yellow and Orange. The light output of each unit is measured and bin categorized for consistent and even brightness so that each lot will not contain units with visible differences between individual displays. All units shown are completely epoxy encapsulated and offer clear bold segments for maximum light output. Call for information on pinouts or ask for a data sheet giving complete specifications on units of your choice.



Please note that individual data sheets are available upon request for each product giving specific details on brightness, operating voltages and currents, maximum ratings, package sizes, tolerances, and pinouts. For some displays, companion overflow digits are available for popular sizes. Multiple packages that appear on the same line indicates there are variations in pinouts or drive circuitry. This is especially true in the case of multi-digit models where it is common to use multiplex, duplex or direct drive schemes. Call us for specifics.

7-SEGMENT MULTI-DIGITS

Char. Size	Pkg Style	Pin Compat.	Cross Reference Guide
0.30"	31	Toshiba	TLR32X Series (Dual Digit)
0.40"	32,33	Toshiba	TLR42X Series (Dual Digit)
0.50"	34,35	Litronix	DL72X Series (Dual Digit)
0.56"	38	GI	MAN6XXX Series (Dual Digit)
0.56"	39	GI	MAN6XXX Series (1 1/2 Digit)
0.56"	41	NA	New Product (3-Digit Direct Drive)
0.56"	42	NA	New Product (3-Digit Multiplex)
0.56"	45	NA	New Product (4-Digit Direct Drive)
0.56"	46	NA	New Product (4-Digit Multiplex)
0.80"	40	NA	New Product (Dual Digit)

DOT MATRIX

Char. Size	Pkg Style	Pin Compat.	Cross Reference Guide
0.30"	52	IEE	LR1704X Series (5x7)
0.68"	53,54	IEE	LR7057X Series (5x7)
1.16"	55	IEE	LR1257X Series (5x7)
2.00"	57	IEE	LR2057X Series (5x7)
2.30"	59	NA	New Product (8X8)
2.40"	60,61	NA	New Product (5X8)
4.00"	62	NA	New Product (5X7)

BAR GRAPHS & LIGHT BARS

Char. Size	Pkg Style	Pin Compat.	Cross Reference Guide
0.50"	63	GI	MV5X173(Light Bar)
0.75"	64	NA	New Product (Light Bar)
1.00"	65	GI	HPMV5X164,HDSP48XX (Bar Graph)

PLEASE SELECT DISPLAYS BY *Package Style.*
(Complete data sheets are available for all other information).

AVAILABLE COLORS IN MOST DISPLAYS:

R = RED (GaAsP)
P = RED (GaP)
H = HIGH EFFICIENCY RED
E = ORANGE
G = GREEN
Y = YELLOW

SPECIFY COMMON (or COLUMN) ANODE OR CATHODE

7-SEGMENT SINGLE DIGITS

Char. Size	Pkg Style	Pin Compat.	Cross Reference Guide
0.30"	01	TI,HP	TIL3xxx ,HP5082-7XXX Series
0.30"	02,03	GI	MAN3XXX Series
0.36"	06	Fairchild	FND3XX Series
0.40"	08	GI	MAN4XXX Series
0.43"	10	HP	HP5082-7XXX Series
0.50"	12	TI	TIL3XX Series
0.56"	16	GI	Man6XXX Series
0.63"	19	IEE	R18XX Series
0.80"	21,22	HP,GI	HDSP-XXXX, MAN8400 Series
1.02"	26	IEE	LR17XX Series
2.30"	29	NA	New Product
4.00"	30	NA	New Product

SEGMENTED ALPHANUMERIC

Char. Size	Pkg Style	Pin Compat.	Cross Reference Guide
0.39"	47	Litronix	HD14101X Series
0.54"	50	IEE	LR3784X Series(Dual Digit)
0.80"	48	NA	New Product
2.30"	49	NA	New Product

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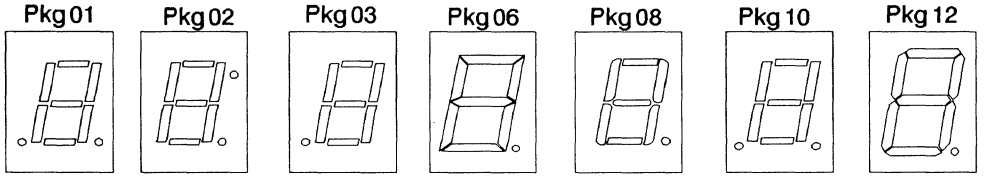
PACKAGE STYLES

NOT TO SCALE
SEE FACING PAGE FOR CHARACTER HTS.

Pkg 01 Pkg 02 Pkg 03 Pkg 06 Pkg 08 Pkg 10 Pkg 12



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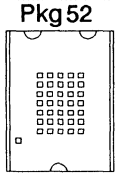

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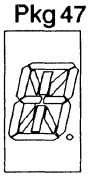

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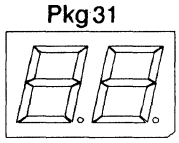

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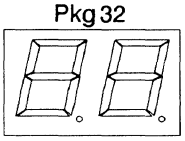

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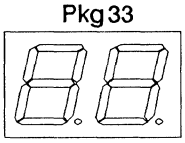
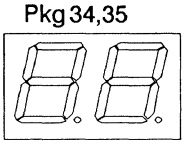
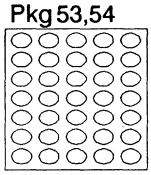


Pkg 34,35



Pkg 53,54



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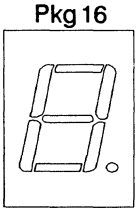

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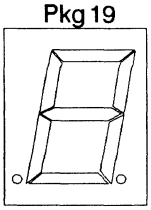

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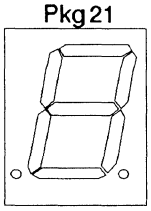
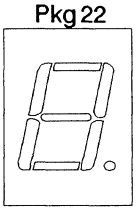
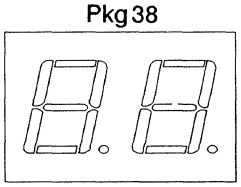


Pkg 22



Pkg 38



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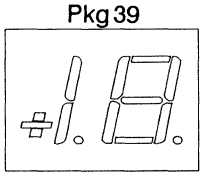

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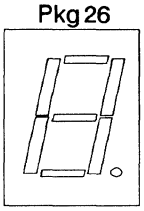

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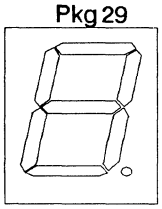
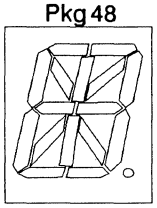
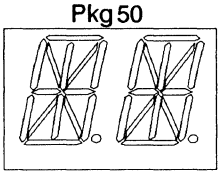


Pkg 48



Pkg 50



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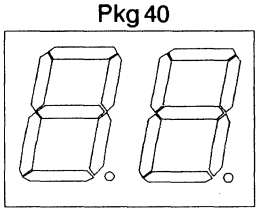
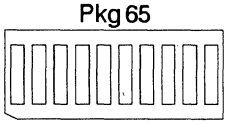
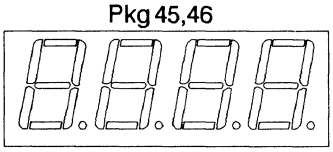


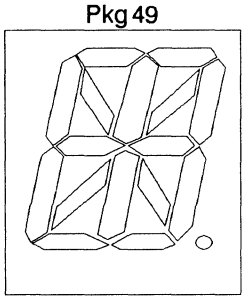
Pkg 65



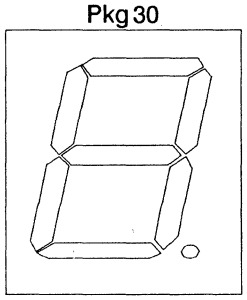
Pkg 45,46



Pkg 49



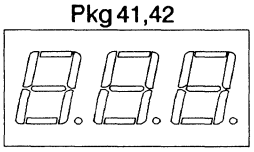
Pkg 30



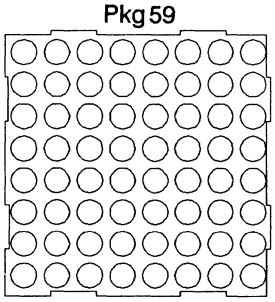
Pkg 63

Pkg 64

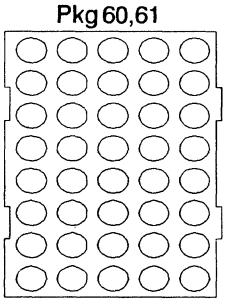
Pkg 41,42



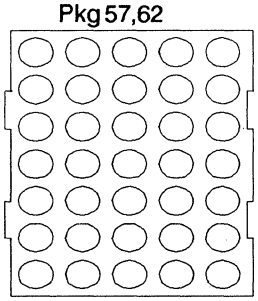
Pkg 59



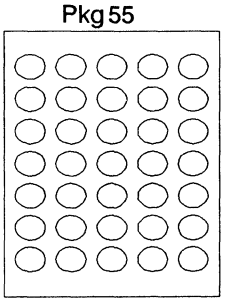
Pkg 60,61



Pkg 57,62



Pkg 55



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PACIFIC COMPONENTS
An ALTAIR™ Company

MINIATURE FLUORESCENTS
Cold Cathodes for Backlight Applications
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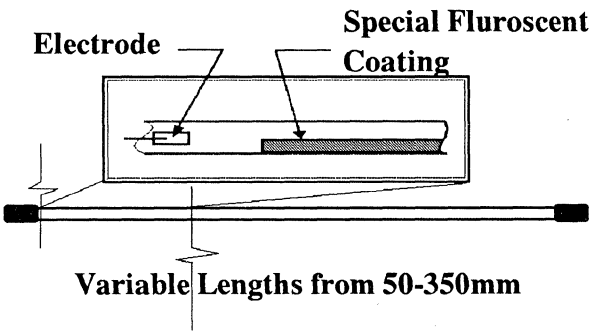
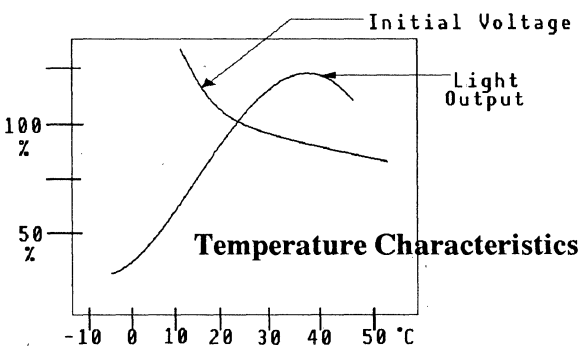
FEATURES

- (4) Colors (B)lue, (G)reen, (YG)yel/green, (R)ed
- (3) Whites (NW)natural white, (DW)daylight white, (BW)blue white
- Variable Lengths from 50-350mm.
- Variable Diameters from 4.1-12.25mm
- Aperture types for increased area luminance
- Wire terminal or End Cap termination
- Wide Color Temperature range from 5000°K to 8500°K
- Low Power Consumption
- Tipless Design for tight space requirements
- Very Low Heat generation
- Long Life -- up to 20,000 hours for larger diameter types
- High brightness -- up to 8000 cd/M^2
- Available with (3) bends for illuminating larger areas
- Both Mercury and Non-Mercury *(low temp.)* types available
- Inverters available for prototyping and preproduction units

APPLICATIONS

- Backlighting for Liquid Crystal Displays
- Lighting for Panel legends
- Slide and Document Scanners
- Copy and FAX Machines





Examples of standard 100mm units in Natural White (NW)

Type	Dia. (mm)	MOL (mm)	Eff. Light Length (mm)	Current (mA)	Voltage (Vrms)	Watts (W)	Brightness (cd/m2)	Life (hrs)
HMB4(NW)100B	4.10	100	75	3.5	270	0.95	8000	5000
HMB5(NW)100B	4.80	100	65	4.0	230	0.92	7500	10000
HMB6(NW)100B	5.80	100	65	5.0	210	1.05	6500	10000
HMB7(NW)100B	6.50	100	65	5.0	200	1.00	5500	10000
HMB8(NW)100FS	8.15	100	70	5.0	195	0.98	4000	20000
HMB10(NW)100FS	9.80	100	60	10.0	190	1.90	5000	20000
HMB12(NW)100FS	12.25	100	55	20.0	180	3.60	5000	20000

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

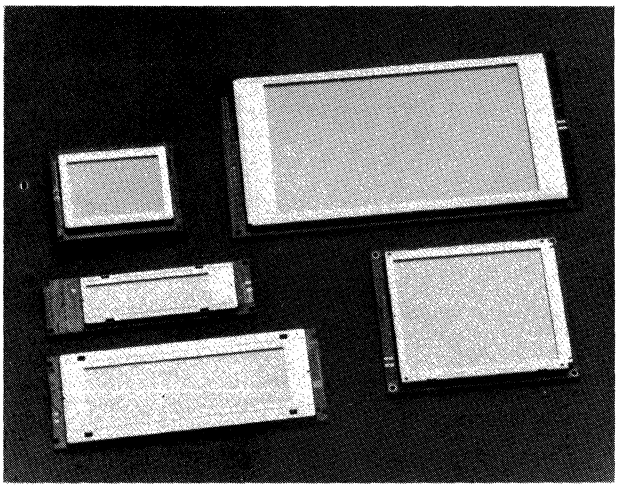
Z
ZIF zero insertion force

AND

ONE OF THE PURDY GROUP OF COMPANIES

Liquid Crystal Display Modules (Alphanumeric and Graphics)

770 AIRPORT BLVD., BURLINGAME, CA 94010 • TEL (415) 347-9916 • FAX (415) 340-1670 • MCI/TLX 677-1439 (PURDY UW)



AND offers a wide variety of LCD modules to meet any needs. All models use state of the art liquid crystal display technology.

AND's dot matrix LCD modules are ideally suited for today's industrial and consumer product applications. The low power consumption, easy interfacing, and high readability of these devices allow them to be used in measurement instruments, hand held computers, and telecommunication terminals.

LCD MODULE QUICK REFERENCE GUIDE

Type No.	Number of Characters/ Dots	Character/Dot Size (mm)	Viewing Area (mm)	Outline Dimension (mm)	Driving Voltage (V)	Controller	–30	–EO
Character Displays with Controller/RAM								
AND241	16 × 1	3.15 W × 7.9 H	64.5 W × 13.8 H	80 W × 36 H × 12 D	+5	HD44780 or equivalent	—	—
AND671	16 × 1	3.15 W × 5.76 H	64.5 W × 13.8 H	80 W × 36 H × 12 D	+5		Yes	—
AND691	24 × 1	3.2 W × 7.95 H	100 W × 13.8 H	126 W × 36 H × 12 D	+5		Yes	—
AND601	40 × 1	3.2 W × 7.95 H	154.8 W × 17.5 H	182 W × 33.5 H × 13 D	+5		Yes	—
AND491	16 × 2	2.95 W × 4.29 H	64.5 W × 15 H	80 W × 36 H × 12 D	+5		Yes	—
AND501	20 × 2	3.21 W × 5.55 H	83 W × 18.6 H	116 W × 37 H × 12.5 D	+5		Yes	—
AND501-EO	20 × 2	3.21 W × 5.55 H	83 W × 18.6 H	116 W × 37 H × 12.5 D	+5		—	Yes
AND771	24 × 2	3.21 W × 5.07 H	93.5 W × 16.5 H	118 W × 36 H × 12 D	+5		Yes	—
AND771-EO	24 × 2	3.21 W × 5.07 H	93.5 W × 16.5 H	118 W × 36 H × 12 D	+5		—	Yes
AND591	40 × 2	3.2 W × 5.55 H	154.8 W × 17.5 H	182 W × 33.5 H × 13 D	+5		Yes	—
AND591-EO	40 × 2	3.2 W × 5.55 H	154.8 W × 17.5 H	182 W × 33.5 H × 13 D	+5		—	Yes
AND731	16 × 4	2.96 W × 4.51 H	61.8 W × 26.6 H	87 W × 60 H × 12 D	+5		Yes	—
AND721	20 × 4	2.96 W × 4.51 H	76 W × 27 H	98 W × 60 H × 12 D	+5		Yes	—
AND721-EO	20 × 4	2.96 W × 4.51 H	76 W × 27 H	98 W × 60 H × 12 D	+5		—	Yes
AND1001	40 × 4	3.95 W × 5.55 H	199 W × 44 H	221 W × 76 H × 12.5 D	±5	T6963C	—	—
LED Backlight Character Displays with Controller/RAM								
AND493-JO	16 × 2	2.95 W × 4.29 H	64.5 W × 15 H	80 W × 36 H × 16 D	+5	HD44780	LED	
AND673-JO	16 × 1	3.15 W × 5.76 H	64.5 W × 13.8 H	80 W × 36 H × 16 D	+5	HD44780	LED	
Graphic Displays with Controller/RAM								
AND1021	120 W × 64 H	0.44 W × 0.56 H	62.5 W × 43.5 H	85 W × 70 H × 20 D	+5/–8.5	T6963C	Yes	Yes
AND711A	240 W × 64 H	0.49 W × 0.49 H	132 W × 39 H	180 W × 65 H × 12 D	+5/–8.5	T6963C	Yes	Yes
Graphic Displays with Super Twist Nematic with Controller								
AND711AST	240 W × 64 H	0.49 W × 0.49 H	132 W × 39 H	180 W × 65 H × 12 D	+5/–8.5	T6963C	Yes	—
AND1021ST	120 W × 64 H	0.44 W × 0.56 H	62.5 W × 43.5 H	85 W × 70 H × 20 D	+5/–8.5	T6963C	Yes	—
AND1013ST	160 W × 128 H	0.56 W × 0.56 H	101 W × 82 H	129 W × 104.5 H × 14 D	+5/–8.5	T6963C	Yes	—
AND1301VST	240 W × 128 H	0.66 W × 0.66 H	179.9 W × 101.5 H	240 W × 125.3 H × 12 D	+5/–14.5	T6963C	Yes	—
AND1391ST	128 W × 128 H	0.40 W × 0.40 H	62.0 W × 62.0 H	85 W × 100 H × 14 D	+5/–14.5	T6963C	Yes	—
AND1741MST	240 W × 128 H	0.47 W × 0.47 H	126.0 W × 70.0 H	170 W × 106 H × 14 D	—	T6963C	CCFL	
AND711AST-EO	240 W × 64 H	0.49 W × 0.49 H	132 W × 39 H	180 W × 65 H × 12 D	+5/–8.5	T6963C	—	Yes
AND1021ST-EO	120 W × 64 H	0.44 W × 0.56 H	62.5 W × 43.5 H	85 W × 70 H × 20 D	+5/–8.5	T6963C	—	Yes
AND1013ST-EO	160 W × 128 H	0.56 W × 0.56 H	101 W × 82 H	129 W × 104.5 H × 14 D	+5/–8.5	T6963C	—	Yes
AND1301VST-EO	240 W × 128 H	0.66 W × 0.66 H	179.9 W × 101.5 H	240 W × 125.3 H × 12 D	+5/–14.5	T6963C	—	Yes
AND1391ST-EO	128 W × 128 H	0.40 W × 0.40 H	62.0 W × 62.0 H	85 W × 100 H × 14 D	+5/–14.5	T6963C	—	Yes

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Light Emitting Diode Displays

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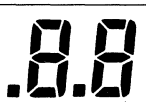
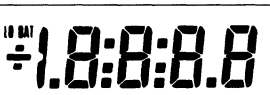
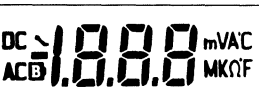
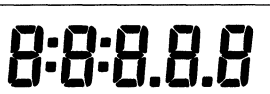
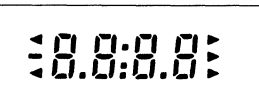
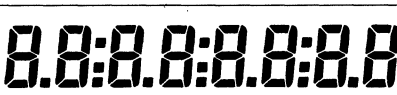
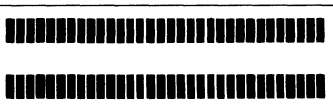
LCD MODULE QUICK REFERENCE GUIDE (con't.)

Type No.	Number of Characters/ Dots	Character/Dot Size (mm)	Viewing Area (mm)	Outline Dimension (mm)	Driving Voltage (V)	Controller	– 30	– EO
Graphic Displays with Super Twist Nematic without Controller								
AND1241ST	480 W × 128 H	0.48 W × 0.48 H	236 W × 67 H	277 W × 83 H × 14 D	+5/–14.5	(T7779)	Yes	—
AND932ST	640 W × 200 H	0.345 W × 0.345 H	249 W × 82 H	293 W × 97.6 H × 14 D	+5/–22.5	(T7779)	—	—
AND561ST	640 W × 200 H	0.32 W × 0.46 H	231 W × 105 H	275 W × 126 H × 14 D	+5/–22.5	(T7779)	Yes	Yes
AND1342BST	640 W × 200 H	0.32 W × 0.46 H	231 W × 105 H	275 W × 126 H × 14 D	+5/–22.5	(T7779)	—	Yes
AND1181ST	640 W × 400 H	0.32 W × 0.32 H	230 W × 146 H	276 W × 186 H × 14 D	+5/–22.5	(T7779)	Yes	Yes
AND1181BST	640 W × 400 H	0.32 W × 0.32 H	230 W × 146 H	276 W × 186 H × 14 D	+5/–22.5	(T7779)	—	Yes
AND1501MST	640 W × 400 H	0.30 W × 0.30 H	217 W × 138 H	320 W × 197.4 H × 22 D	+5/–15.7	(T7779)	CCFL	
AND1551MST	640 W × 480 H	0.28 W × 0.28 H	206 W × 156 H	276 W × 182 H × 20 D	+5/–24.0	(T7779)	CCFL	

1) Standard AND LCD modules are configured to operate in a reflective viewing mode. Transflective and transflective viewing modes with electroluminescent lamps installed are also available for most modules.
2) – 30 suffix designates a module with a transflective backing rather than a reflective one (i.e. AND591-30 for a transflective 40 character × 2 line dot matrix LCD module). The transflective backing makes viewing possible under normal ambient light or by using a backlight. The backlight slips between the LCD and the PC board making viewing possible in dark or dim lighting conditions.
3) – EO suffix designates a module which has a transflective backing and an electroluminescent lamp (EL) installed (i.e. AND591-EO for 40 character × 2 line dot matrix LCD module with EL lamp). Normally an inverter is necessary to generate the high frequency AC signal needed by the EL lamp. The backlight operates on 110 VAC at 500 Hz.
4) LED Backlit modules have a transflective backing and LED backlight array installed. The backlight operates on 4.1 V and a maximum current of 220 mA.
5) Cold Cathode Fluorescent Lamp (CCFL) backlighting is available for certain modules.

LIQUID CRYSTAL DISPLAY PANELS

Display Font	Digit Height (inches)	Part Number	Package Dimensions L × W (inches)	Display Font	Digit Height (inches)	Part Number	Package Dimensions L × W (inches)
	0.5	FE1901	1.2 × 1.2		0.5	FE0205	2.0 × 1.2
	0.2 0.5 0.7 1.0	FE2201 FE0201 FE0501 FE0701	1.6 × 0.7 2.0 × 1.2 2.75 × 1.5 3.7 × 1.8		0.4	FE0206	2.0 × 1.2
	0.5	FE0203	2.0 × 1.2		0.4	FE0208	2.0 × 1.2
	0.4	FE0801	2.0 × 0.95		0.3 0.5 0.7	FE0803 FE0401 FE0601	2.0 × 0.95 2.75 × 1.2 3.7 × 1.2
	0.3	FE0101 (pinless only)	1.57 × 0.7		0.5	FE1001	3.7 × 1.2
	0.35 0.5 0.5 0.7 1.0	FE0804 FE0202 FE0204* FE0502 FE0703	2.0 × 0.95 2.0 × 1.2 2.0 × 1.2 2.75 × 1.5 3.7 × 1.8		0.15	FE0405	2.75 × 1.2

* TRIPLEX

Ordering Information:

PART Number FEXXXX X-X X

Model Number:
Liquid Crystal Material—Polarizer Options:
Leave digit blank—Standard Grade (– 20 to + 60°C)—Standard Polarizer
W-_U—Wide Temperature (– 30 to + 85°C)—High Temp./High Humidity Polarizer
Viewing Mode (see configuration chart):

Example: Model FE0203, with wide temperature fluid, pinned reflective foil configuration and high temp./high humidity polarizer: FE203W-DU

Custom LCD'S. Contact our representatives or consult factory for your custom LCD'S

Configuration Chart

Viewing Mode	Configuration	
	Pinned	Pinned
Transmissive	A	F
Reflective Frosted	K	
Reflective Aluminum Foil	D	I
Transflective	E	J

OPTREX LCD...*OPTREX* LCD...*OPTREX* LCD...*OPTREX* LCD

Since the beginning of the LCD module industry, Apollo Display Technologies has served the OEM Market as a technical, stocking distributor, manufacturer, and value-added manufacturer of LCD products and services. A wide range of industry-standard LCD modules are stocked in depth for immediate delivery. Our New York based value-added, semi-custom and custom manufacturing capabilities broaden the variety of viewing and performance characteristics to better suit customer's special needs. It is our unique combination of low-cost standard product, local in-depth stocking, technical assistance and value-added services that have made our company the first choice of so many display engineers.

- Very Aggressive Pricing in 10's through 1,000's of units
- OPTREX...World's Largest LCD Manufacturer
- Display Engineers to Answer Your Technical Questions
- Stock.....Stock.....Stock.....Stock.....Stock
- Graphic LCD Controller Boards

CHARACTER MODULES Including Character Generator

ROWS X CHARACTERS					
1 x 16	2 x 16	4 x 16	8 x 16	16 x 24	25 x 80
1 x 20	2 x 20	4 x 20	8 x 20	16 x 20	
1 x 24	2 x 24	4 x 40	8 x 30	16 x 32	
1 x 32	2 x 32		8 x 40	16 x 40	
1 x 40	2 x 40		8 x 80	16 x 80	

GRAPHIC MODULES Combined Character & Graphic

PIXEL ROW X PIXEL COLUMN				
64 x 128	128 x 160	200 x 640	400 x 640	480 x 640
64 x 240	128 x 240		400 x 720	480 x 720
64 x 480	128 x 480	350 x 720		
64 x 640				

SPECIAL LIGHTING TECHNIQUES

Multi-Color Backlighting
User Replaceable Backlighting
Emulate Emissive Displays
Extended Life EL Panels
Increased Backlight Intensity
Front Lighting
Color Matching
CCT Florescent Tubes
LED
EL
Incandescent
5V, 12V, 24V Inverters
Backlight Timers
Fiber Optic Backlight

FEATURES & VALUE-ADDED SERVICES

Anti-Glare Films
Negative Image
High-Brightness Reflectors
5V Thin Glass Supertwist
5V Neutral/Blue Supertwist
5V Yellow/Black Supertwist
ESD Protection
Software-Adjusted Contrast
Connectors
Sample Display Routines
Complete Operations Manual
Surface Mounting Service
Testing Services
Fix Scratched Displays
Add/Change/Replace Backlights
LCD Repair Service

CONTROLLERS

CONTROLLER IC
Yamaha, OKI, Toshiba, Hitachi, SMOS.
CONTROLLER BOARDS
CDS6255, CDS1330, CDS66480, Yamaha Display Master, CDS700 Terminal, RGB, RS232 Ports, Composite Video, MDA, CGA, EGA, VGA, etc.
CUSTOM CHARACTER FONTS
Hebrew, etc.

EXTRAS

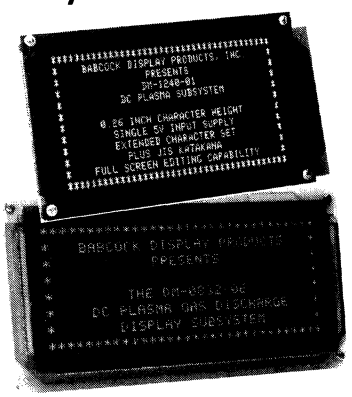
Touch Screens
Enclosures
Bezels
Monitors
Terminals
Customs

APOLLO DISPLAY TECHNOLOGIES

182 Morris Avenue
Holtsville, NY 11742
Phone: (516) 654-1143
Fax: (516) 654-1496

DC PLASMA AND VF DISPLAYS

DC Plasma Display Subsystems



Babcock's MESSENGER Series of DC Plasma displays are 5 x 7 dot matrix multi-line flat panel display subsystems which incorporate the latest in high voltage display drivers and microprocessor design. They are available in 4 lines of 16 characters, 6 lines of 40 characters, 8 lines of 32 characters and 12 lines of 40 characters and feature optional DC-DC converters for single +5 VDC input supply. Some models accept serial as well as parallel data at selectable baud rates. Bright, high contrast neon-orange displays provide a wide 130 degree viewing angle. They are ideal for operator interface displays in medical and scientific equipment, machine tools, and a wide variety of process control equipment. Plasma displays are specified in applications where viewing conditions are less than optimal.

The dual 100 and 201-element bargraph displays have a thin design that makes front panel mounting easy and require only 7 drivers to independently control the neon-orange elements of each bar. The 100-element bargraph is 6.0" x 1.45" overall, while the 201-element bargraph has 4.5" x 1.2" overall dimensions. Both have hermetically sealed construction and are suited to hostile environments.

Babcock has recently completed a year-long technological program which has resulted in the ability to offer high-resolution, thin film custom design capabilities. Babcock is one of the only display manufacturers in the U.S. to actually manufacture display products from the glass up, and all of Babcock's DC plasma displays are easily modified for custom applications, including specific MIL-SPEC requirements.

Vacuum Fluorescent Displays



VF-0640-TS Touch Screen Display

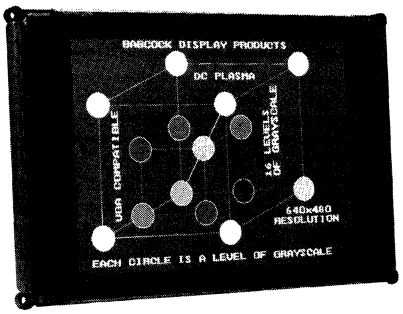
The AZURE and AZURE II VF display subsystems from Babcock have character fields from 1 x 20 to 6 x 40 in a 5 x 7 dot matrix format, and 1 x 16, 1 x 20 and 1 x 32 characters in 14-segment format. The use of vacuum fluorescent technology provides a bright (175 fL) blue-green display which can be filtered to a variety of colors to complement your front panel design.

The VF displays allow for the representation of the 96-character ASCII font consisting of both upper and lower case alphabetic characters, as well as numerals, punctuation, commonly used scientific symbols and European ECMA characters for international applications.

The hardware design includes an on-board DC-DC converter which generates all the voltages required to drive the display and allows the subsystem to be operated from a single +5 VDC power supply. Also included is a microprocessor-controller which serves display refresh and character input, and implements many editing control codes and commands.

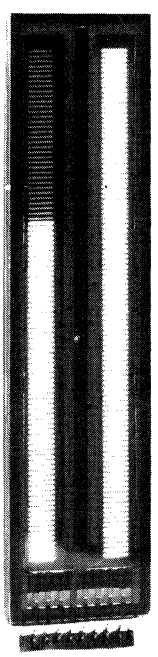
The VF-0640-TS is an interactive terminal subsystem with a display field of 6 lines of 40 characters combined with a touch-input switch field of 8 rows of 16 columns. An on-board DC-DC converter generates all required voltages from a single +5 VDC power input. A microprocessor-controller generates display refresh, character input, touch-screen scanning and implements many control codes and commands. The VF touch panel display subsystem is ideal for automated teller machines, point-of-sale terminals, alarm and security systems, computer peripherals, and much more.

Plasmaflex™ Screened Image Components



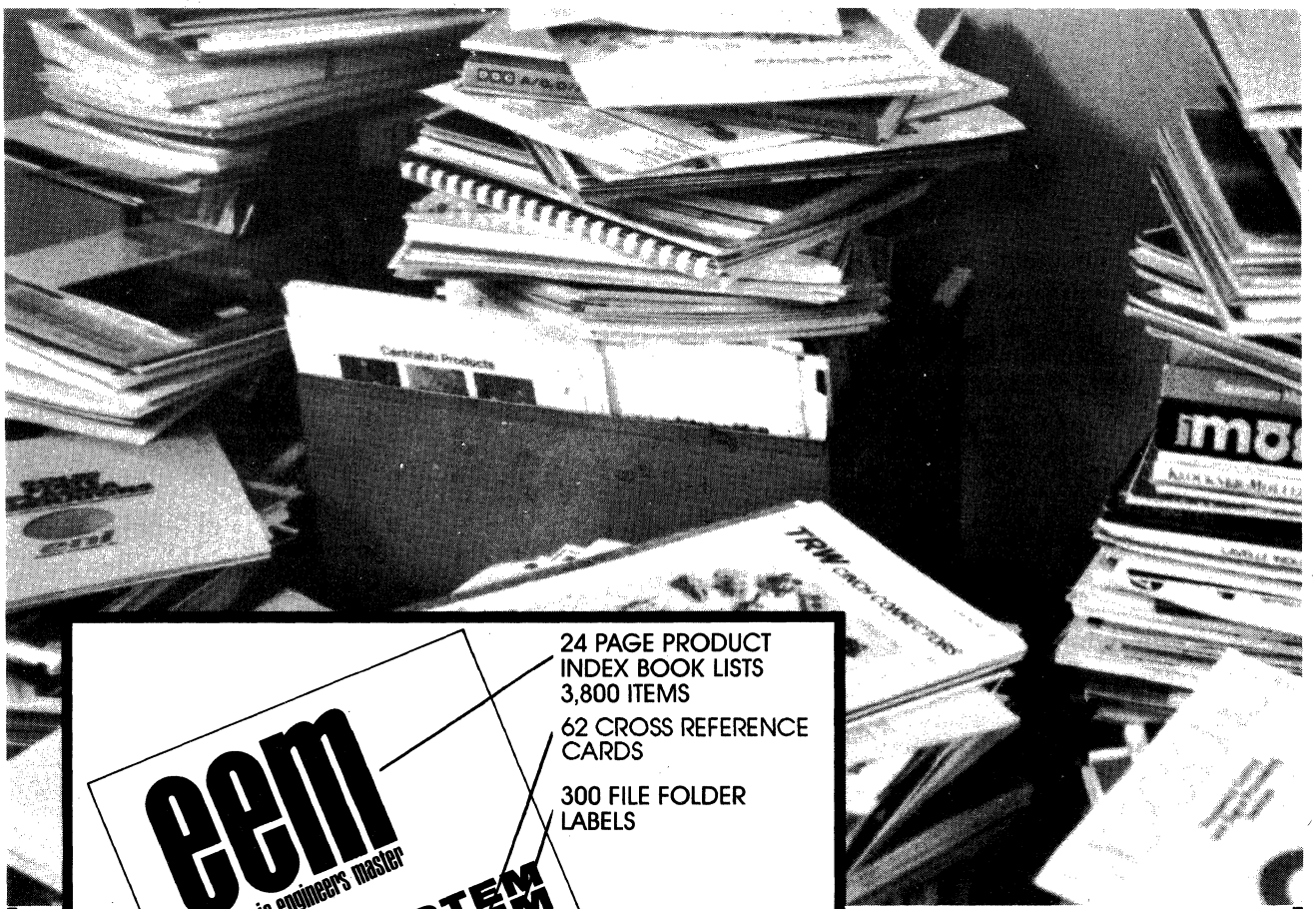
SP-482-001
High Resolution Flat Panel Display

Babcock's Plasmaflex screened image displays lend themselves to custom-tailored applications for unique graphic style requirements. Images are placed on the display using a thick film screen printing process and because a new screen is easily and inexpensively created, custom designs are readily available. Formats include numerics, alphanumerics, graphics, bargraphs, dot matrix or annunciators, or any combination of displays. Plasmaflex screened image displays are ideal for custom requirements, yet still offer the off-the-shelf availability of standard displays.



SP-410-002
100-Element Dual Bargraph Display

BABCOCK
DISPLAY PRODUCTS, INC.
1051 S. East Street, Anaheim, CA 92805-5799
(714) 491-5100 • FAX (714) 490-1368



24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

62 CROSS REFERENCE CARDS

300 FILE FOLDER LABELS

ALL NEW with this edition of EEM

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Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with the System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

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Don't waste any more time. Get organized now!

EEM FILE SYSTEM,

645 stewart ave., garden city, ny 11530

CANYON electronics

READOUT ASSEMBLIES

MINI-PAK DISPLAY ASSEMBLIES

The MINI-PAK® series are gas discharge or LED readout modules, specifically designed for use on low-to-medium volume industrial or commercial instruments. The display and associated electronic drive are packaged in a black thermoplastic case available in two styles; a rear panel mount and a front panel mount. The modules are available in 1½-, 2-, 2½ and 3-digit configuration that can be mounted individually or stacked horizontally to form any number of digits. The MINI-PAK® series are designed for direct interface compatibility with TTL or LSI integrated circuits with 4 line output information in the 8-4-2-1 BCD code format.

GAS DISCHARGE SERIES CE-1000/CE-2000

The MINI-PAK® series CE-1000/CE-2000 include a 0.55" high character gas discharge display and the BCD to seven segments Decoder/Driver. The interface terminals are brought out to 14 pin dual-in-line header or socket. All components are soldered to the P.C. Board.

GAS DISCHARGE SERIES CE-3000/CE-4000

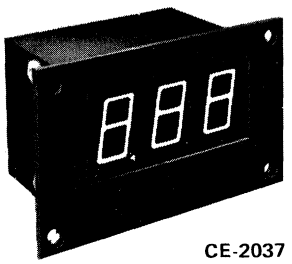
The MINI-PAK® series CE-3000/CE-4000 include a 0.55" high character gas discharge display and socket mounted BCD to seven segments Decoder/Driver. The interface terminals are brought out to wire wrap pins. The gas discharge display can be very easily and efficiently replaced, thereby, minimizing down time.

LED SERIES CE-5000/CE-6000

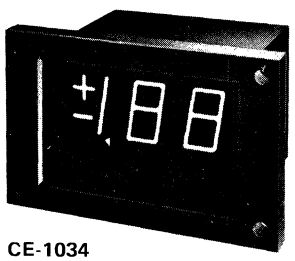
The MINI-PAK® series CE-5000/CE-6000 include a socket mounted 0.43", 0.625" or 0.8" character high LED display, a socket mounted BCD to seven segments Decoder/Driver and current limitting resistors, whenever applicable. The interface terminals are brought out to wire wrap pins. The series is available with or without latch or in 5 mA, 15 mA or 20 mA per segment.

FOR CUSTOM MADE ASSEMBLIES, LARGER CHARACTERS OR OTHER REQUIREMENTS, CONSULT FACTORY

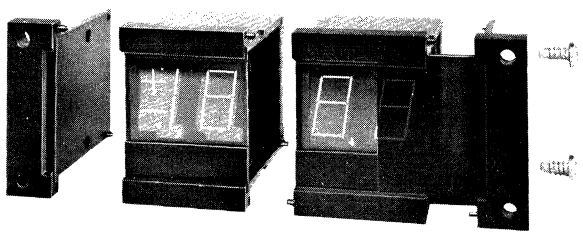
DOUBLES YOUR OPTION TO YOUR PANEL DESIGN WITH THE MINI-PAK® LED AND GAS DISCHARGE DISPLAYS.



CE-2037



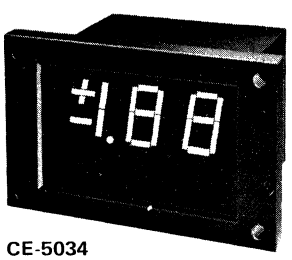
CE-1034



INSTALLATION DRAWING



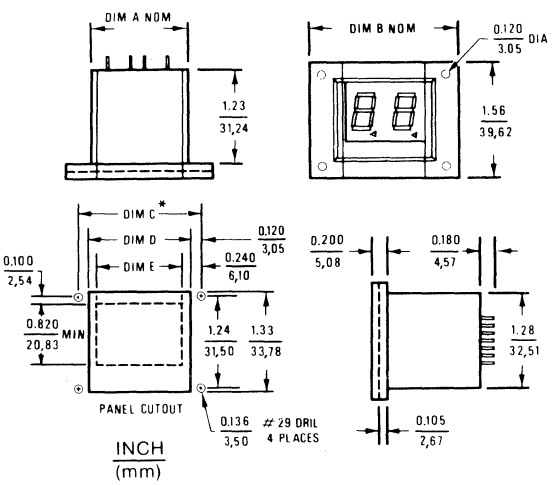
CE-6037



CE-5034

MECHANICAL SPECIFICATIONS

NO DIGITS	BEZEL WIDTH DIM. B NOM.		PANEL CUTOUT † DIM. D		PANEL CUTOUT †† DIM. E	
2	1.94	49,28	1.38	35,1	1.14	28,96
3	2.48	62,99	1.92	48,8	1.68	42,68
4	3.04	77,22	2.48	63,0	2.24	56,90
5	3.58	90,93	3.02	76,70	2.78	70,62
▲ 6	4.12	104,65	3.56	90,42	3.32	84,33
7	4.68	118,87	4.12	104,7	3.88	98,56
▲ 8	5.22	132,59	4.66	118,4	4.42	112,27



▲ Assumes maximum 3 digits modules per assembly.

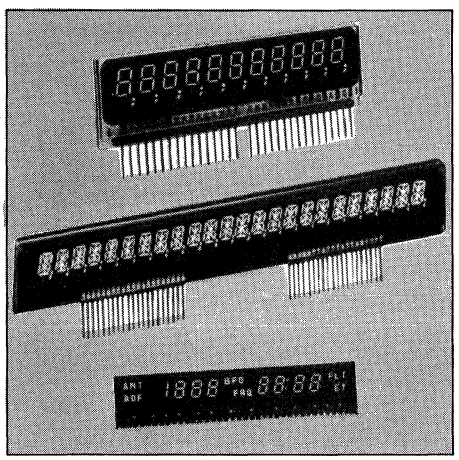
† D Dimension applies to CE-1000/3000/5000 series.

†† E Dimension applies to CE-2000/4000/6000 series.

CANYON ELECTRONICS 2001 W. North Lane, Phoenix, Arizona 85021 (602) 944-4421 FAX (602) 943-0739

CHERRY ELECTRICAL PRODUCTS
3600 Sunset Ave., Waukegan, IL 60087
708/360-3500 • FAX 708/360-3566

Segmented and Custom Graphics Gas Plasma Displays



7, 14, 16 SEGMENT MULTI-DIGIT CHARACTERS — .25″ to 2″ High

Especially designed and engineered for your industrial, commercial or consumer product application requiring the highest possible quality displays and lowest possible cost.

7 SEGMENT NUMERIC — 4 to 11 Digits
14 SEGMENT ALPHANUMERIC — to 24 Characters

- All at low cost per digit
- Flicker-free uniform brightness
- Eye-pleasing soft neon orange color is attractive, easy on the eyes, easy to read, readily filtered with red, amber or neutral (gray).
- All glass construction
- Low power ratio to character size
- Quick, easy connection

When it comes to versatility, gas plasma is tough to beat! Anything a printing press can apply to paper, we can apply to glass.

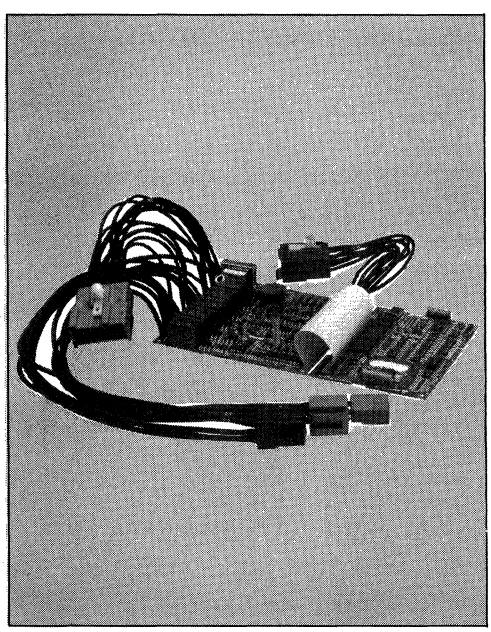
Just look at gas plasma advantages . . .

- **Custom Display capability** — Segments with legends, logos, bar graphs can be combined.
- **Uniform Color** — Excellent. And its neon orange color is filterable to red or amber.
- **Uniform High Brightness** — Excellent. It's viewable in dim or high brightness ambients.
- **Wide Viewing Angles** — Excellent.
- **Readability** — Easier to read at great distances. No more squinting.
- **Multiplexibility** — Excellent capability.
- **Long Life Expectancy.**
- **Rugged Mechanically** — Good for large area displays.
- **Direct PC Board Mounting** — with attached solder leads.

Gas Plasma Displays	
	Gas Discharge
1. Appearance	Active light emitter
2. Color	Neon orange filterable to red or amber, excellent uniformity
3. Brightness	Viewable in dim as well as high brightness ambients; excellent uniformity
4. Power Consumption	Moderate
5. Voltage (Operating)	180 Volts
6. Multiplexing Capability	Excellent
7. Typically Packaged	Multi-digits in one envelope
8. Package Configuration	Flat glass
9. Technology (Fabrication)	Printing (no internal structure) plus gas medium
10. Advantages	Custom capability for digits, legends, symbols, special fronts; excellent viewing angle, mechanically rugged, good for large area displays
11. Disadvantages	Not suited to less than ¼-inch characters
12. Life Expectancy	100,000 hours typically

Electronics

Whether a simple board or a complex module, the Electronics Division of Cherry Electrical Products specializes in working with customers on their electronic product requirements from initial design stage through automated production assembly with a quality and performance level that can only be expected from a vertically integrated manufacturer who can provide these . . .



ENGINEERING CAPABILITIES

Conception to Production
Specification Development
Circuit and System Design
Computer Aided Design
System Test and Evaluation
Manufacturing Engineering
Firmware & Software Development
Packaging & Interconnect Design
Complete Documentation
Model Shop — Prototype Fabrication

ELECTRONIC ASSEMBLY CAPABILITIES

Automatic Component Insertion
Single or Double Sided Surface Mount
Manual Assembly and Hand Soldering
Vapor Phase Reflow and Wave Soldering
Wire Preparation and Termination
Cable and Connector Interfacing
In-circuit Testing
Burn-in Equipment
Thermal Cycling Ovens
Minimum Assembly Standards — ICP

QUALITY ASSURANCE

Materials Test Lab
Design & Fabrication of:
  Automatic Test Equipment
  Special Production Machines
Quality Control Manuals
Quality Awards:
  Ford Q1
  General Motors TFE

IN-HOUSE MANUFACTURING

Close Tolerance Metal Stampings
Close Tolerance Plastic Molding
Metal Spring Generation
Multilayer, Single & Double Sided PCBs
Electroluminescent & Gas Plasma Displays
Switches: Precision, Subminiature, Snap Action, Thumbwheel, Automotive, Keyboard, etc.

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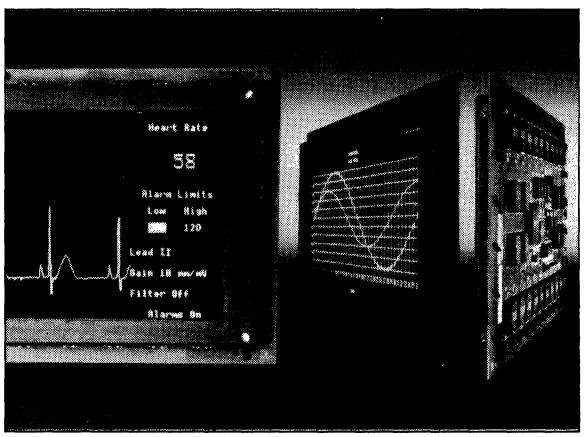
DC Electroluminescent Flat-Panel Displays



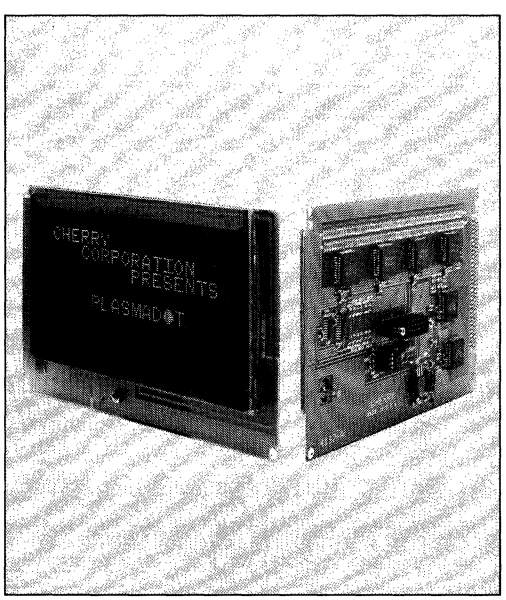
Features Unique to Cherry DCEL:

- LOW COST: Equivalent to back-lit, double-layer, supertwist LCD.
- LOW POWER CONSUMPTION: 6 watts per typical display page of text on 640 x 200 screen.
- FASTEST RESPONSE TIME: No-blur graphics with refresh frequencies from 60 to 240 Hz.
- INFINITE BRIGHTNESS CONTROL: For use in bright or dark environments.
- NO POLARIZING FILTER REQUIRED: Expensive polarizing filters cut up to 70% of the light output. Cherry DCEL holds down the cost and lets all the brilliance through.

Other Cherry DCEL Features:

- COMPACT: Only 0.6 inches thick including display and drive electronics.
- LIGHTWEIGHT: 1.5 lbs.
- LONG LIFE: Eight years of normal use with no diminution of brilliance.
- BRILLIANT: 25 to 30 FL standard.
- HIGH CONTRAST: 15:1 up to 20:1 ratio.
- RUGGED AND RELIABLE
- ERGONOMIC AMBER COLOR
- NO HARMFUL RADIATION
- MINIMAL RFI/EMI GENERATION
- NO AUDIBLE HUM OR WHINE
- AVAILABLE IN VARIOUS SIZES

PLASMADOT™ Gas Plasma Dot Matrix Displays



PRODUCT FEATURES

- Eye pleasing soft neon orange color is consistent, attractive, easy on the eyes and readily filterable with red, amber or neutral (grey)
- Flicker free uniform high brightness pixels with excellent contrast, wide viewing angle and long distance readability
- Reliable, rugged internal structure . . . no delicate filaments or complex layers
- Glass construction, no plastic or metal parts
- Slim profile flat panel for packaging flexibility
- Low power consumption and 50,000 hour life
- Directly PCB mountable with solderable connection pins on standard 0.100 inch centers

STANDARD P/N	PD01-A220	PD02-A100	PD03-A220	PD04-A220	PD05-A220
Configuration:					
Rows	32	64	9	24	32
Columns	128	128	106	106	106
Pixels:					
Shape	Round	Square	Round	Round	Round
Size	.050″	.020″	.050″	.050″	.050″
Row Pitch	0.1″	.040″	0.1″	0.1″	0.1″
Column Pitch	0.1″	.040″	0.1″	0.1″	0.1″

DESIGN CAPABILITIES

- Round, square or rectangular pixel shapes
- Pixel sizes from 0.015 inches minimum to 0.100 maximum
- Inter-pixel spacing of 0.010 inches minimum
- Glass panel sizes up to 18 inches by 24 inches

DOT MATRIX PLASMA DISPLAY
Quick Reference Guide

A COMPANY OF VISHAY DALE®

MODEL	APD-064M033	APD-064M033-1	APD-016M040	APD-222G007	APD-080M025-1	APD-128G128	APD-192G096
No. of Characters	64	64	16	32	80	192	256
Configuration	4 x 16	4 x 16	1 x 16	222 x 7	4 x 20	128 x 128	192 x 96
Display Format	Character	Character	Character	Graphic	Character	Graphics	Graphics
Character Height	0.33	0.33	0.40	0.20	0.25	0.17	0.17
Pixel Size (W x H)	0.030 (Dia.)	0.030 (Dia.)	0.036 (Dia.)	0.019 x 0.017	0.018 x 0.018	0.015 (Dia.)	0.017 (Dia.)
Pixel Pitch (W x H)	0.050 x 0.050	0.050 x 0.050	0.061 x 0.061	0.030 x 0.030	0.034 x 0.038	0.025 x 0.025	0.026 x 0.026
Display Area (W x H)	4.76 x 2.00	4.76 x 2.00	7.15 x 0.40	7.15 x 0.20	4.03 x 1.46	3.24 x 3.24	4.96 x 2.47
Outline Dim. (W x H x D)	8.00 x 3.48 x 2.33	8.00 x 3.48 x 2.33	8.50 x 2.25 x 1.96	8.50 x 2.25 x 0.98	6.25 x 3.00 x 1.75	4.62 x 4.72 x 3.75	6.0 x 4.5 x 1.95
Luminance (fL)	80	80	80	35	80	80	70
Interface *	ASCII (P)	ASCII (S)	ASCII (P&S)	Special	ASCII (S)	ASCII (S)	ASCII (S)
Supply Voltage	+ 5, + 185	+ 5	5.0	+ 5, + 250	+ 5	+ 5, + 12	+ 5
Power Consumption (Max)	6.45	7.50	6.25	9.90	5.00	8.5	12
Viewing Angle (Degrees)	150°	150°	150°	150°	150°	120°	120°
Operating Temperature	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	- 15°C to + 55°C	0°C to + 55°C
Storage Temperature	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C
MODEL	**APD-240M026A**	**APD-240M026A-1**	**APD-240M019**	**APD-240M021**	**APD-256M026**	**APD-256M026-1**	**APD-256M025A**
No. of Characters	240	240	240	240	256	256	256
Configuration	6 x 40	6 x 40	6 x 40	6 x 40	8 x 32	8 x 32	8 x 32
Display Format	Character	Character	Character	Character	Character	Character	Character
Character Height	0.26	0.26	0.196	0.21	0.26	0.26	0.25
Pixel Size (W x H)	0.020 (Dia.)	0.020 (Dia.)	0.019 x 0.019	0.018 (Dia.)	0.020 (Dia.)	0.020 (Dia.)	0.018 x 0.018
Pixel Pitch (W x H)	0.030 x 0.040	0.030 x 0.040	0.030 x 0.030	0.032 x 0.032	0.040 x 0.040	0.040 x 0.040	0.032 x 0.039
Display Area (W x H)	8.33 x 2.26	8.33 x 2.26	7.43 x 1.83	7.52 x 2.15	7.62 x 3.30	7.62 x 3.30	7.00 x 3.05
Outline Dim. (W x H x D)	11.0 x 4.3 x 1.21	11.0 x 4.3 x 1.91	10.63 x 4.33 x 1.85	10.00 x 4.30 x 1.7	9.15 x 6.10	11.0 x 6.10 x 2.2	9.45 x 4.72 x 2.28
Luminance (fL)	100	100	100	100	100	100	70
Interface *	CRT	ASCII (P&S)	ASCII (S)	ASCII (P)	CRT	ASCII (P&S)	ASCII (P)
Supply Voltage	+ 5, + 12, + 65, - 115	+ 5, + 12	+ 5	+ 5, + 12 to + 30	+ 5, + 12, + 95, - 90	+ 5, + 12	+ 5, + 185
Power Consumption (Max)	14.00	15.50	12.50	11.10	14.00	15.50	12.00
Viewing Angle (Degrees)	150°	150°	150°	150°	150°	150°	150°
Operating Temperature	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	- 5°C to + 55°C
Storage Temperature	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C
MODEL	**APD-480M021**	**APD-480M021-1**	**APD-480M021-2**	**APD-336M019**	**APD-336M019-2**	**APD-192G088**	**APD-240G120**
No. of Characters	480	480	480	336	336	352	480
Configuration	12 x 40	12 x 40	12 x 40	14 x 24	14 x 24	192 x 88	240 x 120
Display Format	Character	Character	Character	Character	Character	Graphics	Graphics
Character Height	0.21	0.21	0.21	0.19	0.19	0.26	0.21
Pixel Size (W x H)	0.018 x 0.018	0.018 x 0.018	0.018 x 0.018	0.013 (Dia.)	0.013 (Dia.)	0.020 (Dia.)	0.018 x 0.018
Pixel Pitch (W x H)	0.032 x 0.032	0.032 x 0.032	0.032 x 0.032	0.023 x 0.030	0.023 x 0.030	0.040 x 0.040	0.032 x 0.031
Display Area (W x H)	7.56 x 3.74	7.56 x 3.74	7.56 x 3.74	3.27 x 3.30	3.27 x 3.30	7.66 x 3.50	7.55 x 3.74
Outline Dim. (W x H x D)	10.87 x 5.91 x 1.77	10.87 x 5.91 x 1.77	10.87 x 5.91 x 1.77	4.40 x 4.60 x 3.0	4.40 x 4.60 x 3.0	10.87 x 6.00 x 2.25	10.87 x 5.91 x 1.77
Luminance (fL)	60	60	60	80	80	80	40
Interface *	ASCII (P)	ASCII (S)	ASCII (P)	ASCII (P)	ASCII (P)	ASCII (P & S)	ASCII (P & S)
Supply Voltage	+ 5, + 185	+ 5, + 12	+ 5, + 12	+ 5, + 15	+ 5, + 15	+ 5, + 12	+ 5, + 12
Power Consumption (Max)	10.00	12.20	12.40	10.00	10.00	15.50	13.50
Viewing Angle (Degrees)	150°	150°	150°	120°	120°	150°	150°
Operating Temperature	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	- 15°C to + 70°C	0°C to + 55°C	0°C to + 55°C
Storage Temperature	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C

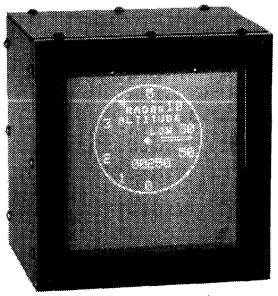
* (P) = Parallel Interface. (S) = Serial (RS-232) Interface.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

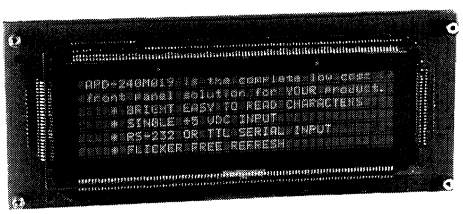
DC PLASMA DISPLAY

A COMPANY OF VISHAY DALE®

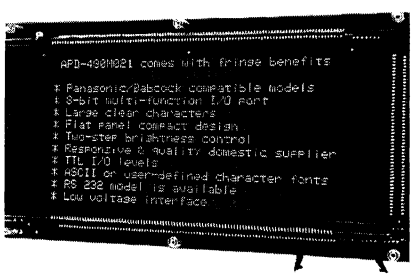
APD-128G128



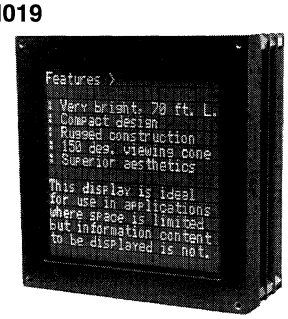
APD-240M019



APD-480M021-1



APD-336M019



FEATURES

- **Viewing Angle:** Dale's patented "open" construction method provides superior viewing angles that are unsurpassed by any display technology.
- **Brightness:** Dale displays are designed to exploit the inherent high brightness capability of DC Plasma displays to make them excellent choices for practically any application, whether it is in sunlight, brightly lit factories, or total darkness. The nature of the plasma glow make the display characters or graphics appear much larger than they actually are. The brightness is also extremely uniform since there are no internal filaments or grids that affect the light output.
- **Compact Size:** State-of-the-art design using the latest SMT components and DC/DC converters result in modules that provide minimum front panel space and depth.
- **Flexibility:** Dale excels in building display modules that allow the user to personalize their products at affordable prices. Our screened image display technology allows maximum freedom to design a display module that is application specific with interface circuitry that is synergistic to the end system.
- **High Speed Data Input:** Dale's creative interfaces allow high speed data input without display flickering or difficult handshaking schemes.
- **Rugged Design:** Shock and Vibration (non operating and operating) are no problem, as there are no fragile filaments or grids that may break.
- **Made in USA:** Dale Plasma display modules are completely manufactured in the USA by Dale which insures total control over all aspects of design and manufacturing to provide the utmost in customer service and support.

THE SELECTION PROCESS

- **Call Dale:** We have designed hundreds of application specific displays which enable us to give you an objective analysis of your needs and options.
- **Type and Amount of Information to be Displayed:** This will define whether a graphics or character format is required, and the minimum size of the format.
- **Viewing Distance Range:** This will determine the size of the characters from which the pixel pitch and size will be derived.
- **Ambient Lighting Conditions:** The lighting conditions will dictate the display luminance, whether or not dimming is required, and the type of contrast enhancement filter.
- **Power and Voltage Available:** Through the use of efficient DC/DC converters, Dale can design modules compatible with practically any power and voltage source. Dale Plasma display power requirements are competitive with any light emissive display technology.
- **Overall Size:** Dale is adept at designing packages to fit your space budget.
- **Interface:** Three basic interface levels are available: (1) ASCII - Parallel or serial (RS-232), (2) CRT controller (user supplies sync, pixel data, and clock signals) or (3) Display glass only (Dale will gladly provide application assistance).
- **Operating Environment:** The operating conditions may affect the component selection and whether special packaging is required for hostile environments.

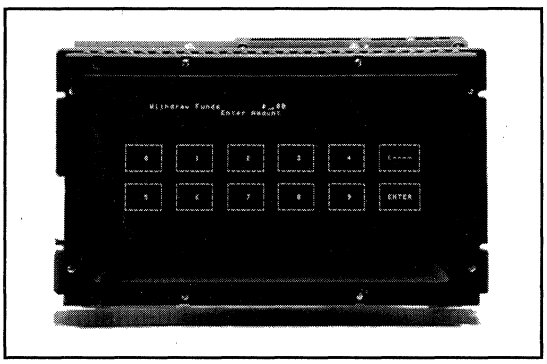
DALE'S GOAL

- To help you select the best display for your application - the first time.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street. Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

MODEL TIP
Infrared Touch Panels
With Controller

A COMPANY OF VISHAY DALE®



TIP products are infrared touch panels designed to fit most flat panel display technologies. The touch panels are a matrix of infrared diodes and detectors, scanning electronics, microprocessor controller, bezel/optical filter assembly and hardware to mount the touch panel and controller to the flat panel display. These touch panels are ideal for many applications including medical instrumentation, machine or process controls, point of sale devices, public information displays, banking and military.

Optional PC based ezTouch® software provides simple touch panel integration, facilitating the creation of user keypads. ezTouch® is a resident program and is language independent. Commands are executed by writing to the screen and touch information is read from the keyboard buffer.

FEATURES

- Fast response time
- Flexible operating modes
- User transparent
- Rugged construction
- Sealed for environmental resistance
- Immune to high or changing ambient light
- RS-232C interface
- Pre-assembled - no assembly or disassembly required to mount display

ELECTRICAL SPECIFICATIONS

Voltage: + 12 VDC ± 5%.
Current: 400 mA typical.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C.
Storage Temperature: - 55°C to + 85°C.
Relative Humidity: 10-90% non-condensing.

INTERFACE SPECIFICATIONS

Type: RS-232C.
Data Rate: 300, 1200, 9600 baud and auto baud.
Word Format: 8 bits, no parity, 1 start bit, 1 stop bit.

HOW TO ORDER

TIP	3216	FA	A	##
MODEL	MATRIX	DISPLAY DESIGNATOR	FILTER * DESIGNATOR	DASH NUMBER (If Required)

TOUCH PANEL		DISPLAY				
MATRIX	TOUCH POINTS	PIXELS	TECHNOLOGY	MANUFACTURER	PART NUMBER	DESIGNATOR
3216	63 x 31	512 x 256	ELD	Finlux Planar	MD512.256 EL6648MSS	FA PA
3220	63 x 39	640 x 400	ELD	Finlux Planar Sharp	MD640.400 EL8358HR LJ640U27	FB PB SA
3224	63 x 47	640 x 480	ELD	Sharp	LJ64ZU49	SB
3526	69 x 51	640 x 480	ELD	Planar	EL7768(G/M)S	PC
5648	111 x 95	1024 x 864	ELD	Planar	EL751214MS	PD

A = Non polarized, gray
B = Polarized, gray
C = Non polarized, amber
D = Polarized, amber
S = Special - Contact factory

NOTES:

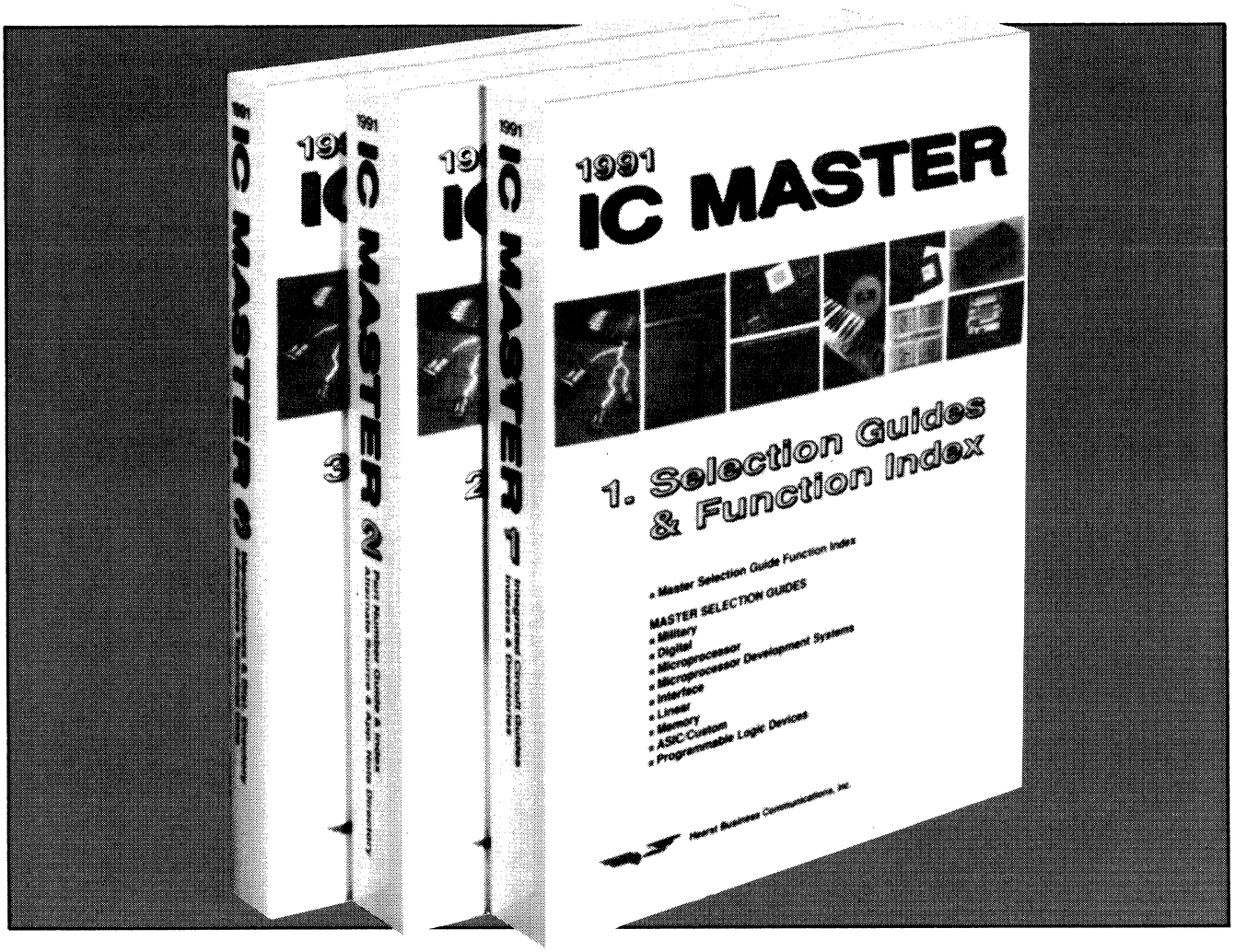
1. A dash number suffix will be factory assigned for modifications or "S" type filters.
2. Contact factory for other touch panel and display combinations.

* Other user specified filters will be designated as "S". Contact factory for availability. Any "S" filter designation will require a factory assigned dash number suffix.

Filters A-D are plastic. Glass filters may be available on selected models.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

SUPER TIME SAVER!



Do you work with ICs? Do you have trouble finding the IC you need? Are you sick and tired of sifting through dozens of manufacturers' data books? Do you have trouble comparing one set of specs to another? Are you sick and tired of wasting time?

Do we have good news for you! Get your hands on the latest annual copy of the IC Master. The Master will save you both time and money. Here's how.

The Master lists every single IC you can buy. Better yet, the Master lists ICs by function. You know what you want to do. The Master tells you who makes what for what you want to do.

There's more! The Master lists every known alternate source to every integrated circuit. If somebody makes a substitute for an IC, the Master tells you. And fast!

Want to find a custom or semicustom IC? The Master tells you who the manufacturers are, what their capabilities are, and what design tools you need.

Looking for a distributor or a local sales office? The Master tells you where they are. Got a technical problem? The Master tells you who to call. Can't figure out a part number? The Master tells you how the part number systems work.

There's more! The Master has a section on microprocessor development tools with complete performance parameters. There's another section on programmable logic devices giving you everything from output configuration to PLD development systems.

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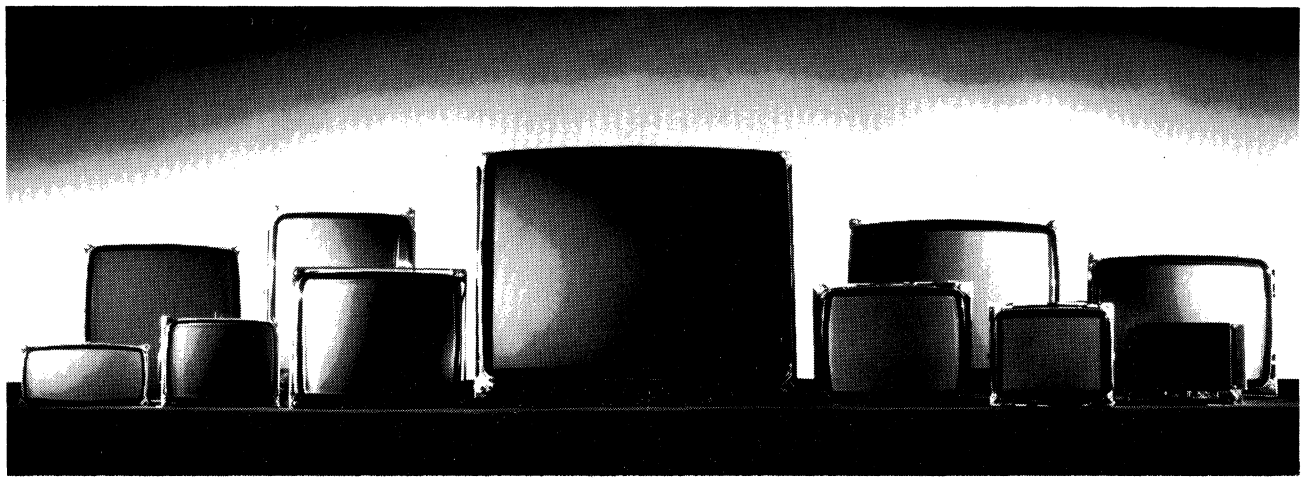
If you prefer, write to Marie, Hearst Business Communications, 645 Stewart Ave., Garden City, NY 11530. She'll mail you the IC Master subscription form right away.

And, if you tell her you saw it in the 1991/92 EEM, she'll take $10 off the subscription price!

IC MASTER

More Than The Eye Can See



At Data Ray Corporation, we offer more than high performance monitors with outstanding image quality. From our facilities located near Denver, Colorado, we are dedicated to:

- **SERVING A WIDE RANGE OF OEM APPLICATIONS**
  Data Ray's versatile color and monochrome monitors allow us to serve a wide range of OEM applications, including medical and industrial imaging, high resolution graphics, flight simulation, training, and data display. This design flexibility means shorter approval cycles and more competitive pricing for you.
- **CLOSE ENGINEERING INTERFACE**
  Our experienced engineering staff works closely with you to ensure that your particular electrical and mechanical specifications are met.
- **FLEXIBLE MANUFACTURING CAPABILITIES**
  We strive to accommodate our customers' varying volume requirements and different product configurations — kit, open frame chassis or enclosures where available. Our 65,000 sq. ft. manufacturing and R&D facility was specifically designed to accommodate the unique requirements of display manufacturing. Our modern production techniques will allow us to maximize our responsiveness to our customers.
- **HIGH QUALITY STANDARDS**
  From design conception through production, Data Ray incorporates a philosophy of total quality control to ensure the highest degree of quality and reliability in our products.
- **RESPONSIVE CUSTOMER SUPPORT**
  Data Ray recognizes that the OEM markets we serve are dynamic and demanding. We are dedicated to providing the ongoing technical and customer service support critical to a successful OEM relationship.

Call us today to discuss your particular color or monochrome monitor requirements. Not only will you find the best looking images in the industry, you'll discover that Data Ray offers *more than the eye can see.*

DATA RAY CORPORATION

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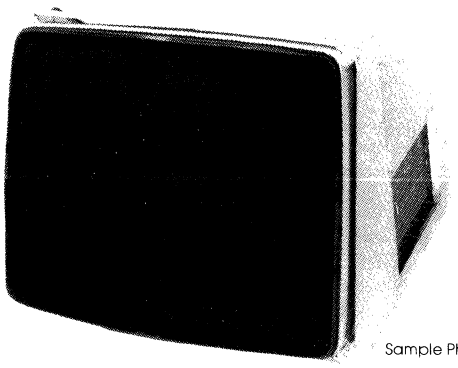
DATA RAY CORPORATION

HIGH PERFORMANCE COLOR & MONOCHROME MONITORS
More Than The Eye Can See . . .

DR50/DR55 SERIES HIGH RESOLUTION LARGE SCREEN COLOR MONITORS

CRT
Type: Shadow Mask
Size: 14" to 20" (DR50 Series)
26", 29" (DR55 Series)
Electronic Gun: In-Line (DR50 Series)
In-Line, DAF System (DR55 Series)
Deflection Angle: 90 degrees
Dot Pitch: .31 mm (DR50 Series)
.31 mm (26"); .37 mm (29") (DR55 Series)
SIGNAL INPUT
Type: Analog RGB
Level: Composite: 1.0V p-p
Non-composite: .7V p-p
Signal Polarity: Positive
Termination Impedance: 75 Ohms
SYNC
Type: Composite
Level: 0.5 to 1.0V p-p @ 75 Ohms
Signal Polarity: Negative or Positive
Connectors: BNC for RGB and Sync
ELECTRICAL PERFORMANCE
Resolution: Up to 1600 x 1200 (Non-Interlaced)
Scanning Frequency: Horizontal: 30-78 kHz
Vertical: 50-120Hz
High Voltage Regulation: Better than .1%
POWER REQUIREMENTS:
Voltage: 110/220 VAC
Frequency: 47-63 Hz
Consumption: Nominal: 115 watts
Max: 135 watts
VIDEO
Bandwidth: 130 MHz/-3dB
ENVIRONMENT:
Operating: 0° TO 40° C
Storage: −30° TO 65° C
Humidity: 10-90% Non-condensing
Altitude: Operating: 10,000 ft.
AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
DR50 Series: Available in chassis (Standard or Custom)
DR55 Series: Available in chassis or plastic enclosure
Specifications subject to change.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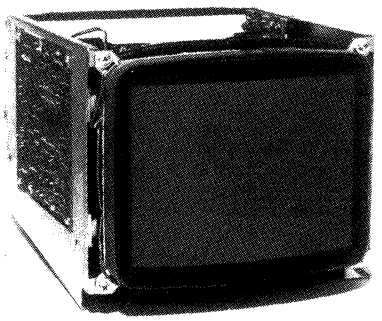
- **26" and 29" Diagonal Ideal for High-Res Large Screen Applications: Simulation, Training, GIS, Engineering Workstations, and Stereoscopic Displays**
- **Excellent Focus with DAF System CRT**
- **High Voltage Regulation Better than .1%**
- **Low Power Consumption**
- **High Reliability**
- **Available in Open Frame or Enclosure**

CALL US TODAY TO DISCUSS YOUR OEM REQUIREMENTS!

DR53/DR54 SERIES HIGH PERFORMANCE SMALL SCREEN COLOR MONITORS

CRT
Type: Shadow Mask (DR53 Series)
Trinitron * (DR54 Series)
Size: 12", 14" (DR53 Series)
7.5", 10", 14" (DR54 Series)
Electronic Gun: In-Line
Deflection Angle: 90 degrees
Dot Pitch: .28 and .31 (DR53 Series)
.26 (DR54 Series)
SIGNAL INPUT
Type: Analog RGB (TTL input available)
Level: Composite: 1.0V p-p
Non-composite: .7V p-p
Signal Polarity: Positive
Termination Impedance: 75 Ohms
SYNC
Type: Composite
Level: 0.3 to 1.0V p-p @ 75 Ohms
Signal Polarity: Negative
Connectors: BNC for RGB and Sync
ELECTRICAL PERFORMANCE
Resolution: Up to 640 x 480 (Interlaced)
Scanning Frequency: Horizontal: 15.75 kHz-32 kHz (fixed)
Vertical: 50/60/70Hz
High Voltage Regulation: 1.5% Standard (< 1% Available)
POWER REQUIREMENTS:
Voltage: 110/220 VAC
(DC Input Available)
Frequency: 47-63 Hz
Consumption: Nominal: 55 watts
VIDEO
Bandwidth: 15 MHz/-3dB
ENVIRONMENT:
Operating: 0° TO 40° C
Storage: −30° TO 65° C
Humidity: 10-90% Non-condensing
Altitude: Operating: 10,000 ft.
AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
Available in chassis (Standard or Custom)

*Trinitron is a trademark of Sony Corporation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- **Designed for high performance applications utilizing small color CRTs, the DR53/DR54 Series is ideal for medical and industrial imaging**
- **Sony Trinitron or Shadow Mask CRT**
- **Automatic White Balance Compensation System**
- **Compact Design**

CALL US TODAY TO DISCUSS YOUR OEM REQUIREMENTS!

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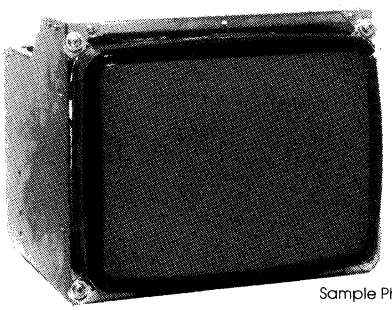
HIGH PERFORMANCE COLOR & MONOCHROME MONITORS
More Than The Eye Can See . . .

DR56 SERIES COLOR MONITORS FOR INDUSTRIAL IMAGING

CRT
Shadow Mask (DR56S Series)
Trinitron (DR56T Series)
Size: 12" to 14" (DR56S Series)
5", 7.5", 10", 14" (DR56T Series)
Electronic Gun: In-Line
Deflection Angle: 90 degrees
Dot Pitch: .28 and .31 (DR56S Series)
.26 (DR56T Series)
SIGNAL INPUT
Type: TTL (Analog Available)
Signal Polarity: Black Negative
SYNC
Type: TTL (Analog Available)
Signal Polarity: TTL Positive (Analog Available)
Connectors: TTL 9 Pin-D
Analog BNC
ELECTRICAL PERFORMANCE
Resolution: Up to 640 X 480 (Non-Interlaced)
Scanning Frequency: Horizontal: 15-35 kHz (set frequency)
Vertical: 50 or 60 Hz
AC POWER REQUIREMENTS
Voltage: 115 VAC
Frequency: 50/60 Hz
Consumption: 60 watts typical
VIDEO
Bandwidth: 24 MHz
ENVIRONMENT
Operating: −5° C to 55° C
Storage: −20° C to 65° C
Humidity: 10%-90% Non-condensing (Operating)
Altitude: Operating 10,000 ft.
AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
Available in chassis (standard or custom)
Some enclosures available

*Specifications subject to change.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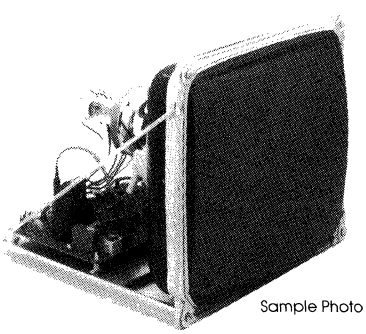
- **Ruggedized to withstand harsh environments (shock, vibration, noise immunity, and temperature)**
- **Compatible with CGA, EGA, and VGA (single mode)**
- **Designed to drive both small and large color CRTs**
- **Price Competitive**

CALL US TODAY TO DISCUSS YOUR OEM REQUIREMENTS!

DR60/DR70 SERIES HIGH PERFORMANCE MONOCHROME MONITORS

CRT
Size: 7" to 20"
Faceplate: Non-glare/Contrast Treatments Available
Phosphors: All EIA Phosphors
Neck Size: 20 mm/29 mm
DISPLAY
Resolution: Up to 1024 x 1024
Linearity: 10% Standard (Tighter tolerances available)
Geometry: 1% of Display Size
Configuration: Portrait or Landscape
Dynamic Focus: Horizontal and Vertical
High Voltage Regulation: 3% Standard (Tighter tolerances available)
VIDEO PERFORMANCE
Bandwidth: 30 MHz/-3dB
Input Signal: TTL, Composite, or Analog
Polarity: Positive = White
HORIZONTAL SYNC
Frequency: 15-33kHz
Input: TTL
Polarity: Positive or Negative
VERTICAL SYNC
Frequency: 30-120 Hz
Input: TTL
Polarity: Positive or Negative
POWER REQUIREMENTS:
Input Voltage: 12-24 VDC nominal
115/230 VAC Available (Automatic Switch)
Power Consumption: 15 watts typical (DR60 Series w/9" CRT)
36 watts typical (DR70 Series w/15" CRT)
ENVIRONMENT:
Operating: 0° TO 50° C
Storage: −20° TO 65° C
Humidity: 10-90% Non-condensing
Altitude: 10,000 ft. Operating
AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
Available in kit or chassis (standard or custom)
Some enclosures available

*Specifications subject to change.


Sample Photo Only

- **Engineered for high performance, the DR60/DR70 Series is especially suited to meet the demanding requirements of the medical imaging industry.**
- **Internal and External Blanking**
- **Dual Axis Dynamic Focus**
- **Backporch Clamping**
- **Capable of Excellent Linearity**

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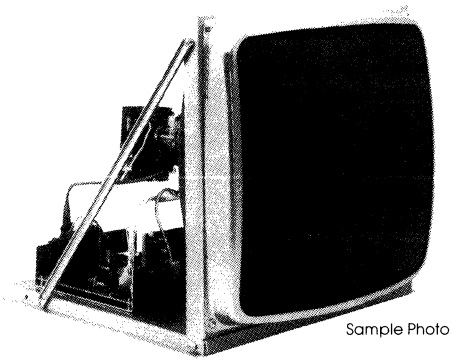
DATA RAY CORPORATION

HIGH PERFORMANCE COLOR & MONOCHROME MONITORS
More Than The Eye Can See . . .

DR31 SERIES HIGH RESOLUTION MONOCHROME MONITOR

CRT
Size: 12" to 20"
Faceplate: Non-glare/Contrast Treatments Available
Phosphors: All EIA Phosphors
Neck Size: 29 mm
DISPLAY
Resolution: Up to 1500 x 1024
Linearity: 10% Standard (Tighter tolerances available)
Geometry: 1% of Display Size
Configuration: Portrait or Landscape
Dynamic Focus: Horizontal and Vertical
High Voltage Regulation: Better than .5%
VIDEO PERFORMANCE
Bandwidth: 130 MHz/-3dB
Input Signal: ECL, TTL (1 or 2-bit) or Analog
Polarity: Positive or Negative (TTL, ECL)
Positive = White (Analog)
HORIZONTAL SYNC
Frequency: 30-70 kHz
Input: TTL
Polarity: Positive or Negative
VERTICAL SYNC
Frequency: 50-120 Hz
Input: TTL
Polarity: Positive or Negative
POWER REQUIREMENTS:
Input Voltage: 24 VDC nominal
115/230 VAC Available (Automatic Switch)
Power Consumption: 55 watts typical w/15" CRT
ENVIRONMENT:
Operating: 0° TO 50° C
Storage: −20° TO 65° C
Humidity: 10-90% Non-condensing
Altitude: 10,000 ft. Operating
AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
Available in kit or chassis (standard or custom)
Some enclosures available

*Specifications subject to change.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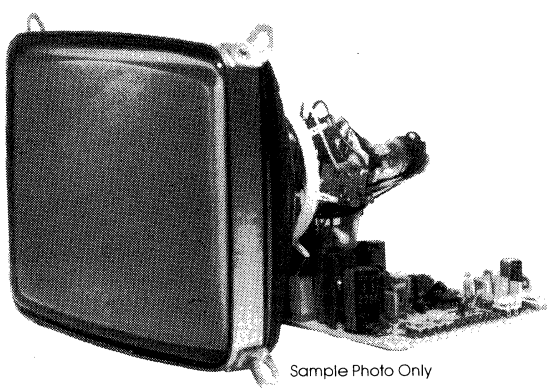
- **Ideal for High-Resolution Computer Graphics and Data Display Applications**
- **Better than .5% High Voltage Regulation**
- **Wide Video Bandwidth for High-Res Graphics**
- **High Reliability**

CALL US TODA TO DISCUSS YOUR OEM REQUIREMENTS!

DR10 SERIES MONOCHROME DATA DISPLAY

CRT
Size: 7" to 14"
Faceplate: Non-glare/Contrast Treatments Available
Phosphors: All EIA Phosphors
Neck Size: 20 mm
DISPLAY
Resolution: Up to 800 x 600
Linearity: 10% Standard (Tighter tolerances available)
Geometry: 1% of Display Size
Configuration: Portrait or Landscape
Dynamic Focus: Horizontal
High Voltage Regulation: 5% Standard
VIDEO PERFORMANCE
Bandwidth: 18 MHz/-3dB
Input Signal: TTL, Analog, or Composite
Polarity: Positive = White
HORIZONTAL SYNC
Frequency: 15.75 kHz (nominal)
Input: TTL
Polarity: Positive or Negative
VERTICAL SYNC
Frequency: 50-60 Hz
Input: TTL
Polarity: Positive or Negative
POWER REQUIREMENTS:
Input Voltage: 12 VDC nominal
115/230 VAC Available (Automatic Switch)
Power Consumption: 12 watts typical w/9" CRT
ENVIRONMENT:
Operating: 0° TO 50° C
Storage: −20° TO 65° C
Humidity: 10-90% Non-condensing
Altitude: 10,000 ft. Operating
AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
Available in kit or chassis (standard or custom)
Some enclosures available

*Specifications subject to change.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- **Ideal for Medium Resolution Data Display Applications**
- **Cost-effective**
- **High Reliability**
- **Compact Design**

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CUSTOM DISPLAYS

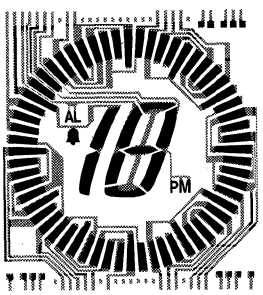


WITH CUSTOM DESIGN SUPPORT



Display graphics are limited only by your imagination.

Liquid crystal technology is ideal for creative visual displays of all kinds. Our engineers can help you design indicators which are alpha, numeric, pictorial or any combination of these. Discuss your ideas with our friendly engineers—we'll help you create the display you have in mind.

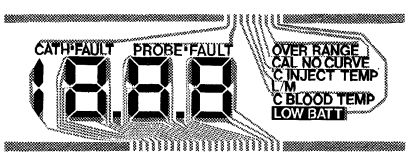


A clock display with digital hours and analog minutes.

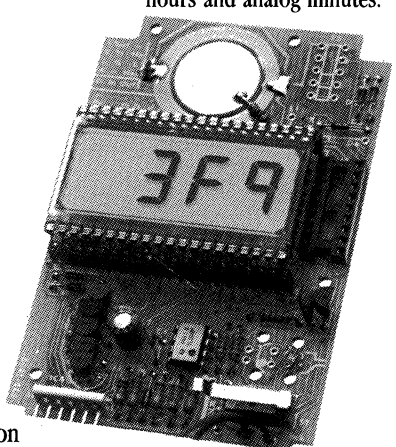
Advanced LCD technology

DCI uses the latest production methods and fabrication techniques to produce displays with:

- Wide Temperature Range
- Excellent visual Contrast
- Broad viewing angle
- Low power consumption
- High Reliability
- Tremendous design latitude



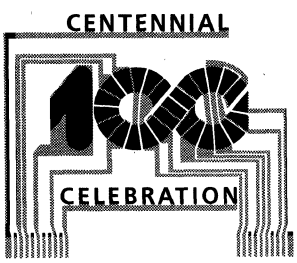
An alpha-numeric instrument display with switchable legends.



Ask us about our turnkey production capability: circuit design, prototype, assembly and packaging.

Specification experts

Whether you have defined requirements or only an idea you'll find our engineers ready and able to help. Regardless of how unique, different or unusual your need we can custom-make a display for your application. Call Larry Shelton or Bill Cook at (913) 782-5672 for the support you need.



Use graphic elements for emphasis.

The custom specialists

DCI INCORPORATED

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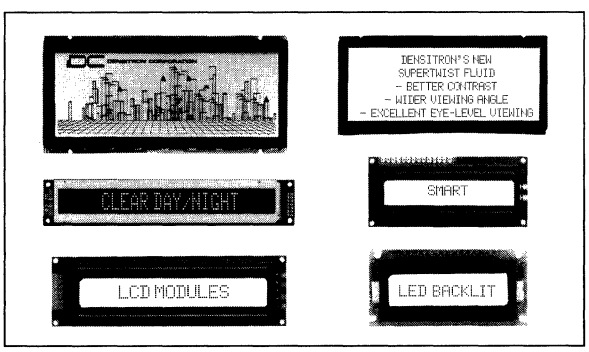
SEE THE WORLD ON OUR DISPLAYS

DENSITRON CORPORATION has been supplying the world with flat panel displays for over 15 years. Specializing in the industrial market, Densitron's LCD modules with many value added features are now accepted around the world. Densitron offers "One Stop Shopping" for all your display needs.

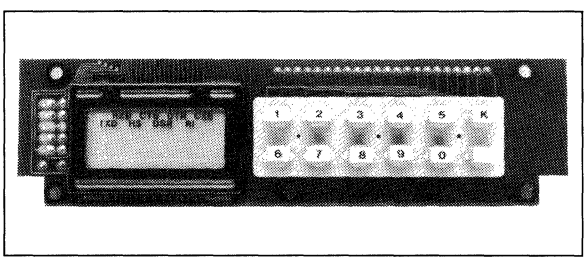
LCD SUPERTWIST GRAPHICS DISPLAY

- Many value added options are available, including: keyboard, computer interface connectors, RAM memory.
- Display formats: 32X80, 32X120, 64X120, 64X128, 64X240, 64X480, 128X240, 128X256, 128X480, 200X320, 200X640, 400X640, 480X640.
- EL, LED and CFL backlighting
- 5 types of polarizers available
- Background colors: yellow, blue, gray (STN only)
- Supplied with various controller options



HIGH BRIGHTNESS PLASMA DISPLAYS

- Wide variety of AC and DC Plasma Displays
- 400X640 and 480X640 formats
- 150 candella/m^2
- Variety of controllers available for PC and RS232 operation
- Gray scale capability supported in selected models
- Infrared IR touch panel overlay available in some models
- Computer terminals available



STANDARD AND LARGE SIZE ALPHA NUMERIC LCD MODULES

- Available in TN, NTN, STN and the new FSTN technologies
- Wide range of display formats: 1X16, 1X20, 1X24, 1X40, 2X16, 2X20, 2X24, 2X40, and 4X40
- Character sizes: .175", .2", .33", .5"
- Operating temperatures: 0°C to +50°C for standard and -20°C to +70°C for high temperature operations
- Backlighting formats: EL, and LED
- Many value added features: drive boards, interfaces, connectors, etc.



DENSITRON INTERNATIONAL

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Torrance, CA 90505
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The all new 1991 version of the world famous Alternate Source Directory is now available in floppy disk form for your IBM XT & AT and 100% compatible personal computer with hard drive.

The **1991 ICMASD** contains the more than 180,000 listings that appear in the Alternate Source Directory Section contained in Volume Two of the printed version of the 1991 IC Master ...plus additional discontinued parts. The database includes complete vendor addresses and phone numbers.

You can personalize the **ICMASD** for your application. The program allows you to add comments, up to 20 digits long, to each listing. These comments can be part numbers, prices, or any information specific to your needs. You may also add, delete and/or discontinue devices!

For greater flexibility the base number search feature enables you to access parts by base number, i.e., the device number stripped of prefixes and suffixes. You don't need to know the manufactures codes to call up any of the alternates to these devices.

The **1991 ICMASD** is fast, convenient and very user friendly!

Complete program documentation is included. When ordering, be sure to specify if you want the **1991 ICMASD** on three, double-sided, double-density disks OR on one high-density disk.

For immediate delivery you can order the **1991 ICMASD** at $179.50* simply by charging your Visa or MasterCard credit card. To place your order or for more information, call or write:

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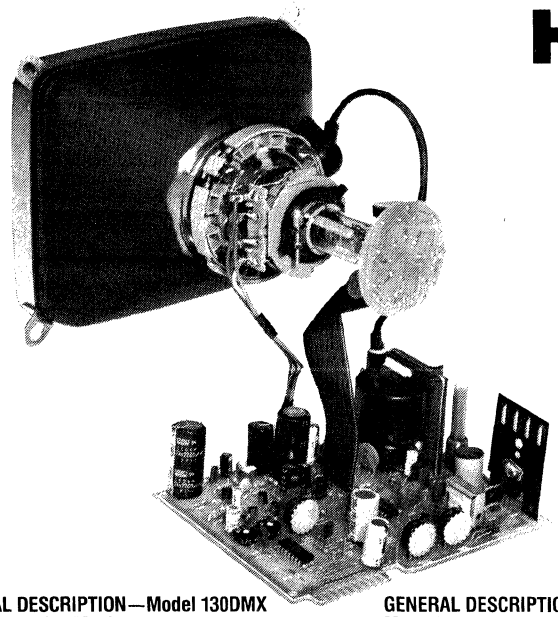
Published Annually in March

* Please add sales tax in NY, MA, IL, and CA. Prices valid in USA only.



High Performance CRT Monitors For Medical, Military Industrial and All High Resolution Applications

Now Available in Color.

GENERAL DESCRIPTION—Model 130DMX
Militarized Video Monitor.

The 130DMX is a state of the art militarized performance for rugged environments. This line of monitors features high brightness P43 phosphor, sunlight readability, EMI/RFI shielding, low power consumption and splashproof front panel mounting. This line is available with flat screen in a variety of sizes. All monitors are built to custom specifications. This line of monitors is designed to meet or exceed the following military specifications; MIL-E-6051D, MIL-P-11268, MIL-C-14806A, MIL-STD-461B, MIL-STD-810D.

Specifications:

Electrical:

Signal Interface: RS170A/RS375A composite BNC
Power Input: 15VDC @ 1.2 Amp nominal
CRT Type: 6 inch/20mm Display grade
P43 Phosphor color
OCLI optical notch filter
EMI/RFI Mil-C-14806A
Front panel splashproof seal
Operating Humidity Range: 100% non-condensing
Operating Temp Range: −33°C to +71°C
Temperature Shock Range: −46°C to +71°C
Operating Altitude: 25,000 feet
MECHANICAL (6 inch display)
Overall Length: 10.2″ (260mm)
Overall Width: 5.9″ (151mm)
Overall Height: 4.9″ (125mm)
Weight: 6 LBS

GENERAL DESCRIPTION—Model 118DMX-110°
Monochrome Display Module

Model 118 is designed for high density, large screen, monochrome applications where superb performance, wide deflection angle CRT's are required. Landscape or portrait formats are available.

Performance Characteristics:

- Time Base Range: Horiz.; 15KHz to 35KHz
  Vert.; 40Hz to 100Hz
- Video System
  - Bandwidth to 50MHz
  - Digitally balanced and phase corrected for inverse video display
  - Analog display of multilevel video attributes
- Sync compatibility
  - Horizontal and vertical are positive edge triggered at TTL levels
- Deflection System
  - CRT high acceleration voltage range from 12 to 18KV.
  - Dual axis dynamic focus correction.
  - Linearity 10% or better, horizontal and vertical axis.
- HV fault sensing auto shutdown.
- System power requirement
  24VDC at 1.0-1.5 A max.

GENERAL DESCRIPTION—Model 115DMX-90°
Monochrome Display Module

Model 115 is a high performance, general purpose monitor compatible with the full range of 20mm CRT's Landscape or portrait formats are available.

Performance Characteristics:

- Time base range:
  - Vertical: 40-100Hz
  - Horizontal: 15-40 KHz (see options)
- Sync compatibility
  - Horizontal and vertical are positive edge triggered at TTL levels
- Video System
  - Bandwidth; 50MHz (min).
  - Digitally balanced and phase corrected for inverse video display
  - Analog display of multilevel video attributes
  - Discrete dual intensity capability
- Deflection System
  - CRT high acceleration voltage range from 9 to 16KV
  - Linearity 10% or better, horizontal and vertical axis.
  - HV fault sensing auto shutdown
- System power requirement
  12-15V DC at 700mA to 1.5 A max.

Mechanical:

CRT Satellite PCB (circular)
Model 115DMX 2.0″ (50.8mm)
118DMX 2.1″ (53.34mm)
Main Sweep PCB+ (rectangular)
Model 115DMX 5.7″ (144.8mm)×4.55″ (114.3mm)
Model 118DMX 7.00″ (77.80mm)×4.55″ (115.57mm)
Model 130DMX 7.2″ (182.7mm)×5.60″ (142.13mm)

Safety:

- All models are UL, CSA, DHHS, FCC certifiable

Environmental Specification: (115DMX and 118DMX)

- Operating temperature: 65°C to −20°C
- Storage temperature: 80°C to −55°C
- Operating altitude: 20,000 ft. max.

Configurations:

- Kit form—Pre-aligned CRT packaged with display electronics circuit (PCB) board
- Chassis assembly—As above with standard or custom sheet metal designs
- Cabinet model—Complete display and power electronics integrated and supplied in a finished housing.

Available Options:

- All Standard video formats available: VGA, EGA, Hercules, CGA, Super VGA, etc.
- Bipolar sync interface: Provides buffered sync compatibility to any combination of positive or negative going signals.
- Composite signal interface: Provides A/D conversion of low level composite sync and video wave forms and adds vertical and horizontal retrace blanking signals.
- CRT Options (Model 115DMX)
  Data Grade 5″, 7″, 8″, 9″, 10″, 12″ and 14″
- CRT Options (Model 118DMX)
  Data Grade 12″, 15″, 17″, 19″ and 23″ sizes
- CRT Options (Model 130DMX)
  Data Grade 5″, 7″, 8″, 9″, 10″, 12″, and 14″
- CRT options—all units
  - High contrast optical enhancements
  - All EIA and special phosphors

Optional Power Supply(s)

- Hybrid single rail switcher
  120/240V AC (selectable), 50/60Hz compatibility
- Output: single output regulated for 12, 15, 18, or 24 VDC
- Full range international switcher
  - Input: 90-265 VAC continuous
    Available as single or multiple (4) outputs with up to 120 watts total
- Additional features:
  - Soft start limits in-rush current
  - Over voltage and current foldback protection
  - Input line filter limits EMI to meet FCC20780 Class B
  - High efficiency operation 75-80% typical.

Above specifications represent nominal performance. Please check for current performance capability.

*Price for monitor and kit configuration subject to change. Consult factory.

†The unit can be signal driven through a standard card edge connector or alternately via 10-pin or 20-pin square wire terminals.

COMPUTRON DISPLAY SYSTEMS

A DIVISION OF
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Let Computron integrate your monitors into your subassembly. Contact Computron's Subsystems Engineering and Manufacturing Services Center at (714) 391-4321. Also see our keyboards (5150) and switches (5100).

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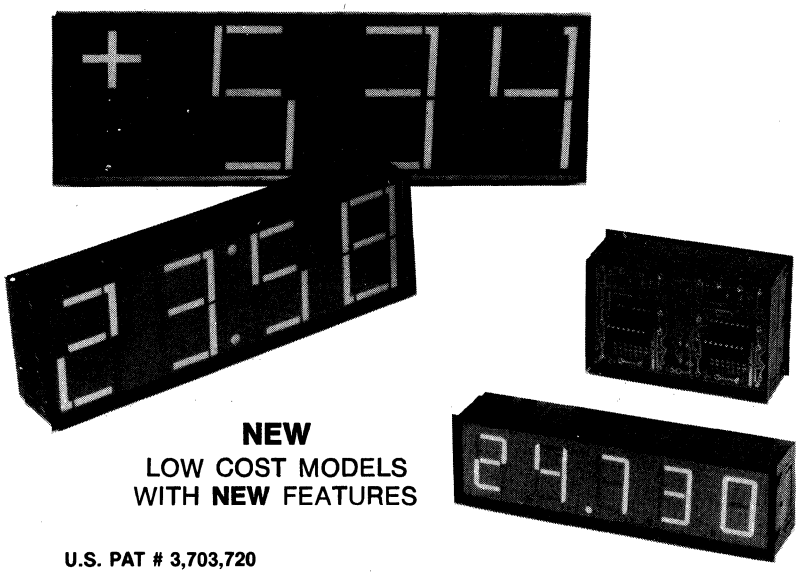
THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

LARGE NUMERICS ALPHANUMERICS



NEW
LOW COST MODELS
WITH **NEW** FEATURES

U.S. PAT # 3,703,720

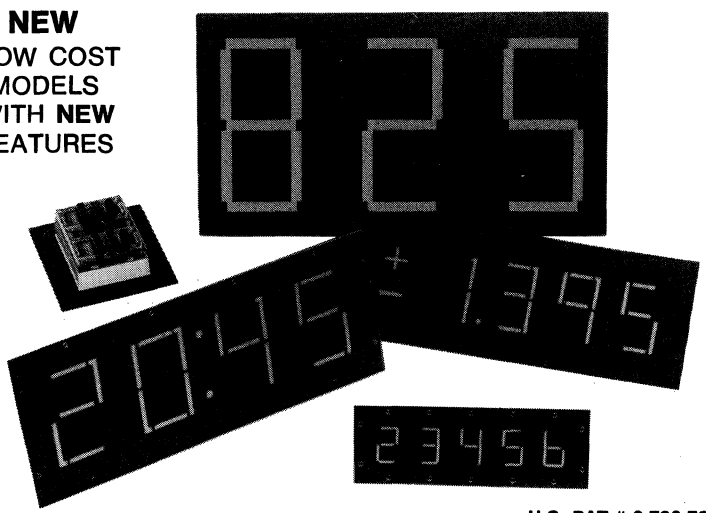
DESIGNER SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68631	1.0 IN.	30 FT.
68632	2.0 IN.	60 FT.
68633	2.8 IN.	85 FT.

FEATURES

- Supplied in attractive, multi-digit assemblies
- Ready to install into rectangular panel cutout
- Assembly includes bezel & anti-glare front panel
- High-Effeciency Red Std; yellow & green optional
- Low power: .6 watt/1″ digit; 1.5 watt/2″ digit for LED displays
- TTL or CMOS logic boards are part of assembly—Memory opt'l
- ± sign, colons, fixed or floating decimal are standard options
- Logic Socketed
- Solderless, plug-in I/O
- 1 year parts & labor warranty

NEW
LOW COST
MODELS
WITH **NEW**
FEATURES



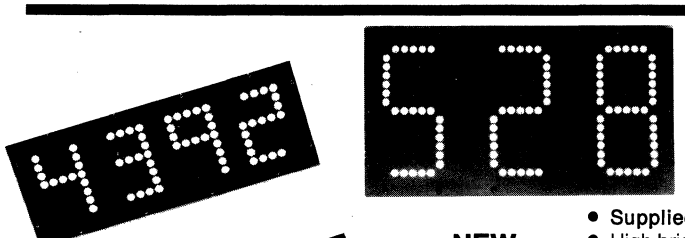
U.S. PAT # 3,703,720

INDUSTRIAL SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68731	1.0 IN.	30 FT.
68732	2.0 IN.	60 FT.
68733	2.8 IN.	85 FT.
68736	5.6 IN.	170 FT.

FEATURES

- Supplied in multi-digit assemblies w/anti-glare front panel
- Flange mounting w/gasket for NEMA environments
- TTL or CMOS drive logic boards are part of assembly—Memory opt'l
- High-Effeciency Red Std; yellow & green optional
- ± sign, colons, fixed or floating decimal are standard options
- Logic Socketed
- Solderless, plug-in I/O
- 1 year parts & labor warranty



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LOW COST
MODELS
WITH **NEW**
FEATURES

U.S. PAT # 3,703,720

OUTDOOR SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68832	2.0 IN.	60 FT.
68833	2.7 IN.	80 FT.
68836	5.5 IN.	150 FT.

FEATURES

- Supplied in 1 to 8 digit assemblies w/anti-glare front panel
- High brightness LEDs for sunlight or stage light applications
- Flange mounting w/gasket for NEMA environments
- High-Efficiency Red Std for outdoors; yellow Std for color camera applications
- TTL or CMOS drive logic boards are part of assembly—Memory opt'l
- ± sign. colons, fixed or floating decimal are options
- Logic socket mounted
- Solderless, Plug-in I/O

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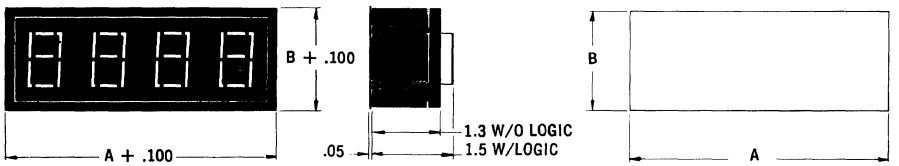
"LINKS BETWEEN MAN AND MACHINE"

MOUNTING INFORMATION

6863X DESIGNER SERIES



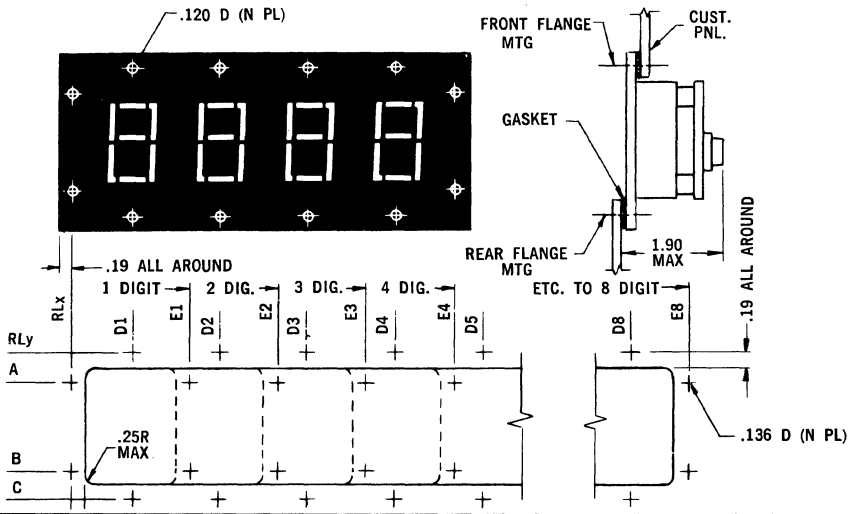
EXAMPLE: 68632-XX-4D-XX-X-X (±8.8.8.8 F'mat)

Would have a cutout of: $2.380^{+.015}_{-.000}$ H × $9.157^{+.015}_{-.000}$ W

CUTOUT DIMENSIONS
ALL TOLERANCES +.015, −.000
* ± sign equals one digit

No. of Digits In Assy*	Series 68631 B = 1.630 A	Series 68632 B = 2.380 A	Series 68633 B = 3.130 A
1	1.253	1.629	2.010
2	2.381	3.511	4.650
3	3.509	5.393	7.290
4	4.637	7.275	9.930
5	5.765	9.157	12.570
6	6.893	11.039	15.210
7	8.021	12.921	17.850
8	9.149	14.803	20.490

6873X INDUSTRIAL SERIES & 6883X OUTDOOR SERIES



NOTES:
(1) Segments on all OUTDOOR Series are dot type. See photos.
(2) Two dimensions for a given Dim. Code indicate 2 mounting hole locations.
(3) ± sign equals one digit.

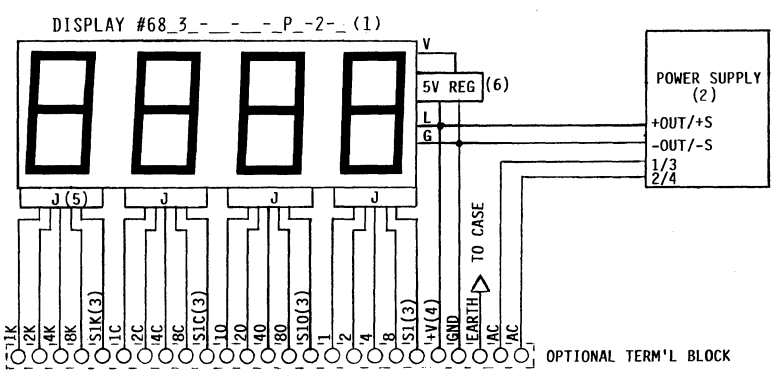
EXAMPLE:
68733-XX-2A-XX-X-X
(88 F'mat)
Would have 8 holes .136D;
Mtg. hole centers would be defined by: A = .750,
B = 3.375, C = 4.125,
D1 = 1.500, D2 = 4.125,
E2 = 5.625; The cutout size will be: 3.75 H × 5.25 W

CUTOUT DIMENSIONS *ALL DIMENSIONS OFF RLX & RLY*

DIM. CODE (2)	SERIES 68731	68732 & 68832	68733 & 68833	68736 & 68836	NO. OF DIGITS	N (Qty. of Mtg. Holes)
A	.375	.750	.750	1.125	1	6
B	1.500	2.625	3.375	3.375	2	6
C	1.875	3.375	4.125	5.625	3	8
D1	.750	1.500	1.500	6.750	4	10
D2	1.875	3.375	4.125	.750	5	6
D3	3.000	5.250	6.750	3.000	6	8
D4	4.125	7.125	9.375	5.250	7	10
D5	5.250	9.000	12.000	7.500	8	12
D6	6.375	10.875	14.625	9.750		14
D7	7.500	12.750	17.250	12.000		16
D8	8.625	14.625	19.875	14.250		18
E1	1.500	2.625	3.000	16.500		22
E2	2.625	4.500	5.625	18.750		26
E3	3.750	6.375	8.250	21.000		30
E4	4.875	8.250	10.875	23.250		34
E5	6.000	10.125	13.500	25.500		38
E6	7.125	12.000	16.125	27.750		
E7	8.250	13.875	18.750	30.000		
E8	9.375	15.750	21.375	32.250		
				34.500		
				35.250		

SCHEMATIC OF TYPICAL DISPLAY WITH PARALLEL BCD INPUTS (STROBE OPTIONAL)

NOTES:
(1) See "GENERATING PART NUMBERS".
(2) For 1" units, 5VDC supply #HB5-3 is used; for 2", 3" & 5½"* units, 12VDC supply #HB12-1.7 is used.
(3) Strobe outputs are provided for displays with -MX Logic Codes only.
(4) +5V for 1" units; +12V for 2", 3" & 5½" units.
(5) J is a 14 pin DIP socket on the display & a 14 pin DIP Plug Cable (#14-1P00-1-36) between the display & Term'l Block.—See Table 4 for pin-out details.
(6) The 5V Regulator option is not required for 1" displays since lamps & logic require 5VDC or for larger displays where 12V, CMOS logic is to be utilized.
(7) All DIO-REY Products carry our 1 year parts and labor warranty.



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GENERATING PART NUMBERS

68X 3X – XX – X X – X – X – X

- **SERIES**: DESIGNER 6; INDUSTRIAL 7; OUTDOOR 8
- **DIGIT HT.**: 1″ 1; 2″ 2; 3″ 3; 5½″ 6
- **LOGIC CODE (SEE TABLE 1)**
- **NO. OF DIGITS**
- **DISPLAY FORMAT (SEE TABLE 3)**
- **GASKET (1)**: O NONE; F FRONT FLANGE MT'G (2); R REAR FLANGE MT'G
- **COLOR FILTER (6)**: 1 WHITE (3); 2 RED (4); 3 AMBER (7); 4 YELLOW (3) (5); 5 GREEN (3) (5); 6 BLUE (3)
- **LAMP CODE (SEE TABLE 2)**

TABLE 3

CODE	DISPLAY FORMAT
A	88 8
B	8.8. 8
C	±88. 8
D	±8.8. 8
E	88:88:88 or 88:88
F	88 80
X	OTHER F'MATS

NOTES:
(1) Gasket not available on Designer Series.
(2) Not available on 68 x 31 Series.
(3) Not available on Outdoor Series.
(4) Std LED Color; Std outdoor color (Incandes't).
(5) Opt'l LED color.
(6) All colors available w/opt'l incandescent lamps.
(7) Std stage lighting and color camera color.

EXAMPLE: A Designer Series with 2″ digits; TTL, BCD to 7-Bar decoder-drivers without leading zero blanking; 3 digits, ± sign and floating decimal point (± 8.8.8 format); 12 volt, red LEDs and red color filter would have part #68632-D1-3D-P12-2-0. If the unit had a single decimal to the left of the least significant digit, it would be called out as: "#68632-D1-3X-P12-2-0; ± 88.8 format."

LAMP & DRIVE LOGIC OPTIONS

TABLE 1

LOGIC TYPE	TTL		CMOS W/LATCH MEMORY								CMOS				NONE
LOGIC CODE DASH NO.	-D1	-D2	-M1	-M2	-M3	-M4	-M5	-M6	-M7	-M8	-C1	-C2	-C3	-C4	-00
W/O Lead'g Zero Blank'g	●														
W/Lead'g Zero Blank'g		●													W/O
1 Latch Per Digit			●	●	●	●									L
1 Latch Per Display							●	●	●	●					O
Latch Inactive											●	●	●	●	G
Blanking User Driven					●	●			●	●			●	●	I
Blanking Inactive			●	●			●	●			●	●			C
Test User Driven				●		●		●		●		●		●	
Test Inactive			●		●		●		●		●		●		
Requires External Connections		●					●	●	●	●					
Bridge "T" Condition	R	R	C	R	C	R	C	R	C	R	C	R	C	R	
Bridge "B" Condition	R	(9)	C	C	R	R	C	C	R	R	C	C	R	R	
Bridge "S" Condition	R	(9)	R	R	R	R	R	R	R	R	C	C	C	C	
DIP Plug Cable Type	XPOO		XPMX				XPOO				XPOO				

DISPLAY	0	1	2	3	4	5	6	7	8	9	-	+	*	*	*
BINARY INPUTS 8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
1 = High 4	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1
0 = Low 2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

TABLE 2

LAMP TYPE	LAMP CODE	VOLTS (2)	Ma PER LAMP	MAX. AMPS/DIGIT (3) 68631 68731	68632 68732	68832	68733	68833	68736 68836	AVG. LIFE (K HRS.)
RED LED	P5/P12(7)	5.0/12.0(6)	25	.18	.18(10)		.18(10)		.35	100+
INCAN-DESCENT	J1	5.0	60	.42	.84		.84		1.26	10(5)
	K1(4)	12.0	39	.27	.54	.70	.54	.97	.82	10(5)

DRIVE LOGIC NOTES

The 68X31 Series use SN7447A (TTL) or 4511B (CMOS), BCD to 7 Bar decoder drivers. The 68X32, 68X33 & 68 x 36 Series use SN74LS48 (TTL) or 4511B (CMOS), decoders which drive ULN2003A, 7 channel darlington drivers.

As with all CMOS devices, options with user driven inputs must be switched high or low during operation.

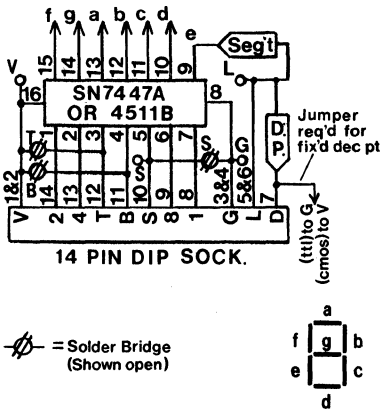
The logic supply current for TTL options is 30ma, typ., per digit except for the 68X31 Series where 55ma per digit is required.

TABLE CODES

*	*With CMOS logic options, the display will blank if BCD input is greater than 9.*
●	*Has the function.*
Blank	*Does not have the function.*
C	*Closed.*
R	*Open.*

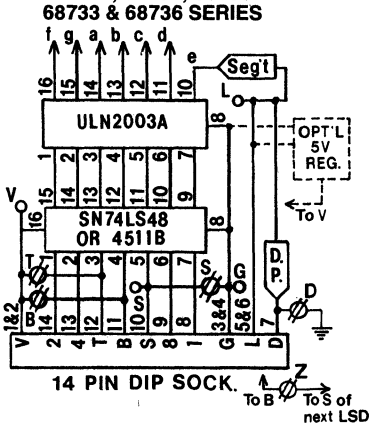
NOTES:
(1) Use with High Efficiency Red only.
(2) Input DC volts to lamp drivers.
(3) With figure 8 displayed.
(4) Use with all 6883X Outdoor Series.
(5) Reducing voltage by 6% doubles life.
(6) 5 V req'd for 1″ model; 12 V req'd for 2″, 3″ & 5½″ models.
(7) For 1″ models w/CMOS Decoders, lamp code is ZP5.
(8) Std LED orientation for 2″, 3″ & 5½″ is common anode. Common cathode opt'l. CC & CA are std for 1″.
(9) See DISPLAY/DIP PLUG CABLE SCHEMATIC.
(10) A 5V regulator for logic power is optional on units with 12V lamps.

1″
68631 & 68731 SERIES



= Solder Bridge (Shown open)

2″, 3″, and 5½″
68632, 68732, 68633
68733 & 68736 SERIES



DRIVE LOGIC SCHEMATICS

The 1″ LED display is supplied w/comm. anode for TTL decoders or comm. cathode for CMOS decoders. Common anode LED's are used in 2″, 3″, and 5½″ units with either type of logic because the ULN2003A, 7 channel, Darlington driver is employed.—TTL or 5V CMOS logic is Std. for 1″ displays; 12V CMOS is opt'l. TTL or 5-15V CMOS logic is standard for the 2″, 3″, 5½″. Latch memory is Std. on all CMOS displays. The schematics for the various lamps used in all the indoor series are shown in Table 5. Consult factory for outdoor lamp schematics. The Std termination for each digit is a 14 pin DIP socket. This I/Os the BCD, logic & lamp power, and, when specified, strobe, blanking, lamp test & decimal point. Additional connection points for logic & lamp power, strobe & decimal point are provided on the drive logic board for applications requiring larger power lines or separate strobe &/or decimal point inputs (-M1 thru -M4). The L, V & G lines are bussed for all digits on ea. P.C. Bd.

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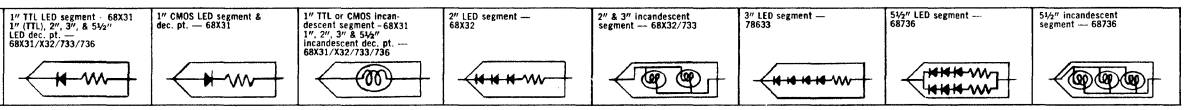
TABLE 4 DRIVE LOGIC TERMINAL DESIGNATIONS & DIP PLUG DATA

TERMINAL CODE	TTL (1) (68X3X-DX-X Series)	CMOS (3)(8) (68X3X-CX&-MX Series)	FLAT CABLE COLOR/LINE#	PLUG PIN#
1, 2, 4 & 8	BCD Inputs	BCD Inputs	OR13, BR1, OR3 & BR11	8, 14, 13 & 9
B	Blank'g Input (2)(6)	Blank'g Input (4)(6)	Violet 7	11
D	Decimal Point (10)	Decimal Point (10)	Yellow 14	7
G	Ground (L & V Return)	Ground (L & V Return)	Blue 6 & Grey 8	3 & 4
L	Lamp Pos. Common	Lamp Common (5)	Black 10 & Red 12	5 & 6
S	Zero Blank'g IN	Latch (11)	White 9	10
T	Lamp Test	Lamp Test (4)(6)	Green 5	12
V	Logic Positive	Logic Positive	Red 2 & Yellow 4	1 & 2

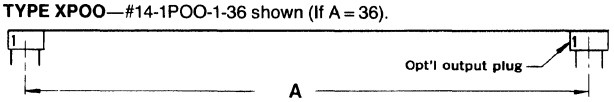
NOTES: (1) See specifications of SN7447A or SN74LS48 for details.
(2) Not available if leading zero suppression is specified.
(3) See specifications of 4511B for details.
(4) The T and/or B inputs are strapped high for CMOS logic options calling for inactive test and/or blanking.
(5) Positive EXCEPT for 68X31-CS & 68X31-MX where L is Gnd.
(6) Test & Blanking are active low functions if specified "User Driven."
(7) Regulated power supplies recommended for lamps & logic.
(8) Handle CMOS logic at a conductive work station until wired into system.
(9) For ± sign: BCD 7 = +, BCD 6 = – (Control w/1 bit; Strap 2 & 4 bits high & 8 bit low.)
(10) Dec. pts. & colons are user driven thru term'l D. Connect D to G on all series except 1" w/CMOS where D goes to V.
(11) S input is strapped low for CMOS logic without memory.
(12) For additional information, see notes in "DIP PLUG CABLES," below.

TABLE 5 LAMP SCHEMATICS

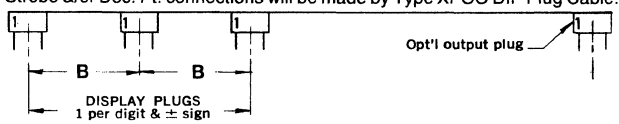


DIP PLUG CABLES

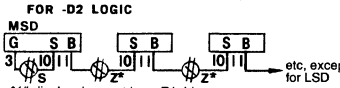
TYPE XPOO—#14-1POO-1-36 shown (If A = 36).



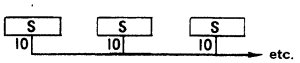
TYPE XPMX—#14-2PM1-3-24 shown (For 1" & 2" Displays; A = 24"; B = 2"). Strobe &/or Dec. Pt. connections will be made by Type XPOO DIP Plug Cable.



EXTERNAL CONNECTIONS REQ'D FOR -D2 LOGIC



EXTERNAL CONNECTIONS REQ'D for -M5 THRU -M8 LOGIC



STANDARD INTERFACE CABLES

Interface Type	Cable Type
820 Serial Receiver	14-2PMX-X-XX-CS001
821 A/D Converter	14-2POO-X-XX-CS003
822 Decade Counter	14-2POO-X-XX-CS004
823 Clocks & Timers	14-2POO-X-XX-CS004

GENERAL: Using type XPOO & XPMX DIP Plug Cables will simplify the installation of the 68X3X Series Displays. This leads to lower installed cost & ease of servicing. They include 14 pin DIP plugs to mate with the drive logic board & optional output plugs, assembled to color coded flat cable (See Table).

EXTERNAL CONNECTIONS IN XPOO & XPMX DIP PLUG CABLES

-D2 Logic Code (XPOO Plug Cable) For -D2 Logic Code (Leading zero blanking): Strap S Term'l of MSD (1) to G (If -D2 Logic Code is specified for display this has been done by closing Bridge S). The B line of the MSD (1) is connected to the S line of the next LSD (1). This B to S connection is repeated on the following digits except the LSD (1) of the display assembly (If -D2 Logic Code is specified for 2", 3" or 5½" displays, Solder Bridges Z are closed between all digits except the last two LSDs).—See schematic "External Connections Req'd for -D2 Logic," to the left.)
-M5 thru -M8 Logic Codes (XPOO Plug Cable) Buss the S Lines from ea. digit (2).
-M1 thru -M4 Logic Codes (XPMX Plug Cable) As supplied, pins 10 (S) & 7 (D) are removed from all the plugs in these cable assy's. Strobe &/or dec. pts. may be brought out by #14-1-POO-XX.
(1) MSD = Most significant digit (L.H. digit); LSD = Least significant digit (R.H. digit).
(2) Naturally, all V lines, G lines & L lines should be bussed to facilitate powering the display. If the T &/or B functions are user driven, they should be bussed also.

GENERATING PART NUMBERS

14-XPXX-X-XX

Single Ended 1
Double Ended 2

Multidrop, 1" & 2" (1)(3) M1
Multidrop, 3" & 5½" (1)(3) M3
Single Drop (2) 00

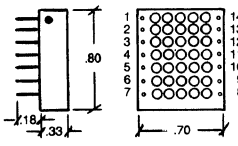
A Dimension (Inches) (3)
Number of Display Plugs (4)

Notes: (1) For -M1 thru -M4 logic codes. (2) For -D1, -D2, M5 thru M8 & C1 thru C4 logic codes. (3) B = 2" for 1" & 2" displays; B = 4⅝" for 3" & 5½" displays. (4) ± sign counts as one digit.

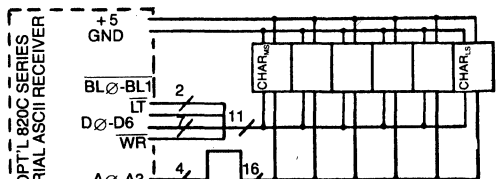
ALPHANUMERICS—0.7", 2.0" & 4.0" 5×7 DOT MATRIX

SINGLE CHARACTER 0.7" LED, DLX-713X SERIES
FEATURES: Integral Memory, Character Generator, Multiplex LED Drive Circuit & Lamp Test • ± 75° Viewing Angle • 4 Level Intensity Control (500ucd, Min. at full brightness) • 96 Character ASCII Repertoire • Inputs are TTL and microprocessor buss compatible • May be stacked to provide multi-character displays • 630nm Red-Orange Std (#DLO-7135), 565nm Green Optl (DLG-7137) • 5VDC at 200ma Max. Power • Rated Viewing: 20 Feet.

LOADING DATA: Chip enable ($\overline{CE}$) to be present & stable during write pulse ($\overline{WR}$). Parallel data to be stable for 200ns min. & held for 100ns after write goes high (latched). No sync is req'd & each character latches until replaced with another. Multiple displays may be stacked together with a binary address as shown or one $\overline{CE}$ per character may be used.



Pin Function		Pin Function	
1	VCC	14	D6 Data input MSB
2	$\overline{LT}$ Lamp test	13	D5 Data input
3	$\overline{CE}$ Chip enable	12	D4 Data input
4	$\overline{WR}$ Write	11	D3 Data input
5	$\overline{BLT}$ Brightness	10	D2 Data input
6	$\overline{BL0}$ Brightness	9	D1 Data input
7	$\overline{GND}$	8	D0 Data input LSB



16 CHARACTER, 0.7", LED UNIT W/SERIAL ASCII OR PARALLEL DATA BUSS INPUT, #84040C-16 The unit employs the DLX-713X display with our 820C Series serial receiver (See 820C data sheet for detailed specs) and accepts RS232, RS422 or current loop at 110 to 4800 baud. The serial type character repertoire includes 64 character subset from Hex 20 to Hex 5F. The parallel type will display the full 96 character repertoire from Hex 20 to Hex 7F. Input power options: 110V, 60Hz(Std), 220V, 50-60Hz at 40Watts or 5VDC at 3Amps. Hardware may be supplied ready for mounting and hook-up into your enclosure panel, or with enclosure

64 CHAR. SUB SET		D0	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
		D1	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H
		D2	L	L	L	L	H	H	H	H	L	L	L	L	H	H	H	H
		D3	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H
D6	D5 D4	HEX	Ø	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
L	H L	2		!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
L	H H	3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
H	L L	4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
H	L H	5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_



Enclosure Sizes (Inches)	
Char. Ht.	A × B × C
0.7	13.8 × 4.5 × 4.7
2.0	36 × 6 × 6
4.0	72 × 8 × 8
Mat'l: Steel Finish: Grey Enamel	

(NEMA12 is std optn). Power and data connections are thru terminal blocks. A typical serial update message would be: SOH/ADD_{10}/ADD_1/$CHAR_{MS}$/CHAR/CHAR/.../CH-AR_{LS}/CR. For parallel inputs with binary address, the address sequence from $CHAR_{LS}$ (Least significant character) to $CHAR_{MS}$ (Most significant character is: Binary Ø, 1, 2, 3... N (N = 16Max.).

2.0", 18 CHARACTER, RED LED, #84042C-18 AND 4.0", 18 CHARACTER, RED LED, #84044C-18 WITH SERIAL OR PARALLEL ASCII INPUT Units accept RS232 or current loop at 300-4800 baud. Or data input may be parallel ASCII from our std. keyboard or a computer buss. Power: 110VAC (220VAC optl) at 70 watts for 2"; 250 watts for 4". Other features: Fixed or Scrolled Messages • Flashing • Double Width Chars • Reverse Chars (Black chars on red background) • 6K Memory • 17 Stored, Addressable Message Memories • 96 Char Repertoire • Rechargeable Back-Up Battery • Real Time Calendar-Clock • Supplied Ready For User Mounting or in NEMA12 or Designer Oak Enclosure • IBM PC Software Available • Graphics Capability • Viewing Distance; 60 feet for 2", 120 feet for 4" • Typical Fixed Message: ESC/CTRL A/CTRL A/ESC/$CHAR_{MS}$/CHAR/CHAR/... $CHAR_{LS}$.

Dio-Rey products carry a 1 year warranty for parts and labor.

If applications engineering assistance is required, please contact us.

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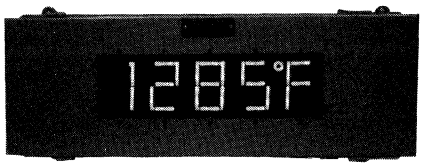
DIO-REY

THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

DIGITAL INSTRUMENTS AND SYSTEMS

SERIAL INTERFACE DISPLAYS, DIGITAL METERS, COUNTERS, CLOCKS & TIMERS





FEATURES

- Large, easy to read LED displays for high reliability (1", 2", 3" and 5½")
- Available in rugged Industrial or attractive Designer packages
- Designed for long, trouble-free service
- Suitable for a wide variety of applications
- Serial interface EIA RS422, RS232 or current loop compatible
- Analog to digital interfaces are voltage, current, temperature, load-cell and tachometer compatible
- Counters, clocks and timers in most popular configurations are available
- Powered from 110/220V, 50/60 Hz
- All wear and calibration components easily accessible

SPECIFICATIONS

- For Displays, see "Large Character Digital Display" spec. sht.
- For Interfaces, see this & next page.
- For Enclosures, see below
- Termination: barrier terminal block std.

GENERAL

Dio-Rey standard instruments integrate a wide range of display interfaces and power supplies. Whether it be a 6 digit, 5½" high display w/serial interface in a NEMA 12 box or a 2" 4 digit clock in a designer enclosure, Dio-Rey has the unit.

APPLICATIONS

SERIAL INTERFACE DISPLAYS: Remote readouts, ASCII readouts, ASCII to BCD converters, telemetry converters & transmissions.

DIGITAL METERS: DC volt, AC volt, DC amp, AC amp, temperature, watt, ohm, flow, decibel, & panel.

DIGITAL COUNTERS: Decade, event, pulse, up-down, preset & universal

DIGITAL CLOCKS: Free running, crystal controlled, master-slave, count down, IRIG B & NASA 36 bit.

DIGITAL TIMERS: Reset up, preset down, count down, up-down & Julian calendar-clock.

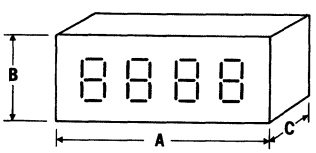
ALPHANUMERICS: Annunciators, message displays, status displays, fault indicators, graphic displays & programmable displays.

If you need applications engineering assistance, please call us. We will be happy to help you.

STD ENCLOSURES, NEMA 12 & DES 'N'R

Digit Ht.	No. of Digits*	Enclosure Size (in)		
		A	B	C
1"	up to 6	8.6	3.8	6.2
2"	up to 4	8.6	3.8	6.2
2"	5 to 7	13.8	4.5	4.7
3"	up to 5	13.8	4.5	4.7
3"	6 to 9	26.6	7.1	5.2
5½"	up to 6	26.6	7.1	5.2

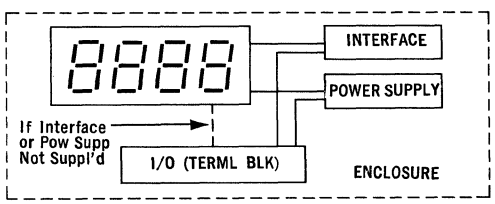
* ± sign equals one digit.



Std finish is grey enamel

All DIO-REY Products carry our one year parts and labor warranty.

BLOCK DIAGRAM



COMMON STANDARD DIGITAL INSTRUMENT PART NUMBERS

"A" & "E" display formats & 115VAC power option shown.

DESCRIPTION	PART NUMBER
4 digit display w/TTL BCD inputs, in designer box.	8863X-4A-DX-1
6 digit display w/CMOS BCD inputs, in NEMA 12 box.	8873X-6A-CX-1
4 digit display w/strobed BCD inputs, in NEMA 12 box.	8873X-4A-MX-1
4 digit display w/1200 baud RS232, in designer box.	8863X-4A-11-1
6 digit w/1200 baud RS232-repeater, in NEMA 12 box.	8873X-6A-11B-1
4 digit display w/0-2V=0–1999 A/D, in NEMA 12 box.	8873X-4A-21A-1
4 digit display w/4-20ma=0–1999 A/D, in NEMA 12 box.	8873X-4A-25A-1
5 digit display w/up counter, in designer box.	8863X-5A-41-1
5 digit display w/preset down counter, NEMA 12 box.	8873X-5A-45-1
6 digit, 24hr, free running clock, in NEMA 12 box.	8873X-6E-62-1
4 digit (Min:Sec) preset down timer, in NEMA 12 box.	8873X-4E-64-1

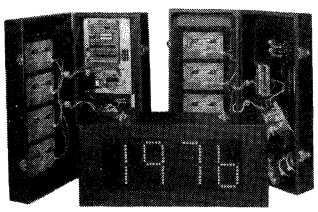
GENERATING PART NUMBERS

88X 3X — XX — XX — X

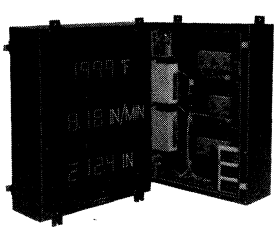
- **ENCLOSURE TYPE**: DESIGNER 6, INDUSTRIAL 7
- **DIGIT HT.**: 1" 1, 2" 2, 3" 3, 5½" 6
- **POWER**: 1 110V, 60 Hz; 2 220V, 60 Hz; 3 220V, 50 Hz
- **INTERFACE CODE**: SEE TABLES ON THIS & NEXT PAGE
- **NO. OF DIGITS & FORMAT**: SEE "GENERATING PART NUMBERS" IN "LARGE CHARACTER DIGITAL DISPLAY" SPEC. SHTS.

EXAMPLE: A 4 digit, 3"; designer unit w/serial RS232 receiver having 110V, 60 Hz power would have pt. no. 88633-4A-11-1.

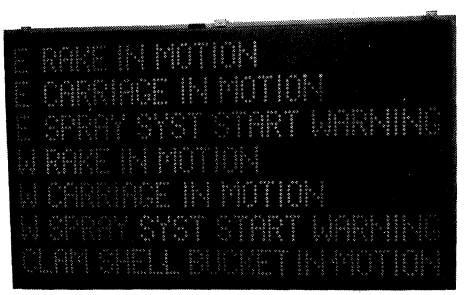
SPECIAL NUMERIC & ALPHA NUMERIC DISPLAY SYSTEMS



Laddle Wt meter (5½")



Laddle temp/cast feed/cast length digital instrument unit for metal slab casting plant (3")



If you have a special requirement for lighted displays, please call us for applications engineering assistance. — We will be happy to help you.

DIO-REY • Div. of INFO-LITE, CORP. • 422 Cliff Street • Fairview, NJ 07022 • (201) 941-4455 • FAX (201) 941-4919

"LINKS BETWEEN MAN AND MACHINE"

DIO-REY

THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

SYSTEM INTERFACES
POWER SUPPLIES

GENERAL

DIO-REY has developed a wide variety of standard system interfaces for its numeric alpha-numeric redouts and lighted indicator annunciators. These are the result of over 20 years experience in serving a broad spectrum of industries including instrumentation process control, communications, metals, chemicals, data processing, agriculture, security, office equipment, petroleum, auto, aerospace, textile, packaging, paper, transportation, governmental agencies and military.

These products may also be used in systems which do not require displays. In addition, custom interface electronics, designed to perform outside the specifications or capabilities of our standard units are available. Contact our sales department for technical application assistance.

821 SERIES ANALOG TO DIGITAL CONVERTERS

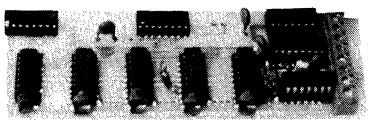
The DIO-REY 821 Series are bipolar A/D's with up to 4½ digit output capacity • BCD output ranges are: ±1999, ±3999, ±19999 and ±39999.

All feature state-of-the-art technology at competitive cost • Input impedance >100 mΩ • Common mode rejection is 110 dB for DC; 90 dB for AC • Accuracy is ±0.05%, ±1 count • Auto zero and zero offset available • Ranging and zero adjustments conveniently located • 5 VDC and 110/220, 47-500 Hz input, depending on model • −10°C to +65°C; 0-90% RH non-condensing operating environment • ½" LED display available • 100 K hr MTBF.

Size: 3.75" × 4.88" × 1.88"

PART NUMBER	INTERFACE CODE	RANGE (SCALING)	ADJUSTABLE RANGE	ZERO OFFSET
821-1A	—21A	0-2V=0-1999	NO	NO
821-1B	—21B	0-.2V=0-1999	NO	NO
821-1C	—21C	0-XV=0-XXX (1999MAX)	YES	NO
821-2X	—22X	THERMOCOUPLE INPUT	NO	NO
821-3X	—23X	TACHOMETER INPUT	NO	NO
821-4A	—24A	0-5V=X-1999MAX	YES	YES
821-4B	—24B	1-5V=X-1999MAX	YES	YES
821-4C	—24C	0-10V=X-1999MAX	YES	YES
821-5A	—25A	4-20MA=X-1999MAX	YES	YES
821-5B	—25B	0-20MA=X-1999MAX	YES	YES
821-6A	—26A	0-10V=X-9999MAX	YES	YES
821-6B	—26B	0-10MA=X-9999MAX	YES	YES

822 SERIES DECADE COUNTERS



Size: 5.5" × 2.0" × .6"

Stds available up to 5 decades, opt'l units available up to 10 decades. This series of counters includes Up, Down, Bi-Directional and Presetable (or combinations of these) units. All have TTL BCD outputs, compatible with DIO-REY displays. — Reset, count and power (5 VDC) are brought in via a terminal block. Outputs terminate through a header.

CONTACT DEBOUNCER IS STD OPTION.

Part Number	Interface Code	X = No. of decades Description
822-X-1	—41	X Decade, Up Counter
822-X-2	—42	X Decade, Down Counter
822-X-3	—43	X Decade, Up-Down Counter
822-X-4	—44	X Decade, Present Up Counter
822-X-5	—45	X Decade, Preset Down Counter
822-X-6	—46	X Decade, Preset Up-Down Counter

823 SERIES CLOCKS & TIMERS

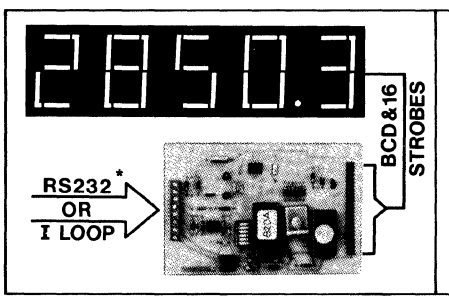
Standard clock Interfaces are supplied in 4 or 6 digit, 12 or 24 hour formats. Calendar and decimal formats are available. Fast and Slow set inputs are standard; hold is optional. (1) As with the timers, all have BCD outputs compatible with Dio-Rey's Numeric Readouts. Timer interfaces that are available include count up, count down, both with preset options. Switch operation at a specified time optional.

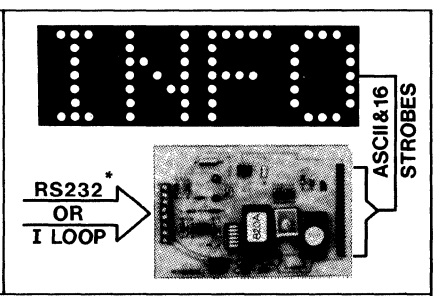
(1) 50/60 Hz and crystal oscillation time bases are optional as are master/slave systems.

Part Number	Interface Code	Description
823-1	—61	4/6 Digit, 12 Hr Clock
823-2	—62	4/6 Digit, 24 Hr Clock
823-3	—63	Up Timer
823-4	—64	Down Timer

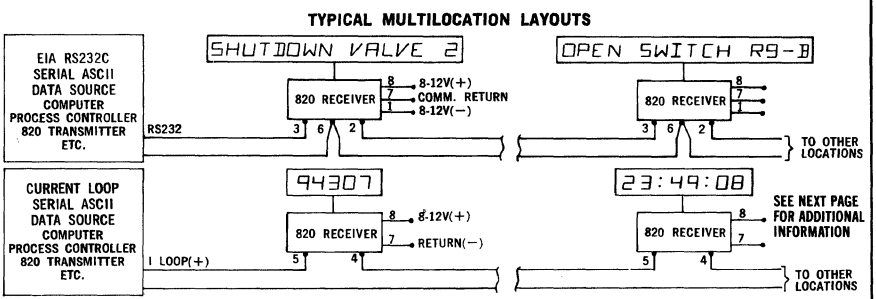
SERIAL ASCII RECEIVERS & TRANSMITTERS
FOR REMOTE DISPLAYS. CONTROLS & TELEMETRY

*RS422 NOW AVAILABLE





TYPICAL MULTILOCATION LAYOUTS



820C SERIES SERIAL ASCII INTERFACES

Size: 5.3" × 3.6" × .6"

The DIO-REY 820 Series Serial to Parallel and Parallel to Serial Converters are microprocessor based and are primarily intended for driving remote display decoders.

The input to the 820 Receiver is a Serial ASCII coded data stream at either RS232 or current loop levels. The 820 Receiver automatically adapts itself to incoming data rates over the range of 110 to 1200 baud. In addition it features a six position DIP switch which allows selective addressing of up to 64 separate receivers on one data link. The output of the receiver is six bits of data and sixteen strobe lines. The receiver, therefore, can drive either sixteen numeric or alphanumeric displays per receiver or up to 96 points in an annunciator system.

An array of sixteen, 6-bit registers may be sequentially inputed to the 820 Transmitter and converted to a serial output, for annunciator systems.

PART NUMBER	INTERFACE CODE	SERIAL TRANSMISSION MODE
820C-1-X-X-X	—11	RS232 @ 110-1200 baud
820C-1B-X-X-X	—11B	RS232 @ 110-1200 baud w/serial repeater circuit & voltage inverter
820C-2-X-X-X	—12	Current loop @ 110-1200 baud
820C-5-X-X-X	—13	RS232 @ 1200-4800 baud
820C-5B-X-X-X	—13B	RS232 @ 1200-4800 baud w/serial repeater circuit & voltage inverter
820C-9-X-X-X	—14	RS422 @ 110-1200 baud
820C-10-X-X-X	—15	RS422 @ 1200-4800 baud

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"LINKS BETWEEN MAN AND MACHINE"

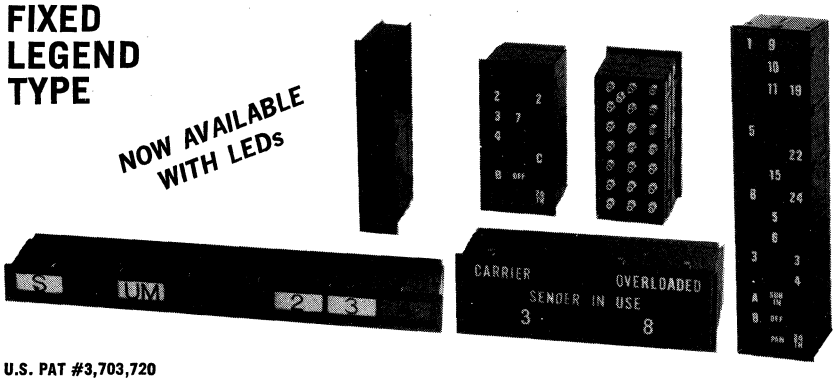
DIO-REY

THE LIGHTED DISPLAY DIVISION OF INFO-LITE CORPORATION

LIGHTED INDICATORS AND ANNUNCIATORS

FIXED LEGEND TYPE

NOW AVAILABLE WITH LEDs



U.S. PAT #3,703,720

Series	Indicator Module Size	Series	Indicator Module Size
68811	3/8" x 3/8"	68822	3/4" x 3/4"
68812	3/8" x 3/4"	68823	3/4" x 1 1/8"
68813	3/8" x 1 1/8"	68824	3/4" x 1 1/2"
68814	3/8" x 1 1/2"	Special	Any size on 3/8" Grid

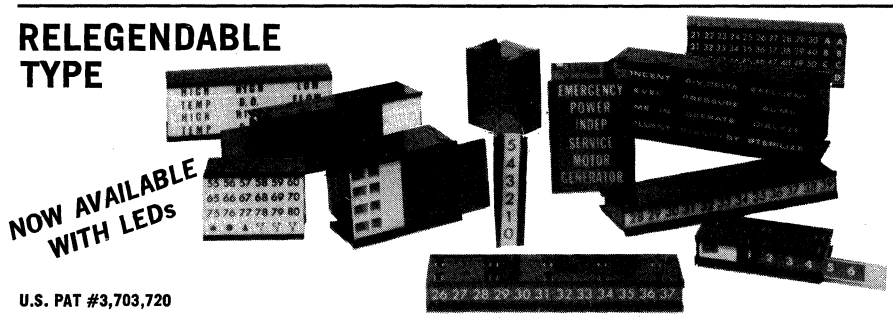
Any group of messages/symbols can be displayed in any combination of colors

- Construction is modular
- Front panel graphics are back lighted using LEDS — STD MFB T1 3/4 lamps also available
- Units are supplied in an attractive package with bezel and "Black-Out" front panel, ready to snap into rectangular panel cutout
- Lamp common reduces installation time
- Serviced from the front
- Lamp drivers and special logic available

ALL DIO-REY PRODUCTS CARRY A 1 YEAR PARTS & LABOR WARRANTY

RELEGENDABLE TYPE

NOW AVAILABLE WITH LEDs



U.S. PAT #3,703,720

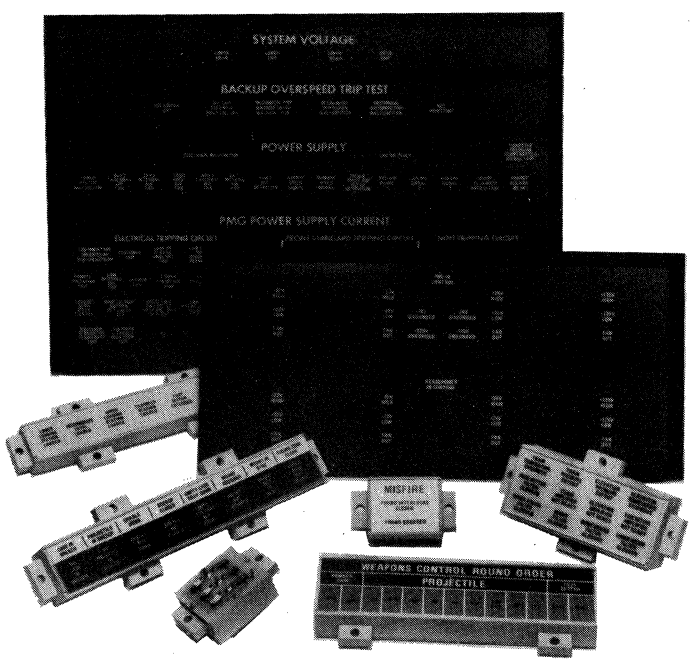
Series	68911	68912	68914
Indicator Module Size	3/8" x 3/8"	3/8" x 3/4"	3/8" x 1 1/2"

For applications where the legend or graphics must be able to be changed

- Same features as the FIXED LEGEND TYPE
- Can be supplied with photographic film legend
- Relegendable from front
- Six standard color filters
- Twenty-three standard units with from 2 to 48 indicator modules
- Special assemblies available

74000 SERIES CUSTOM UNITS

ANNUNCIATORS • STATUS DISPLAYS • BACK LIGHTED INDICATORS PANELS • MAP/FLOW DISPLAYS • DEAD FRONT PANELS



Units shown include status displays for power generating station & military fire control system. Many other configurations have been supplied for applications such as: Industrial process control, security systems, automated machine control, chemical/petroleum/textile flow indicators, steel/aluminum plant condition displays, banking system displays, medical instrument displays, communication network indicators and data processing/computer system communication.

Dio-Rey's back lighted displays are now available with either LEDs and/or incandescent light sources. They provide design flexibility and attractive appearance usually associated with expensive custom units. Dio-Rey allows you to choose the size, shape, color, legend and intensity combination that will meet your requirements. Color filters, special legends and masks are supplied to meet customer specifications. As well as having a standard line, we have supplied a wide range of hardware designed to meet special requirements. Contact us to discuss your specific needs.

FEATURES

- Available with standard LED and/or incandescent light source
- Sizes range from several square inches to square yards
- Fixed legends may be screened in one or more colors
- Can be supplied to endure severe environments (NEM4 or MIL-E-5400 and MIL-STD-202)
- Special units with any group of messages/symbols may be displayed in any combination of colors
- Units are supplied in an attractive package with bezel
- Front panel options include: "black out," clear, high efficiency red, amber or green. Lampdrivers/flashers and annunciator logic is available
- All incandescent lamps are socket mounted to ease servicing
- Termination options include: terminal block, header, connector-harness, taper pin and solder terminal

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"LINKS BETWEEN MAN AND MACHINE"

EDI 780 CREEL DRIVE, WOOD DALE, ILLINOIS 60191

SUPER LARGE INDUSTRIAL READOUTS



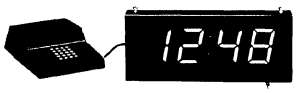
COUNTER/TIMER

MODELS: ED225, ED400, ED500-Synchronous, Secondary Clocks, Timers, Numeric Field. Fraction of Seconds to Hours. Start/Stop/Run Control. Elapsed Timer, Counter, Up/Down Pulse Input, Reset, Preset 4-8 Digits.
CHARACTER HEIGHT: 2.25 inch, 4.0 inch, 5.0 inch.



ANALOG DIGITAL CONVERTER

MODEL ED245ADC-Full Range of Analog Inputs. Display on Large Numeric Display-Remote or Local. Transmit from ADC via RS232, RS422. 1200 BAUD, 8 Data, 1 Stop, No Parity.



CENTRAL CONTROLLER-TIME AND NUMERIC

MODELS ED1000/ED1800-Time/Date, Numeric, Keyboard Input. Sends Data to LED & Incandescent Displays. Refresh Secondaries Every Second. 6 Digit Local Display. Up to 30 Large Displays at 1000 Feet.



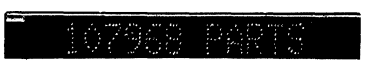
LED READOUTS WITH CABINET

MODEL ED 225-2.25 inch Character.
MODEL ED400-4.0 inch Character.
LED 7 Segment Bar (2.25 and 4.0 inch Height). Seven Segment (P) Red, (Y) Yellow, or (G) Green Bar LED, Up to 8 Character, Addressable. Serial Data Transmission.* NEMA Rated Cabinet, Black, Extruded Aluminum, Anodized. Single or Double Faced. Two 5/16 inch Mounting Bolts on Top. Contact, PB or Photocell Input.
APPLICATIONS: Up/Down Counter, Timer, Large Remote Meter.
*DATA TRANSMISSION: Serial ASCII RS232, RD422, 1200 BPS, No Parity. 8 Data Bits, 1 Stop, 2 Wire Simplex.



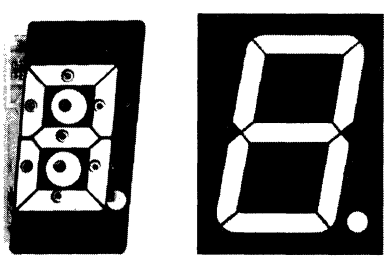
5.0 INCH SUPER LARGE INCANDESCENT READOUT

MODEL ED500-Up to 6 Digits. Serial/Parallel BCD Interface. Standalone Timer, Contact, PB or Photocell Input. Up/Down Counter with Reset, Run/Hold, Preset.
DISPLAY COLOR: Red, Yellow, Green.
SIZE: 4 Digit 8x24x3.5 (HxWxD) inches. NEMA Rated Cabinet.



MESSAGE SIGNS-INDOOR OR OUTDOOR

MODEL ED020-0.7 inch Character Height (Indoor Only)
MODEL ED050-2.0 inch Character Height (Indoor Only)
MODEL ED100-4.0 inch Character Height (Indoor Only)
MODEL ED125-5.25 inch Character Height (Indoor/Outdoor)
MODEL ED180-8.0 inch Character Height (Indoor/Outdoor)
ADD SUFFIX -16, -20 for Character Length.
Addressable, Network, Serial Interface RS232, RS422. Visible Characters: 16, 20. Single or Multi-Line. LED Dot. Canned Messages. BCD or Contact Closure Activation. RAM Storage-7000 Characters. NEMA Rated Cabinet, Black, Extruded Aluminum, Anodized. 5/16 inch Mounting Bolts.

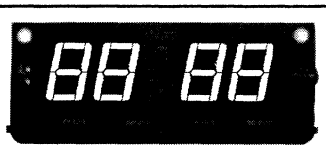


NUMERIC OEM DIGITS WITH DRIVER CARD

MODEL ED2250-2.25 inch LED Bar Segment
MODEL ED4000-4.0 inch LED Bar Segment
MODEL ED5000-5.0 inch Bar Incandescent

ALPHA-NUMERIC OEM DIGITS WITH DRIVER CARD

MODEL ED1250A-5.0 inch Alpha/Numeric
MODEL ED1250N-5.0 inch Numeric
MODEL ED1800A-8.0 inch Alpha/Numeric
MODEL ED1800N-8.0 inch Numeric
OPT: **MODEL ED5180-**Serial to Parallel Receiver Card. Translates Up to 8 ASCII Characters to Drive OEM Digits.
RS232C, RS422 Compatible. 300-9600 BAUD, 8 Data, 1 Stop, No Parity. Parallel BCD Input With or Without Strobe. Single or Multiple Digits.



PANEL METER

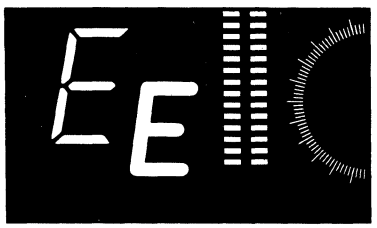
MODEL ED060PM-0.6 inch 7 Segment LED, RS232 Input 1200 BAUD. 4 Digits. Module Only. Requires +5 Volts.
MODEL ED060RTC-0.6 inch 7 Segment LED. Local Oscillator, Display Time. Requires 5-12 VDC. Run/Hold. Module Only.

EDI

780 Creel Drive, Wood Dale, Illinois 60191
(708) 860-5838 Toll Free (800) 367-6056 FAX (708) 860-0502
PLEASE CALL OR WRITE FOR MORE INFORMATION AND DATA SHEETS.

Power your displays —

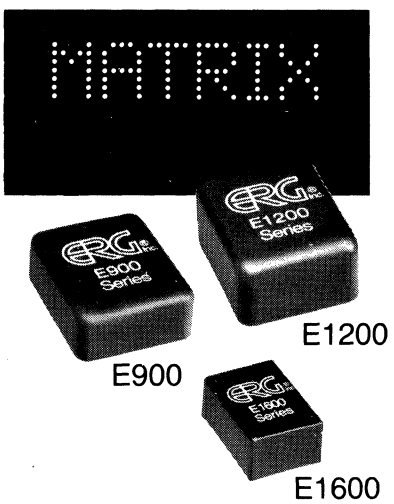
DC-DC converters for Gas Discharge Displays up to 25W





Made in U.S.A.

Convert low DC line voltage to the higher voltage levels required to activate multi-segment plasma gas discharge displays (including bar graphs). ERG Converters eliminate need for 200–250V DC line.



General Specifications

ERG Converter Series	Input	Output	Size	Weight	Package
E700U	5,9,12,15 V DC standard (to 48 available)	Up to 3W unregulated (e.g. 200 V DC @ 15 ma)	1.1" (27.94 mm) × 1.2" (30.48 mm) × .91" (23.11 mm) max. high	30 gms.	Plastic
E700R (Regulated)	5,9,12,15 V DC standard (to 48 available)	Up to 3W regulated (e.g. 200 V DC @ 15 ma)	1.43" (36.32 mm) × 1.5" (38.10 mm) × 1.03" (26.16 mm) max. high	40 gms.	Plastic
E500*	5,9,12,15 V DC standard (to 48 available)	Up to 3W unregulated (e.g. 200 V DC @ 15 ma)	1.00" (25.40 mm) × 1.38" (35.05 mm) × 0.70" (17.78 mm) high	20 gms.	Plastic
E1600	5,9,12,15 V DC standard (to 48 available)	Up to 6W unregulated (e.g. 250 V DC @ 24 ma)	1.30" (33.02 mm) × 1.88" (47.75 mm) × 0.82" (20.83 mm) high	44 gms.	Plastic
E900	5,12,15 V DC standard (to 48 available)	Up to 12W total, with single or dual outputs, unregulated; (e.g. Single: 250V DC @ 30 ma Dual: 250V DC @ 30 ma and −16V DC @ up to 200 ma to power the drive electronics in many applications using the Burroughs SELF-SCAN* or IEE* ARGUS displays)	2" (50.80 mm) × 2.5" (63.50 mm) × .98" (24.9 mm) high	122 gms.	Aluminum
E1200	12,15 V DC standard (others to your spec)	Up to 25W unregulated (e.g. 250V DC @ 100 ma)	2" (50.80 mm) × 2.5" (63.50 mm) × 1.19" (30.23 mm) high	185 gms.	Aluminum

*For high-volume requirements, E500 delivers same performance as E700 at significantly lower unit cost!

Mounting: P.C. board standard
Encapsulation: All ERG converters are fully encapsulated
Isolation (in/out): 600V RMS (60 Hz. breakdown for 1 min.) standard
Temperature: 0–70° C. standard. Wider ranges available. 85° C. case max. 25° C. temp. rise typical for E1200

Tell us about your display needs:

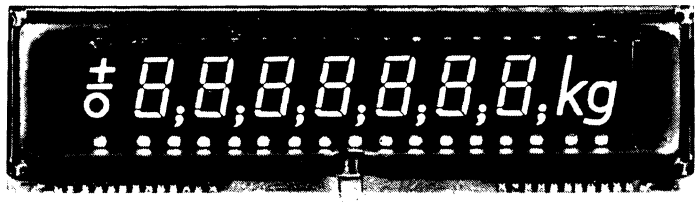
- **Custom Design Variations for multi-segment, bar graph and dot matrix gas discharge and vacuum fluorescent displays**
- **Inputs from 5V DC to 28V DC Standard (your choice)**
- **Outputs from 5V DC to 1,500 DC (your choice)**
- **Single and dual outputs (up to 25W total)**
- **Regulated and unregulated**
- **Center tap (voltages)**

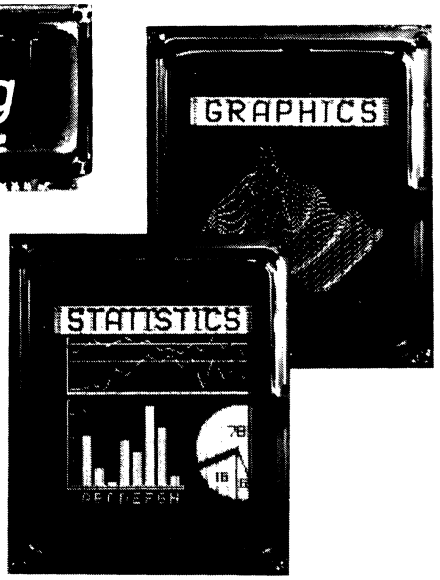
Contact ERG with your special requirements:

ERG® Endicott Research Group, Inc.
2601 Wayne Street, Endicott, NY 13760
607-754-9187 FAX 607-754-9255

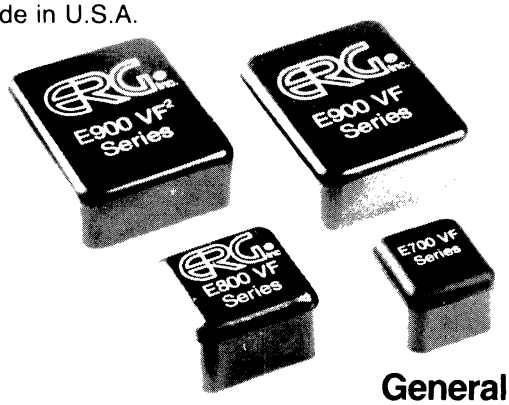
from low DC voltage

DC-DC converters for Vacuum Fluorescent Displays up to 12W





Made in U.S.A.



No need for "special" multiple output power supplies. ERG converters produce both anode and filament voltages for VF displays up to 12W. Compatible with all major VF display makes. Mount on your PC board as needed, where needed.

General Specifications

ERG Converter Series	Input	Output	Size	Weight	Package
E700 VF up to 3W	5, 12V DC (other inputs available.)	DC Anode voltage and Center tap (AC) filament voltage.	1.1" (27.94 mm) × 1.2" (30.48 mm) × .91" (23.11 mm) high	30 gms.	Plastic
E800 VF up to 6W	5, 12V DC (other inputs available.)	Up to 6W max.	1.43" (36.32 mm) × 1.50" (38.10 mm) × 1.03" (26.16 mm) high	40 gms.	Plastic
E900 VF up to 12W	5, 12V DC (other inputs available.)	Up to 12W max. (to 7.5W max. with 5V DC input)	2" (50.80 mm) × 2.5" (63.50 mm) × .98" (24.9 mm) high	122 gms.	Aluminum

Mounting: P.C. board standard
Encapsulation: All ERG converters are fully encapsulated
Isolation (in/out): 300V RMS (60 Hz. breakdown for 1 min.) standard
Temperature: 0-70° C. standard. Wider ranges available. 85° C. case max.

ERG can tailor a "VF" Series Power Supply to match the voltage requirements of any Vacuum Fluorescent Display or input voltage (DC) requirement.

Contact the factory for more information.

Contact ERG with your special requirements:

ERG® Endicott Research Group, Inc.
2601 Wayne Street, Endicott, NY 13760
607-754-9187 FAX 607-754-9255

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION
WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

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AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
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Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
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Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
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Power Supplies, DC, Product Selection Guide **D**•1501
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EXCELIX® LCD
EXCEL Technology International Corp.

PIONEERS IN LCD TECHNOLOGY

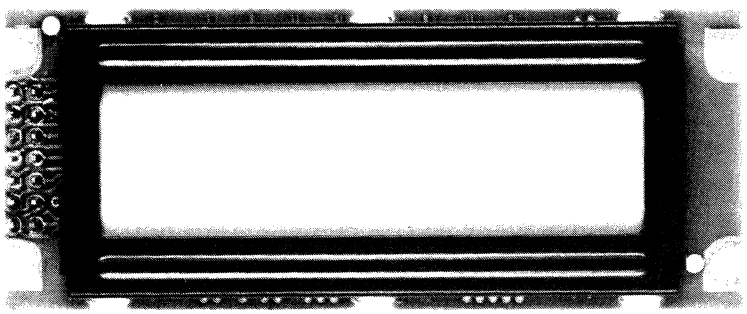
Twisted Nematic
Supertwist
Guest-host
Backlighting

- NUMERIC
- ALPHANUMERIC
- BAR GRAPHS
- LIGHT VALVES
- DOT MATRIX
- GRAPHIC
- LCD MODULES

EXCELIX® LCD MODULES

FEATURES

- Slim, light-weight design.
- High-contrast, wide viewing angle.
- Built-in control IC for easy interfacing.
- Low power consumption.



EXCELIX® LCD MODULE MECHANICAL SPECIFICATIONS

Excelix® No.	Character Format Line x Character	Character Font	Module Size (W x H x T, mm)	Viewing Area (W x H, mm)	Character Size (W x H,mm)	Dot Size (W x H,mm)	Backlight Type	
							EL	LED
LCM1610	1 x 16	5 x 7 dots + cursor	80 x 36 x 10	64.5 x 13.8	3.07 x 5.73	0.55 x 0.75	avail	avail
LCM1610 B	1 x 16	5 x 7 dots + cursor	122 x 33 x 10	99. x 13.	4.84 x 8.06	1.10 x 0.92	avail	avail
LCM1620-30	2 x 16	5 x 7 dots + cursor	85 x 30 x 10	62.2 x 17.2	2.78 x 4.27	0.50 x 0.55	avail	avail
LCM1620-44	2 x 16	5 x 7 dots + cursor	84 x 44 x 10	62.2 x 17.8	2.96 x 4.86	0.56 x 0.66	avail	avail
LCM1640	4 x 16	5 x 7 dots + cursor	87 x 60 x 10	61.5 x 25.2	2.95 x 4.15	0.55 x 0.55	avail	not avail
LCM2020	2 x 20	5 x 7 dots + cursor	115 x 36 x 10	83.0 x 18.8	3.20 x 4.85	0.60 x 0.65	avail	avail
LCM2420	2 x 24	5 x 7 dots + cursor	118 x 36 x 10	94.5 x 18.0	3.20 x 4.85	0.60 x 0.65	avail	avail
LCM4020	2 x 40	5 x 7 dots + cursor	182 x 35.5 x 10	154. x 16.	3.20 x 4.85	0.60 x 0.65	avail	not avail

EXCELIX® LCD MODULE ELECTRICAL SPECIFICATIONS

Excelix® No.	Power Supply Voltage (V)		Current consumption (mA)		Duty Cycle (duty)	LED	Operating Temperature Range (°C)	Storage Temperature Range (°C)	Weight (g)
	(V_{DD}-V_{SS})	(V_{LC}-V_{SS})	I_{DD}	L_{LED}					
LCM1610	5.0	—	1.0	60	1/16	HD 44780 SED 1278	0 ~ +50	−20 ~ +60	25
LCM1610B	5.0	—	1.0	50	1/16	HD 44780 SED 1278	0 ~ +50	−20 ~ +60	50
LCM1620-30	5.0	—	1.5	60	1/16	HD 44780 SED 1278	0 ~ +50	−20 ~ +60	25
LCM1620-44	5.0	—	1.5	60	1/16	HD 44780 SED 1278	0 ~ +50	−20 ~ +60	25
LCM1640	5.0	—	2.5	—	1/16	HD 44780 SED 1278	0 ~ +50	−20 ~ +60	60
LCM2020	5.0	—	2.0	75	1/16	HD 44780 SED 1278	0 ~ +50	−20 ~ +60	50
LCM2420	5.0	—	3.0	80	1/16	HD 44780 SED 1278	0 ~ +50	−20 ~ +60	50
LCM4020	5.0	—	3.0	—	1/16	HD 44780 SED 1278	0 ~ +50	−20 ~ +60	65

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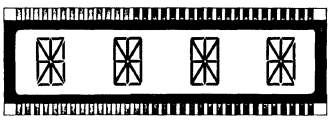
EXCELIX® LCD

Numeric Displays



Excelix L.C.D. Model #	Digit Height (inches)	Display Format	Connector	Glass Size (inches)
3150	0.181	3½ digits, duplex	S.I.L. Elastomer	0.808 × 0.520
3252	0.200	3½ digits, duplex	S.I.L. Elastomer	0.808 × 0.520
6200	0.200	6 digits, duplex	D.I.L. Pins	1.500 × 0.600
3251	0.220	3½ digits, direct	D.I.L. Pins	1.200 × 0.600
8200	0.236	8 digits, M/E, triplex	S.I.L. Elastomer	2.090 × 0.690
3250	0.255	3½ digits, direct	D.I.L. Elastomer	0.808 × 0.590
8200E	0.284	8 digits, triplex	S.I.L. Elastomer	1.575 × 0.567
3313	0.300	3 digits, 5 triangles, triplex	D.I.L. Pins	1.200 × 1.000
8300	0.300	8 digits, triplex	D.I.L. Pins	2.750 × 1.100
4300	0.315	4 digits, S, bell direct	D.I.L. Pins	1.457 × 0.709
3350	0.350	3 digits, direct	D.I.L. Pins	1.300 × 0.950
4320	0.350	4 digits, direct	D.I.L. Pins	2.000 × 0.900
1400	0.400	1 digit, direct	D.I.L. Pins	
3401	0.400	3½ digits, direct	S.I.L. Pins	2.500 × 1.100
3450	0.400	3½ digits, duplex	S.I.L. Elastomer	1.960 × 0.950
4400	0.400	4 digits, AM, PM, S, bell, direct	D.I.L. Pins	1.960 × 0.950
4451	0.400	4½ digits, over-range, direct	D.I.L. Pins	2.005 × 1.200
4455	0.400	4½ digits, Lobat, direct	D.I.L. Pins	2.000 × 1.200
5400	0.400	5 digits, direct	D.I.L. Pins	2.000 × 1.200
3451	0.433	3½ digits, direct	D.I.L. Pins	1.960 × 0.950
3501	0.500	3½ digists, direct	S.I.L. Pis	2.000 × 1.200
3551	0.500	3½ digits, over-range, direct	D.I.L. Pins	2.000 × 1.200
3555	0.500	3½ digits, Lobat, direct	D.I.L. Pins	2.000 × 1.200
3557	0.500	3½ digits, AM, PM, bell, direct	D.I.L. Pins	2.000 × 1.200
4500	0.500	4 digits, direct	D.I.L. Pins	2.000 × 1.200
4500 (M3)	0.500	4 digits, triplex	D.I.L. Pins	2.000 × 1.200
6500	0.500	6 digits, direct	D.I.L. Pins	2.750 × 1.200
8500	0.500	8 digits, direct	D.I.L. Pins	3.695 × 1.200
3452	0.531	3½ digits, AM, PM, AL, bell, direct	D.I.L. Pins	1.960 × 1.079
3751	0.700	3½ digits, over-range direct	D.I.L. Pins	2.750 × 1.500
4700	0.700	4 digits, direct	D.I.L. Pins	2.750 × 1.500
4707	0.700	4 digits, PM, direct	S.I.L. Elastomer	3.250 × 1.250
5700	0.700	5 digits, direct	D.I.L. Pins	3.200 × 1.500
5701	0.700	5 digits, 1 D.P., direct	D.I.L. Pins	3.200 × 1.500
6700	0.700	6 digits, direct	D.I.L. Pins	3.695 × 1.500
4851A	0.750	4½ digits, direct	D.I.L. Pins	3.000 × 1.550
31030	1.000	3 digits, direct	D.I.L. Pins	3.695 × 1.800
31051	1.000	3½ digits, over-range, direct	D.I.L. Pins	3.695 × 1.800
41000	1.000	4 digits, direct	D.I.L. Pins	3.695 × 1.800
41051	1.000	4½ digits, over-range, direct	D.I.L. Pins	4.000 × 1.800

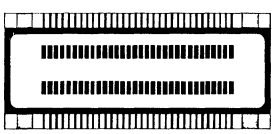
Alphanumeric Displays



Excelix LCD Model #	Character Height (in.)	Display Format	Connector	Glass Size (inches)
4540	0.500	4 characters, direct	D.I.L	3.500 × 1.150
8540	0.500	8 characters, triplex	D.I.L	3.700 × 1.200
12540	0.500	12 characters, triplex	D.I.L	5.750 × 1.200
16540	0.500	16 characters, triplex	D.I.L	7.250 × 1.200
11040	1.000	1 character, direct	S.I.L Elastomer	1.000 × 1.750

PLEASE CALL OUR SALES DEPARTMENT FOR DISPLAYS NOT LISTED ABOVE.

Bar Graph Displays



Excelix LCD Model #	Bar Height (inches)	Display Format	Connector	Glass Size (inches)
0520	0.156	32 bars × 2 lines, direct	Elastomer	2.750 × 1.200
0620	0.230	9 bars × 2 lines, direct	D.I.L.	1.900 × 1.100
0320	0.300	9 bars × 2 lines, direct	D.I.L.	3.100 × 1.300
01420	1.400	20 bars × 1 line, direct	S.I.L.	5.300 × 1.900

PLEASE CALL OUR SALES DEPARTMENT FOR DISPLAYS NOT LISTED ABOVE.

Light Valves

Excelix LCD Model #	Window Size (in.)	Display Format	Connector	Glass Size (inches)
LV001	0.375 × 0.375	1 square, direct	D.I.L.	0.500 × 0.700
LV002	1.800 × 0.700	2 triangles, direct	D.I.L.	2.000 × 1.100
LV003	1.800 × 0.700	1 rectangle, direct	D.I.L.	2.000 × 1.100
LV00S	0.800 × 0.800	1 square, direct	D.I.L.	1.000 × 1.100
LV004	2.000 × 2.000	1 square, direct	S.I.L.	2.200 × 2.400

PLEASE CALL OUR SALES DEPARTMENT FOR LIGHT VALVES NOT LISTED ABOVE.

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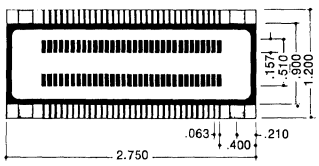
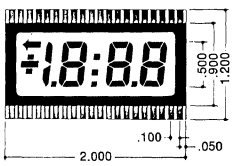
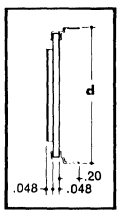
EXCELIX® LCD

0520 d = N/A



3551 d = 1.28





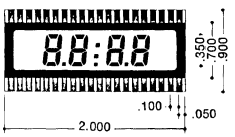
3751 d = 1.58



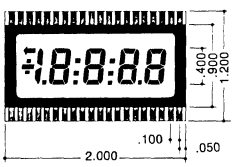
31051 d = 1.88



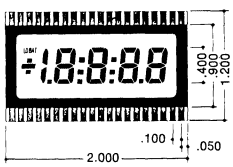
4320 d = .98



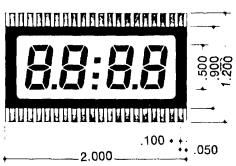
4451 d = 1.28



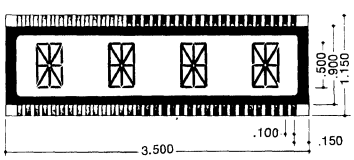
4455 d = 1.28



4500 d = 1.28



4540 d = 1.23



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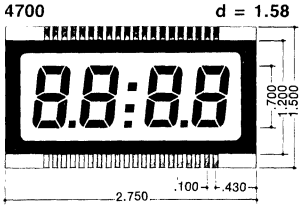
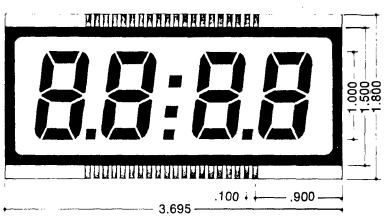
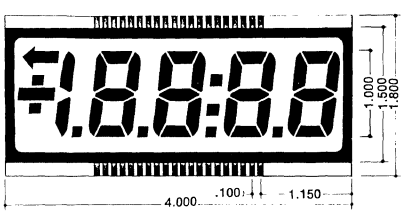


41000 d = 1.88



41051 d = 1.88



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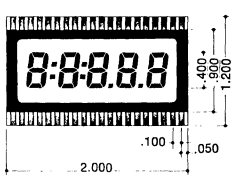
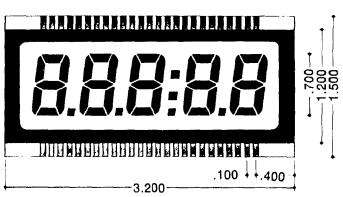
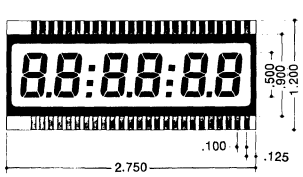


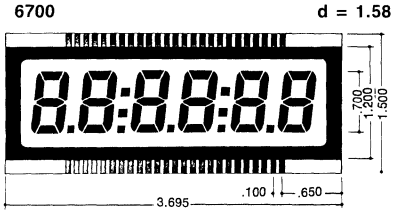
5700 d = 1.58



6500 d = 1.28



6700 d = 1.58



DIRECT-DRIVE LCD PERFORMANCE SPECIFICATIONS

PARAMETER	UNITS	MIN.	TYP.	MAX.
Operating Voltage	V	3	5	10
Operating Frequency	Hz	30	60	120
Current*	µA		3	10
Capacitance*	pf		3,000	
DC resistance*	MΩ	20		
Allowable DC Offset	mV			50
Response Times (25°C)				
Rise to 90% ON	ms		30	50
Decay to 10% OFF	ms		50	100
Contrast Ratio			20:1	
Viewing Angle (at 5V)			±75°	
Operating Temp. Range	°C	—30		85
Storage Temp. Range	°C	—30		85
Estimated Life	hrs.		50,000	

* All Segments ON.

Specifications are for 3½ digit 0.5"DH LCDs.

ORDERING INFORMATION

□□□□-□□□-□

Excelix Part Number

OPTICAL MODES:
- R Reflective
- T Transmissive
- S Transflective
- O No Polarizer

PRINTING MODES:
- P Positive Printing (dark segments on light background)
- N Negative Printing (light segments on dark background
- O No Polarizer

DEVIATION:
- 0 Standard, Epoxied Pins 0.100" center-to-center
- 1 Snap on Terminal 0.100" center-to-center
- 2 No Pins Conductive Pads Up
- 3 No Pins Conductive Pads Down

POLARIZERS:
- H Standard
- Q High Humidity*
- O No Polarizer

* Q-type polarizer is less bright than H-type.

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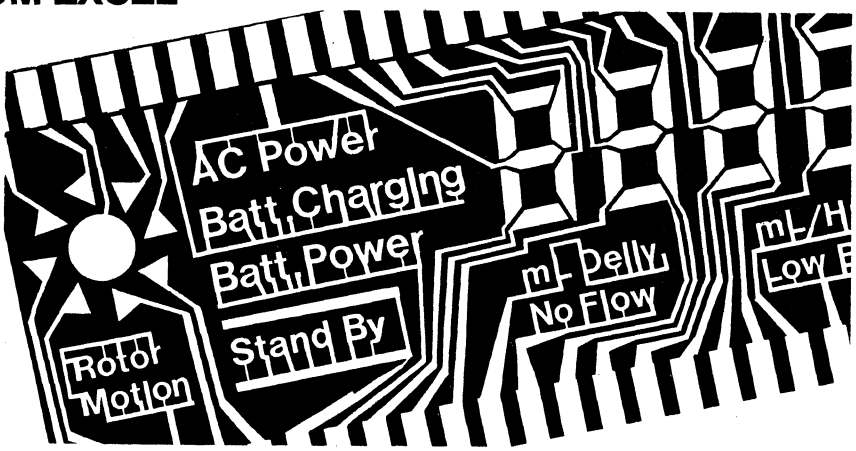
EXCEL Technology International Corp.

EXCELIX® LCD

CUSTOM DISPLAYS FROM EXCEL

Make your display unique by using unusual messages, symbols and artwork.

With the expertise of Excel's Design and Layout department, it's easy to have a display custom-made to meet your particular requirements. Whether you need us to duplicate a display from an existing design, or help you bring your own ideas to life, we can help you move from start to finish smoothly and cost-effectively.



AVAILABLE OPTIONS

- Twisted Nematic, Supertwist, Dynamic Scattering and Guest-Host displays.
- Transmissive, reflective and transflective viewing modes.
- Positive, negative and mixed printing modes.
- Electroluminescent (EL), incandescent and LED backlighting.
- Various colors, using pleochroic dyes, colored polarizers, or our unique Background Color Printing.
- Variety of viewing directions for optimum information presentation.
- Extensive formulations of Liquid Crystal mixtures to accommodate a wide variety of applications.
- Special glass thicknesses and pin lengths.

QUALITY ASSURANCE

Excel Technology's Quality control techniques are your assurance of product reliability and customer satisfaction.

- Vigorous standard QC criteria, with flexibility to carry out additional requirements from our customers.
- 100% electro-optical testing.
- Best materials and technology currently available.
- Close scrutiny of the formulation of our Liquid Crystal mixtures and parameters of cell fabrication to meet your requirements precisely.
- Experienced and disciplined engineering and production staff.
- Accelerated harsh environment testing to ensure reliable operation even under extreme conditions.

COMPANY OVERVIEW

Excel Technology International Corporation has been manufacturing Excelix® Brand Liquid Crystal Displays since 1982, and is proud of its reputation for being a fast, reliable and flexible source for standard, custom and OEM LCD products.

Headquartered in the United States, and with offshore operations as well, we're able to maintain close contact with the market. With our large production capacity and well-educated and experienced engineering staff, Excel is capable of meeting the wide variety of display needs of its customers.

Whether you require "off-the-shelf" items or custom products, you can be confident we'll help you reach your project goals in a timely and cost-effective manner.

Excel also controls its own manufacturing facilities overseas for large volume requirements. The fact that we manage all segments of quality control there, results in products that are not only cost-effective but also well-made.

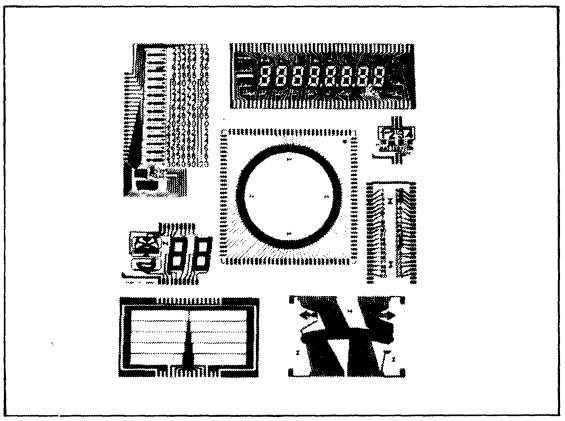
Please call our office for assistance, and information regarding prices and delivery.

TEL. (908) 874-4747

FAX. (908) 874-3278

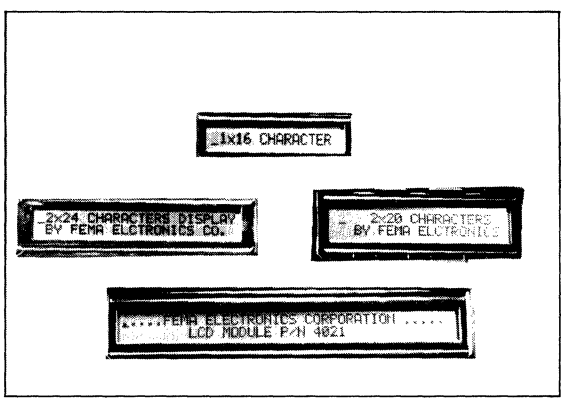
5–4, Stryker Lane • Hillsborough Industrial Park • Belle Mead, NJ 08502 • Tel. (908) 874-4747 • FAX. (908) 874-3278

FEMA *The Display Specialist*

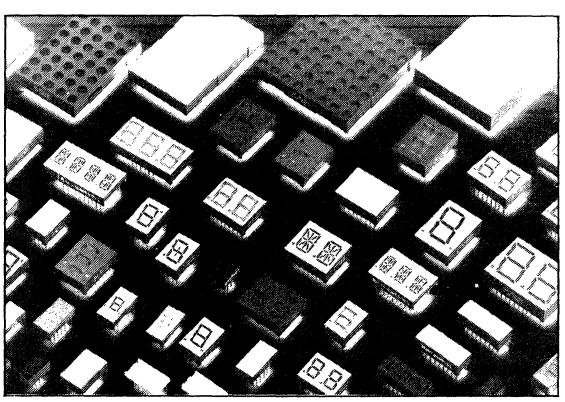


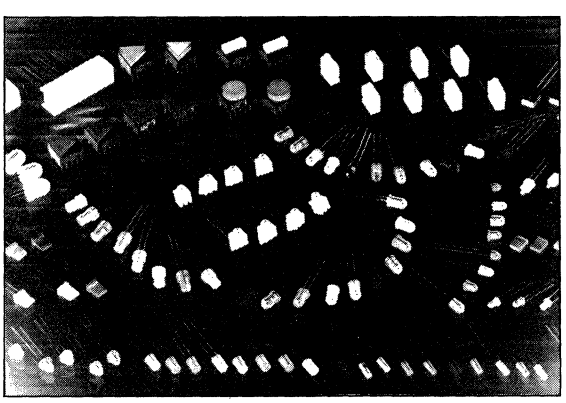
- Over 10 Years Experience in LCD Design & Manufacturing
- Quick Turn-Around Time
- Handle Small to High Volume orders
- Turn Key Operation Including
  - Circuit Design and PCB Layout
  - PCB Fabrication and Board Assembly Services
  - Silicon Rubber Keypads
  - Plastic and Metal Enclosures

COMPLETE LINE OF LCD'S AND LED'S



- Standard and Custom LCD's
- Standard and Custom Dot Matrix Modules
- Character and Graphic Modules
- Twist Neumatic & Super Twist Versions
- EL & LED Backlighting
- LED Displays
- Light Bars
- Graphic Arrays
- LED Lamps





For Any of Your Display Needs or Further Information, Please Call Us Today

FEMA Electronics Corp.
12-6 Edgeboro Road, East Brunswick, NJ 08816
(908) 238-1223 Fax (908) 238-7981
(800) 292-3362 (FEMA)

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

F-P ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

DISPLAY COMPONENTS

Ferranti-Packard light reflecting electro-magnetic display components offer the user numerous benefits such as...

1. Excellent Visibility Utilizing a range of fluorescent colors in addition to white, the contrast ratio of an F-P display actually improves as the ambient light increases, ensuring excellent visibility both in low ambient light and direct sunlight.

2. High Reliability Virtually maintenance free operation is achieved since there are no lamps to burn out, and no mechanical linkages or bearings to wear.

3. Lower Power Consumption Because of our unique patented technology, no power is required to maintain the display, and only minimal energy is required to change the status of display.

4. Ruggedness Modules and indicators are highly resistant to shock and vibration and are ideally suited to mobile applications or displays in a high vibration environment.

COLORS The displays are available in a range of fluorescent colors including green, yellow, red and orange, in addition to white. For a complete listing of standard and non-standard colors refer to the individual product data sheet.

CHARACTER SIZE The general rule for selecting the optimum character size is to allow approximately 26mm (1 in.) of character height for every 15m (50 feet) of viewing distance. This will vary slightly depending on the color selected and the ambient light conditions.

STATUS INDICATORS Disk sizes are 7.6mm (0.3 in.) 8.9mm (0.35 in.) and 13mm (0.53 in.) diameter. A 13mm (0.5 in.) square flag is used in the series 50. These devices are current operated and can be driven from source voltages ranging from 3.3 Vdc to 25 Vdc, depending upon the model selected. Indicators are available for panel mounting or direct PCB mounting. Consult the individual data sheets to determine the indicator best suited for your requirements.

Typical applications include: Transient Recorders, Industrial Process Displays, Fault Indicators, Portable Field Equipment, Continuous Matrix Display

PRE-ENCODED MODULES These modules are designed for applications where a limited number of character symbols are required. Standard modules provide the numerals 0 to 9 plus blank. Non-standard modules can be supplied with up to 12 alphanumeric or special characters including blank. Three character heights are available, 70mm (2.7 in.), 104mm (4.1 in.) and 215mm (8.4 in.). Each character is encoded into the winding of the module coils and no external character generation is required. A single current pulse of 1 millisecond duration applied to the selected control wire erases the existing character and displays the desired character. The pulse can be driven from a single capacitor discharge circuit.

Typical applications include: Weigh-Scale Readouts, Industrial Instrumentation Displays, Cash Register Readouts for parking lots and toll booths, Scoreboards, Time/Temperature Displays, Vehicle Destination Signs.

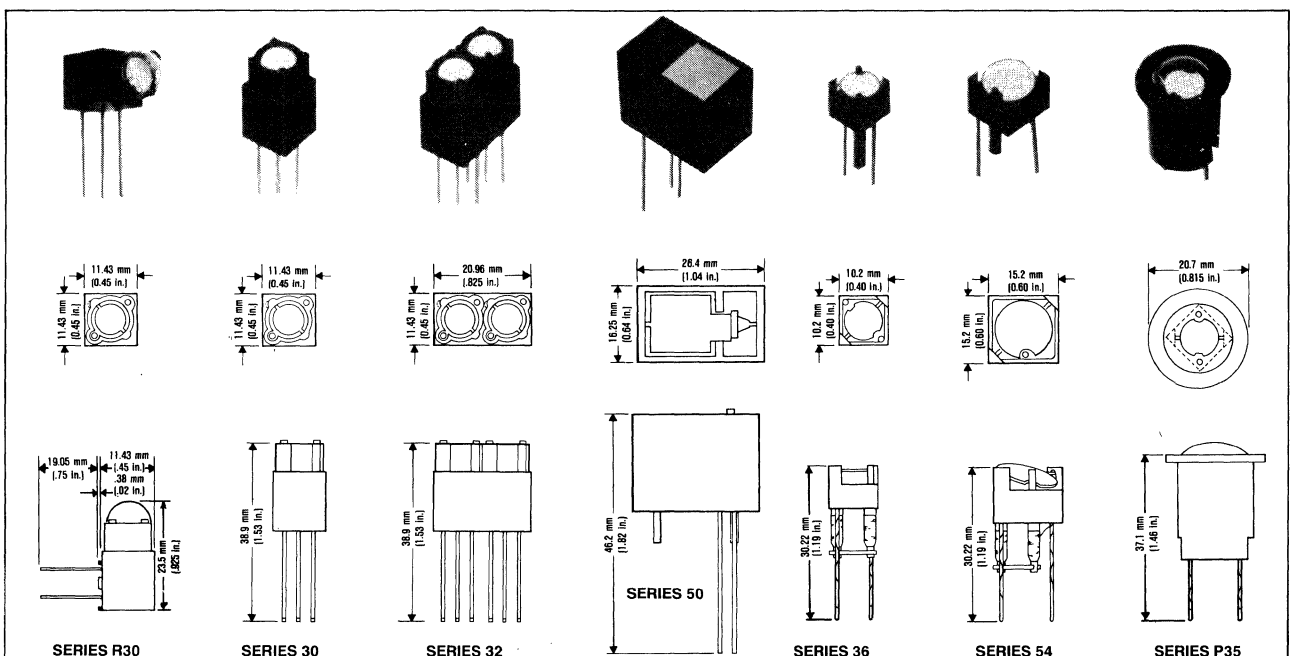
ALPHANUMERIC MODULES These modules offer the user a complete alphanumeric or special character capability. Each module contains 35 light reflecting disks or elements arranged in a 5 × 7 matrix. Five character heights are available — 70mm (2.7 in.), 104mm (4.1 in.), 215mm (8.4 in.), 328mm (12.9 in.) and 452mm (17.8 in.).

Typical applications include: Scoreboard Displays, Advertising Displays, Message Signs, Traffic Control Signs, Industrial Displays, Passenger Information Displays and Vehicle Destination Signs.

7 SEGMENT MODULES The 7 segment module is basically a numeric readout, but it can display a limited number of alpha characters within its 7 segment format. Five character heights are available — 26mm (1.0 in.), 135mm (5.3 in.), 230mm (9.0 in.), 305mm (12.0 in.) and 457mm (18.0 in.).

Typical applications include: Gasoline Pump Displays, Weigh Scale Readouts, Cash Register Readouts, Time/Temperature Displays, Gas Pricing Signs, Speed Limit Signs, Scoreboards, Industrial Displays.

STATUS INDICATORS



SERIES R30 SERIES 30 SERIES 32 SERIES 36 SERIES 54 SERIES P35

Specifications and Operating Parameters

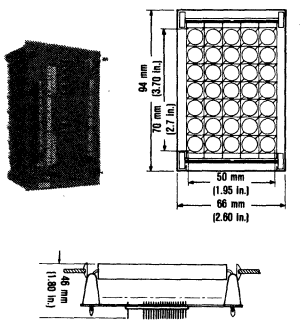
Series	Temperature Range	Relative Humidity (non-condensing)	Minimum Pulse Current	Coil Resistance (at 20°C) (Ω)	Minimum Pulse Duration	Minimum Pulse (V) at 20°C	Data Sheet Reference	Disk Dia	Flag Size	Weight
R30 + 30	– 40 to 92°C	up to 95%	250mA	12Ω ± 10%	1.5 ms	3.3V	372	7.62 mm, 0.30 in.	—	0.16 oz., 4.5 g
32	– 40 to 92°C	up to 95%	250mA	12Ω ± 10%	1.5 ms	3.3V	372	7.62 mm, 0.30 in.	—	0.28 oz., 8.0 g
50	– 40 to 75°C	up to 95%	53mA	430 ± 10%	1.5 ms	25V	372	—	12.7 mm, 0.50 × 0.50 in.	0.50 oz., 14.2 g
36	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	372	8.9 mm, .350 in.	—	0.07 oz., 2.0 g
54	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	372	13.46 mm, .53 in.	—	0.11 oz., 3.2 g
P35	– 40 to 75°C	up to 95%	250mA	27 ± 10%	1 ms	10V	372	8.9 mm, .350 in.	—	0.14 oz., 3.9 g

* All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

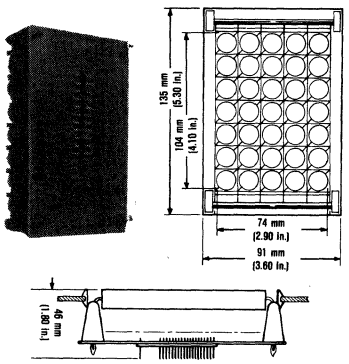
F-P ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

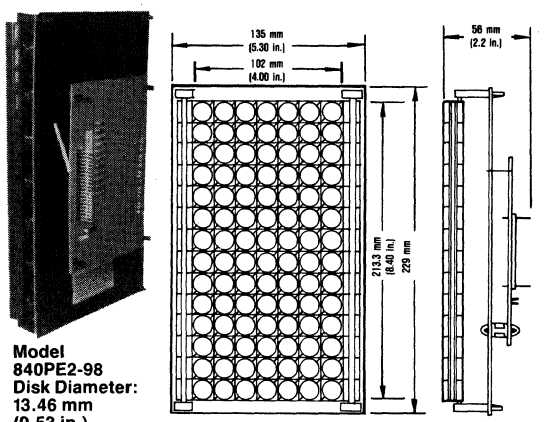
PRE-ENCODED MODULES



Model 270PE2-35
Disk Diameter: 8.9 mm (0.35 in.)
Weight: 142g



Model 410PE2-35
Disk Diameter: 13.46 mm (0.53 in.)
Weight: 227g

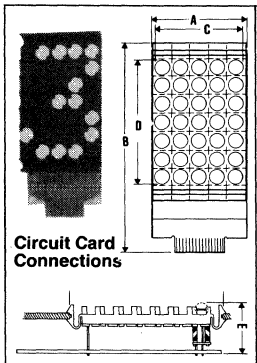


Model 840PE2-98
Disk Diameter: 13.46 mm (0.53 in.)
Weight: 570g

Specifications and Operating Parameters

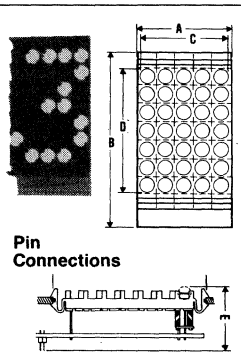
Model Number	Temperature Range	Relative Humidity (non-condensing)	Minimum Pulse Current	Coil Resistance (at 20°V) (Ω)	Minimum Pulse Duration	Minimum Pulse Voltage at	Data Sheet Reference
270PE2-35	– 40 to 75°C	up to 95%	10A	4.3 ± 10%	1 ms	48 V	778
410PE2-35	– 40 to 75°C	up to 95%	12A	5.5 ± 10%	1 ms	72 V	751
840PE2-98	– 40 to 75°C	up to 95%	16A	5.9 ± 10%	1 ms	96 V	759

ALPHANUMERIC MODULES



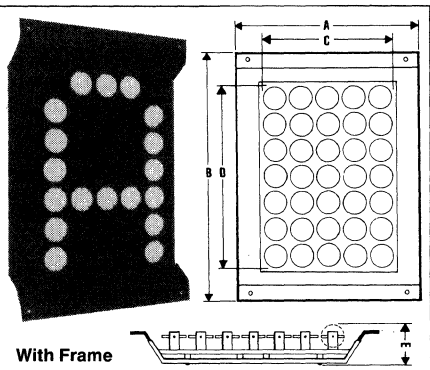
Circuit Card Connections

Model 270XY5-35SC
Model 410XY5-35SC



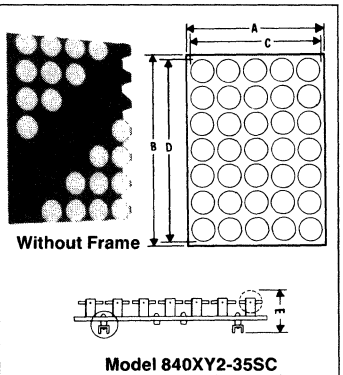
Pin Connections

Model 271XY5-35SC
Model 411XY5-35SC



With Frame

Model 842XY2-35SC
Model 1202XY2-35SC
Model 1802XY2-35SC



Without Frame

Model 840XY2-35SC
Model 1200XY2-35SC
Model 1800XY2-35SC

Specifications and Operating Parameters

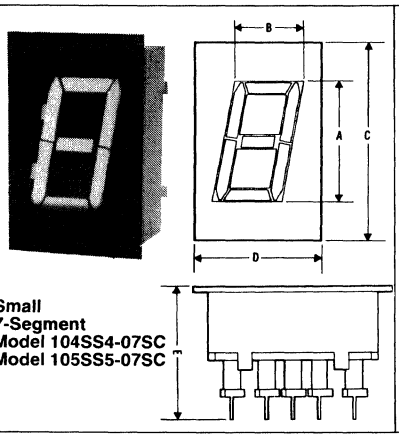
Model Number	Temp. Range	Relative Humidity non-condensing	Min. Pulse Current	Coil Resistance (at 20°C) (Ω)	Min. Pulse Duration	Min. Pulse* Voltage at 20°	A x B	C x D	E	Disk Diameter	Weight (g)	Data Sheet Ref
270XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 52 x 116 in. 2.03 x 4.57	50 x 70 1.95 x 2.70	28.9 1.14	8.9 0.35	98g	797
410XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 77 x 167 mm 3.03 x 6.60	74 x 104 2.93 x 4.10	32 1.26	13.46 0.53	139g	797
271XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 52 x 116 in. 2.03 x 4.57	50 x 70 1.95 x 2.70	39.8 1.57	8.9 0.35	98g	797
411XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 77 x 167 in. 3.03 x 6.60	74 x 104 2.93 x 4.10	42 1.69	13.46 0.53	139g	797
842XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 215 x 312 in. 8.45 x 12.5	150 x 213 5.9 x 8.4	74 2.9	24 0.95	992g	586
1202XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 317 x 457 in. 12.5 x 18.0	231 x 328 9.1 x 12.9	81 3.2	38 1.5	1786g	586
1802XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 457 x 660 in. 18.0 x 26.0	320 x 452 12.6 x 17.8	91 3.6	56 2.2	3317g	586
840XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 163 x 221 in. 6.4 x 8.7	150 x 213 5.9 x 8.4	84 3.29	24 0.95	425g	586
1200XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 244 x 335 in. 9.6 x 13.2	231 x 328 9.1 x 12.9	87 3.42	38 1.5	595g	586
1800XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 333 x 457 in. 13.1 x 18.0	320 x 452 12.6 x 17.8	95 3.75	56 2.2	822g	586

*All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

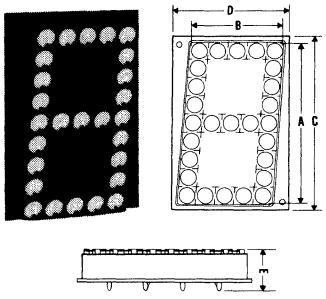
F-P ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

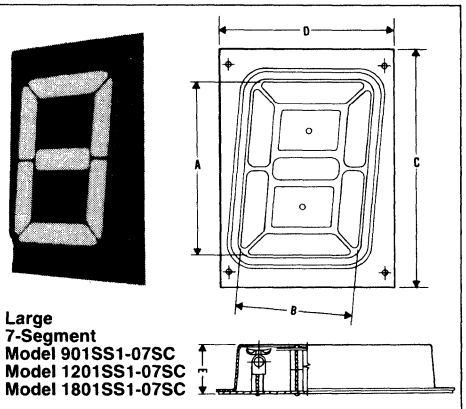
7-SEGMENT MODULES



Small
7-Segment
Model 104SS4-07SC
Model 105SS5-07SC



Disk Matrix
7-Segment
Model 531SS2-07SC



Large
7-Segment
Model 901SS1-07SC
Model 1201SS1-07SC
Model 1801SS1-07SC

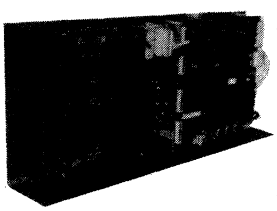
Specifications and Operating Parameters

Model Number	Temp. Range °C	Relative Humidity non-condensing	Min. Pulse Current	Coil Resistance at (20°C) (Ω)	Min. Pulse Duration	Min. Pulse* Voltage at 20°C	A x B	C x D	E	Weight (g)	Data Sheet Reference
104SS4-07SC	– 40 to 75	up to 95%	1A	6.8 ± 10%	650μs	12	mm 25.4 x 14 in. 1.00 x 0.55	42.9 x 27.3 1.69 x 1.075	29 1.123	12.3	777
105SS5-07SC	– 40 to 75	up to 95%	335 mA	45 ± 10%	1ms	19	mm 25.4 x 14 in. 1.00 x 0.55	42.9 x 27.3 1.69 x 1.075	29 1.123	13.8	777
531SS2-07SC	– 40 to 75	up to 95%	1.8A	A, D, G, -60hms B, E -4-50hms C, F -3-60hms	1 ms	See Data Sheet 531	mm 135 x 76.2 in. 5.3 x 3.0	155.7 x 105.4 6.13 x 4.15	33 1.3	150	531
901SS1-07SC	– 40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 230 x 152 in. 9.0 x 6.0	312 x 230 12.3 x 9.0	76 3.0	936	200
1201SS1-07SC	– 40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 305 x 203 in. 12.0 x 8.0	457 x 318 18.0 x 12.5	76 3.0	1360	200
1801SS1-07SC	– 40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 457 x 305 in. 18.0 x 12.0	660 x 457 26.0 x 18.0	79 3.1	2495	200

(1) All erase coils connected in series.
(2) Individual erase coils. If connected in series the erase voltage must be 26V minimum.

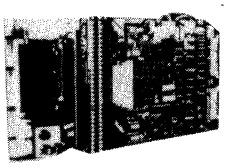
* All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

DRIVE UNITS



FP601 CONTROLLER

The Ferranti-Packard Series FP601 Controller is a small, high speed, solid-state device which contains the power supply, logic and drive circuitry required to operate Ferranti-Packard alphanumeric display modules, Model 271XY5-35 and Model 411XY5-35. The suggested mounting is in a protected area preferably within the sign enclosure. Main features include remote driver board capability and various writing directions. (Data Sheet 601.)



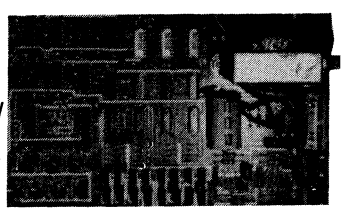
TYPE 1001 CONTROLLER

The 1001 Controller is a versatile, low cost powerful microprocessor based unit for use with displays using Ferranti-Packard large alphanumeric modules: (215mm) 8.4", (328mm) 12.9", and (457mm) 18", alphanumeric modules (70mm) 2.7", (104mm) 4.1", and large seven segment modules: (230mm) 9", (305mm 12", (457mm 18". The main feature of the 1001 Controller is its capability to store and cycle messages. (Data Sheet 1001.)

SERIES 300 DRIVER/DECODER BOARD



The Series 300 driver/decoder boards provide a simple, economical method of driving small display systems comprising either (70mm) 2.7 inch, (104mm) 4.1 inch or (215mm) 8.4 inch type DCP pre-encoded modules. (Data Sheet 265.)



MODEL 700DD DRIVER/ DECODER BOARD

MODEL 701DD DRIVER/ DECODER BOARD

The Model 700DD 7 bar module driver/decoder board provides a simple, economical method of driving small display systems utilizing (230mm) 9 inch, (305mm) 12 inch, (457mm) 18 inch large 7 bar modules. (Data Sheet 700.)

The Model 701DD 7 bar module driver/decoder board drives small display systems utilizing 135mm (5.3 in.) disk matrix segment modules. (Data Sheet 701.)

PRINCIPLES OF OPERATION

Alphanumeric Modules/Status Indicators

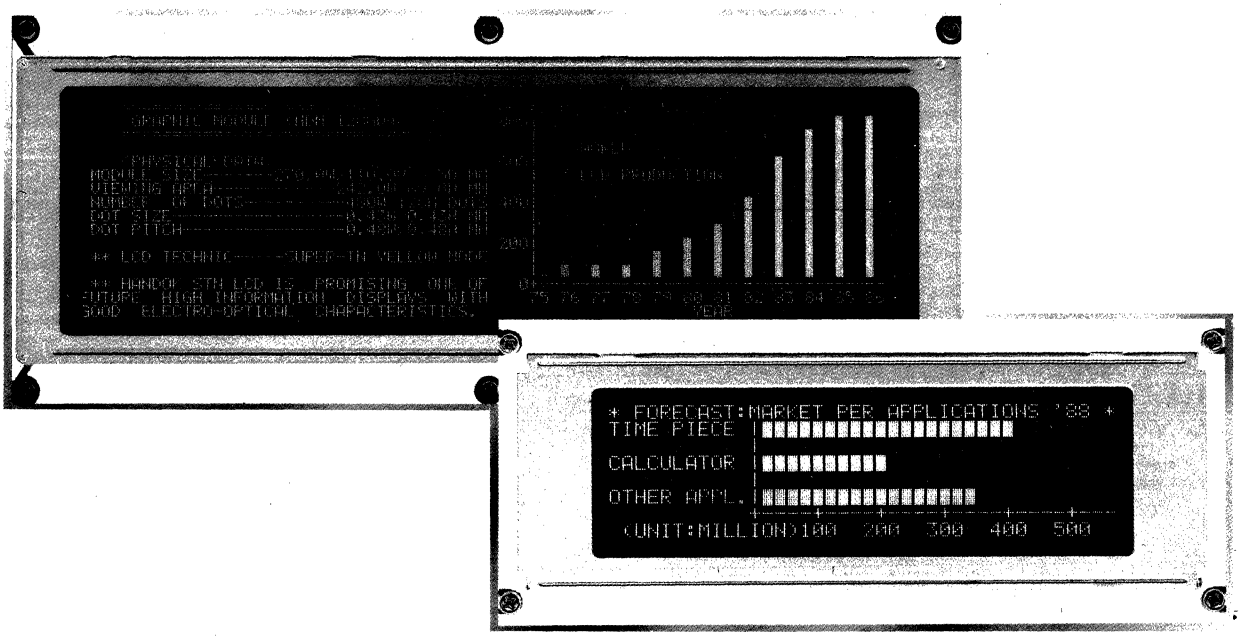
The basic display element is a magnetic disk. Short pulses of current in the coil assembly set the magnetic field in the stator pins in either one direction or the other. Each disk rotates to line up with the stator field and shows either its black side, or colored side.

Small 7-Segment Modules

The basic display element is a magnetic segment which pivots on its axis. Short pulses of current in the coil under each segment set the magnetic field in the stator pins in either one direction or the other. Attraction or repulsion by a segment's bar magnet, retracts or shows a segment.

HANTRONIX DOT MATRIX LCD MODULES

LCD VISIBLY SUPERIOR HANTRONIX



EVEN ON LOW-VOLUME LCD ORDERS.

For fast turnaround on all your LCD requirements, check with Hantronix, Inc. first. We specialize in delivering complete custom LCD modules for low-volume customers.

For even faster turnaround, check out our standard line of dot-matrix LCDs. Modules consume very little power, yet display crystal-clear characters and graphic images with sharp contrast over a wide viewing angle. All modules are designed to make interfacing exceptionally easy.

High-quality Hantronix, Inc. LCDs are competitively priced, with discounts on larger-volume orders. They're warranted for one year, and backed by Hantronix, Inc.'s high reliability standards and prompt service. For full details, contact Hantronix, Inc. today.

APPLICATIONS

- Portable computer terminals
- Telecommunications
- High class electronic calculators
- Display devices
- Automobile display panels
- Word processors
- Chemical analyzers
- Measuring equipment
- Medical instruments

FEATURES

- By the combination of dots it can be displayed many kinds of characters and symbols.
- Using FEM-TN liquid crystal developed newly, it has wide viewing angle.
- Due to low drive voltage and low current consumption, it can be operated with battery.
- For its small size, lightweight, compact display equipments can be constructed.
- Character generator included.
- Many kinds of types are available according to users' requirements.

HANTRONIX, INC., 250 Santa Ana Court, Sunnyvale, CA 94086 Tel: (408) 736-3191 • Fax: (408) 749-0477

HANTRONIX DOT MATRIX LCD MODULES

CHARACTER TYPE (BUILT-IN CONTROLLER)

ITEM / MODEL	EXTERNAL DIMENSION (WxHxDmm)	CHARACTER x LINE	VIEWING AREA (WxHmm)	DRIVING METHOD (DUTY)	CHARACTER FONT (WxH,DOT)	CHARACTER SIZE (WxHmm)	DOT SIZE (WxHmm)
HDM-08111H—1	54.0x37.0x10.0	8x1	32.0x16.0	1/11	5x10, CUR	2.9x6.9	0.5x0.6
HDM-08216H-1	54.0x37.0x10.5	8x2	32.0x16.0	1/16	5x7, CUR	2.95x4.5	0.55x0.6
HDM-16108H—4	80.0x36.0x10.0	16x1	65.6x13.8	1/8	5x7, CUR	3.15x5.5	0.55x0.7
HDM-16108H—7	122.0x33.0x10.0	16x1	99.0x13.0	1/8	5x7, CUR	4.84x8.06	0.92x1.1
HDM-16116H	80.0x36.0x10.0	16x1	65.6x13.8	1/16	5x7, CUR	3.15x5.5	0.55x0.7
HDM-16111H—4	80.0x36.0x10.0	16x1	65.6x13.8	1/11	5x10, CUR	3.15x7.9	0.55x0.7
HDM-16216H—2	85.0x36.0x10.0	16x2	63.5x15.8	1/16	5x7, CUR	3.15x4.45	0.55x0.55
HDM-16216H—4	122.0x44.0x10.0	16x2	99.0x24.0	1/16	5x7, CUR	4.84x8.06	0.92x1.1
HDM-16216H—5	80.0x36.0x10.0	16x2	65.6x13.8	1/16	5x7, CUR	2.95x3.8	0.55x0.55
HDM-16216H—B	84.0x44.0x10.0	16x2	61x15.8	1/16	5x7, CUR	2.85x4.85	0.55x0.65
HDM-16416H	87.0x60.0x10.0	16x4	61.8x25.2	1/16	5x7, CUR	2.95x4.15	0.55x0.55
HDM-20108H	120.0x36x10.0	20x1	88.2x20.0	1/8	5x7, CUR	3.4x5.15	0.6x0.65
HDM-20108H—1	182.0x33.5x10.0	20x1	154.5x15.8	1/8	5x7, CUR	6.7x9.4	1.3x1.3
HDM-20111H	120.0x36.0x10.0	20x1	88.2x20.0	1/11	5x10, CUR	3.4x7.9	0.6x0.7
HDM-20216H	120.0x36.0x10.0	20x2	88.2x20.0	1/16	5x7, CUR	3.4x5.15	0.6x0.65
HDM-20416H	98.60.0x10.0	20x4	76x25.2	1/16	5x7, CUR	2.95x4.15	0.55x0.55
HDM-20416H-1	146.0x62.5x10.0	20x4	123.0x42.5	1/16	5x7, CUR	4.85x8.07	0.93x1.11
HDM-24108H	118.0x36.0x10.0	24x1	93.5x15.8	1/8	5x7, CUR	3.15x5.5	0.55x0.7
HDM-24111H	118.0x36.0x10.0	24x1	93.5x15.8	1/11	5x10, CUR	3.15x7.9	0.55x0.7
HDM-24216H	118.0x36.0x10.0	24x2	93.5x15.8	1/16	5x7, CUR	3.15x4.45	0.55x0.55
HDM-24216H—2	118.0x36.0x10.0	24x2	93.5x15.8	1/16	5x7, CUR	3.20x4.85	0.60x0.65
HDM-32108H—1	174.5x31.0x10.0	32x1	141.2x17.0	1/8	5x7, CUR	3.42x5.52	0.62X0.72
HDM-32111H—1	174.5x31.0x10.0	32x1	141.2x17.0	1/11	5x10, CUR	3.42x7.9	0.62x0.7
HDM-32216H—1	174.5x31.0x10.0	32x2	141.2x17.0	1/16	5x7, CUR	3.42x4.82	0.62x0.62
HDM-40108H—2	182.0x33.5x10.0	40x1	154.5x15.8	1/8	5x7, CUR	3.15x5.5	0.55x0.7
HDM-40111H—1	182.0x33.5x10.0	40x1	154.5x15.8	1/11	5x10, CUR	3.15x7.9	0.55x0.7
HDM-40216H—2	182.0x33.5x10.0	40x2	154.5x15.8	1/16	5x7, CUR	3.15x4.45	0.55x0.55
HDM-40416H	215.0x60.0x10.0	40x4	160.0x34.0	1/16	5x7, CUR	3.2x4.85	0.6x0.65
HDM-40416H-4	190.0x54.0x10.5	40x4	147.0x29.5	1/16	5x7, CUR	2.8x4.29	0.52x0.57
HDM-80111H—1	264.0x50.0x10.0	80x1	206.0x20.0	1/11	5x10, CUR	2.05x4.75	0.37x0.43

CHARACTER TYPE (LED Backlight)

ITEM / MODEL	EXTERNAL DIMENSION (WxHxDm)	CHARACTER X LINE	VIEWING AREA (WxHmm)	DRIVING METHOD (DUTY)	CHARACTER FONT (WxH,DOT)	CHARACTER SIZE (WxHmm)	DOT SIZE (WxHmm)
HDM-16108L	80.0x36.0x13.0	16x1	65.6x13.8	1/8	5x7, CUR	3.2x5.55	0.6x0.75
HDM-16216L	84.0x45.0x13.0	16x2	61.0x16.0	1/16	5x7, CUR	2.95x4.85	0.55x0.65
HDM-16216L-2	80.0x36.0x11.0	16x2	61.0x15.8	1/16	5x7, CUR	2.95x5.55	0.55x0.65
HDM-16216L-4	80.0x35.0x11.0	16x2	61.0x15.8	1/16	5x7, CUR	2.95x5.55	0.55x0.65
HDM-16216L-5	80.0x36.0x11.0	16x2	65.6x13.8	1/16	5x7, CUR	2.95x3.8	0.55x0.5
HDM-16216L-7	122.0x44.0x12.5	16x2	99.0x24.0	1/16	5x7, CUR	4.84x8.06	0.92x1.1
HDM-16416L	87.0x60.0x12.5	16x4	61.8x25.2	1/16	5x7, CUR	2.95x4.15	0.55x0.55
HDM-20216L	116.0x37.0x13.0	20x2	83.0x18.6	1/16	5x7, CUR	3.2x4.85	0.6x0.65
HDM-20416L	98.0x60.0x12.5	20x4	76.0x25.2	1/16	5x7, CUR	2.95x4.15	0.55x0.55
HDM-40216L	182.0x33.5x13.0	40x2	154.5x15.8	1/16	5x7, CUR	3.2x4.85	0.6x0.65

GRAPHIC TYPE

ITEM / MODEL	EXTERNAL DIMENSION (WxHxDmm)	DOT NUMBER (WxH, DOT)	VIEWING AREA (WxHmm)	DRIVING METHOD (DUTY)	DOT SIZE (WxHmm)	DOT PITCH (WxHmm)
HDM-64GD24—2	180.0x75.0x11.0	240x64	132.0x41.0	1/32	0.47x0.47	0.52x0.52
HDM-64GS24—1	180.0x75.0x11.0	240x64	132.0x41.0	1/64	0.47x0.47	0.52x0.52
HDM-48GS64	270.0x63.0x13.0	640x48	241.0x25.0	1/48	0.32x0.38	0.37x0.43
HDM-64GS48	270.0x82.0x10.0	480x64	240.x38.0	1/64	0.44x0.44	0.49x0.49
HDM-128GD25-1	200.0x110.0x10.0	256x128	128.0x66.5	1/64	0.43x0.43	0.48x0.48
HDM-128GD48-1	270.0x110.0x10.0	480x128	242.0x69.0	1/64	0.43x0.43	0.48x0.48
HDM-200GD64	270.0x154.0x11.0	640x200	248.0x114.0	1/100	0.335x0.475	0.375x0.525

OPTIONS

TN (Twisted Nematic) or STN (Super Twisted Nematic) Type
- STN type offers high contrast and wider viewing angle.
- Viewing angle (TN: ±20°, STN: ± 40°)

Standard Temperature Type
- Operating temperature range: 0°C~+50°C
- Storage temperature range: -20°C~+70°C

Extended Temperature Type
- Operating temperature range: -20°C~+70°C
- Storage temperature range: -40°C~+80°C

E/L Backlight Type
- Electro Luminescence for backlight
- Standard emitted color is "blue-green"
- Inverter is required

LED Backlight Type
- Brighter and even backlighting
- Long lifetime of LED

Single Voltage Type
- 5V for logic circuit and LCD driving

Dual Voltage Type
- 5V for logic circuit
- -1V -5V for LCD driving

Display Type
- Positive
- Negative

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HITACHI®

Hitachi America, Ltd. Liquid Crystal Displays

Leadership in Technology

Hitachi has been a pioneer in LCD research and development ever since the infancy of commercial LCD technology. Hitachi involvement in LCD technology began in 1968, with basic research on the electro-optical properties of liquid crystal materials.

Since then, Hitachi expertise has led to a number of important firsts in the LCD industry:

- The first production TN-FE mode numerical LCDs for wristwatch applications.
- The first LSIs for driving matrix LCDs.
- The first LCDs for television applications.
- The first production Super Twist LCD.
- The first LCDs for use in an automotive instrument panel.
- The first production of large-size full color active matrix LCDs.

LCDs Provide a Number of Key Benefits For Your Design

LCDs have a unique combination of features and benefits unmatched by other display technologies.

Low power requirements

Unlike CRT and gas plasma displays, LCDs are inherently low power devices. Typically, they exhibit power consumption of less than 10uw/cm^2, and operate with power supply voltages of 8VDC or less.

As a result, LCDs are ideal for portable or battery-powered applications where power consumption must be as low as possible. For those applications powered from the AC line, a liquid crystal display can mean a smaller, less expensive power supply.

High readability

Clearly, one of the most important qualities of any display is that it be easy to read. In this regard, LCDs excel.

Their flickerless display means improved readability with less eye strain and fatigue. And, because of their optically passive nature, bright ambient light makes them even easier to read.

Compact packaging

LCDs are thin, compact, and lightweight. While obviously ideal for portable applications, these qualities can help make possible the new generation of "small footprint" electronics.

Easy integration into your design

Because of their simple interfacing and power supply requirements, LCDs get your design to market faster, with less design cost.

Highly rugged construction

LCDs don't rely on fragile glass envelopes or complicated structures as do other display technologies. This gives them better durability, making your design more reliable.

Cost-effective design

Hitachi's LCDs are cost-effective design solutions because Hitachi's highly automated manufacturing process results in lower prices per unit. Standard interfaces and low power requirements also contribute to more cost-effective designs, and help reduce your overall system costs.



16-level gray scale, 640 x 480 resolution

Hitachi Delivers the Right LCD Solution for Every Application

Being the leader in LCD technology, Hitachi offers all types of liquid crystal displays.

Twisted Nematic (TN)

TN was the first successful LCD technology to be used on a far-reaching basis. Its combination of low power consumption, low voltage requirements, good visibility under bright ambient light, and its compact size and low weight gave it many advantages over previous display technologies. Even today, the TN LCD continues to enjoy widespread use in cost-constrained consumer and commercial applications.

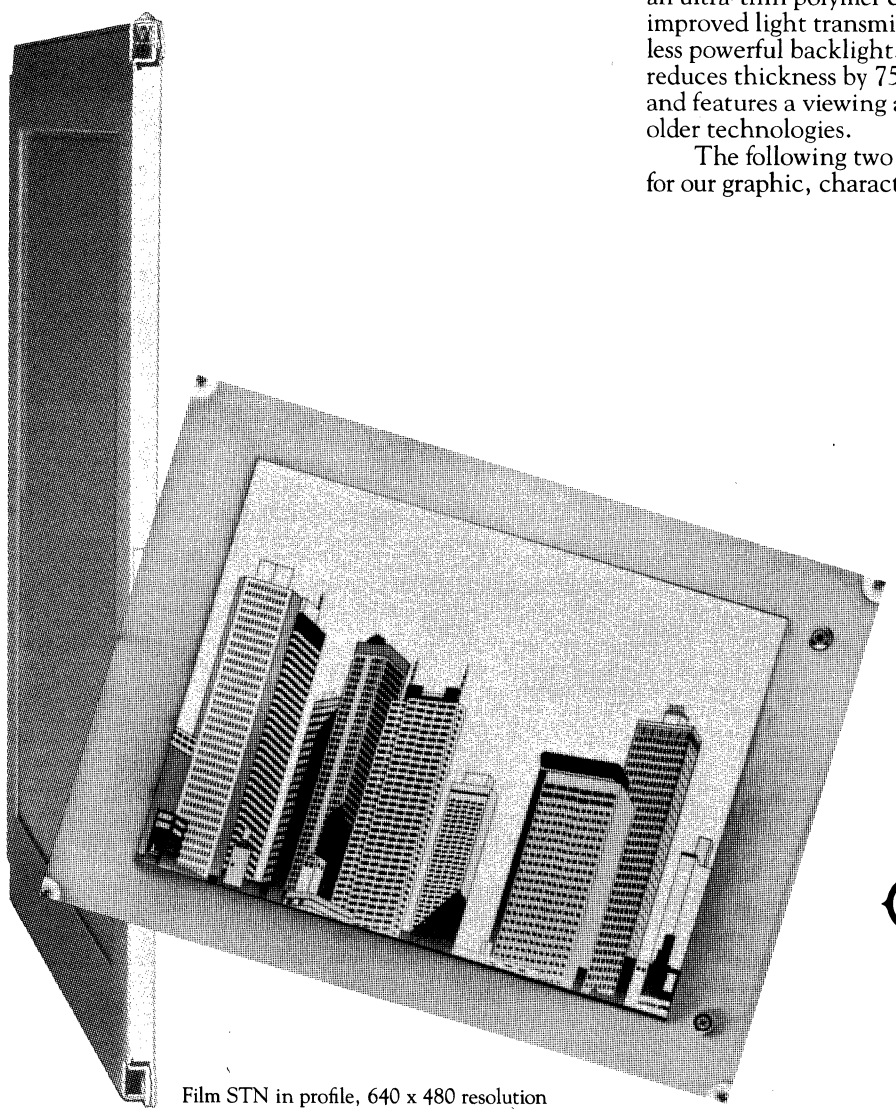
Super Twisted Nematic (STN)

STN represents a refinement of basic TN technology. A single layer of glass is used, but the twist angle of the liquid crystal molecules is greater, allowing improved contrast and viewing angle. STN LCDs can often be recognized by their characteristic blue coloration.

Super Twisted Nematic with Film (Film STN)

Film STN offers excellent black-and-white image quality. This LCD technology replaces one layer of glass with an ultra-thin polymer compensating film. The result is improved light transmission which allows the use of a less powerful backlight. Film STN weighs 50% less, reduces thickness by 75%, consumes 60% less power, and features a viewing angle which is 25% wider over older technologies.

The following two pages give you key specifications for our graphic, character, and segment LCD modules.



Film STN in profile, 640 x 480 resolution

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Our Standards Set Standards

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Electron Tube Division
300 N. Martingale Road, Suite 600
Schaumburg, IL 60173
Telephone 1-708-517-1144

HITACHI® Hitachi America, Ltd.

Graphic LCD Modules

Hitachi graphic LCD modules provide clear, detailed displays of graphics, symbols, and all types of alphanumerics. They have resolutions ranging from 240 x 64 to 1120 x 780, giving you the right display for virtually any application. All have built-in drivers, and some models even include built-in controllers. Hitachi also has available graphic LCD modules with electroluminescent (EL) panel backlight, or cold cathode fluorescent (CCFL) lamp backlight. Contact Hitachi for packaging, backlighting, and transmission options which let you custom-configure LCD modules for your specific application.

Graphic LCD Modules (without backlight)

Module part No.			No. of dot W×H	Display color	(Note) External dimensions W×H×T	Effective viewing area W×H	Dot pitch W×H	Driving method	Recommended power supply	
Separate controller type	Built-in controller type	Controller (Note)	(dot)		(mm)	(mm)	(mm)	(Duty)	$V_{DD}-V_{SS}$ (V)	(Note) $V_{EE}-V_{SS}$ (V)
LM258XB	—	*1	240×64	Yellow-green	149×57×13max.	117×41	0.47×0.47	1/64	+5	−12
LM300XM	—	*1	240×64	New-gray	180×75×11max.	132×39	0.53×0.53	1/32	+5	−9
—	LM213XB	*1	256×64	Yellow-green	184×75×10max.	149.6×43	0.56×0.56	1/64	+5	−10.5
LMG6390QHGR	LMG6380QHGR	*1	256×64	New-gray	$160\times68\times\frac{9.0*4}{(9.5)max.}$	126.3×37	0.47×0.47	1/64	+5	−13
LMG6392QHFR	LMHQ6382QHFR	*1	256×64	Black & white	$160\times68\times\frac{9.0*4}{(9.5)max.}$	126.3×37	0.47×0.47	1/64	+5	−13
LM221XB	LM238XB	*1	240×128	Yellow-green	180×120×13.8max.	148×75	0.55×0.55	1/64	+5	−13.5
LMG6410PLGR	LMG6400PLGR	*1	240×128	New-gray	$159.4\times101\times\frac{9.0*4}{(9.5)max.}$	126×71	0.50×0.50	1/128	+5	−15
LMG6412PLFR	LMG6402PLFR	*1	240×128	Black & white	$159.4\times101\times\frac{9.0*4}{(9.5)max.}$	126×71	0.50×0.50	1/128	+5	−15
LM246X	—	*2	320×256	Yellow-green	168×150×13.5max.	142×115	0.43×0.43	1/128	+5	−20
LM211XB	—	*1	480×64	New-gray	270×82×13max.	240×38	0.49×0.49	1/64	+5	−10.5
LM211XMC	—	*1	480×64	New-gray	270×82×13max.	240×38	0.49×0.49	1/64	+5	−13
LM215XB	—	*1	480×128	Yellow-green	270×110×11.5max.	242×69	0.48×0.48	1/64	+5	−13.5
LMG6250ULGR	—	*3	480×128	New-gray	270×110×11.5max.	242×69	0.48×0.48	1/128	+5	−13
LMG6252ULFR	—	*3	480×128	Black & white	270×110×11.5max.	242×69	0.48×0.48	1/128	+5	−13
LM266XW	—	*2	640×100	New-gray	287.5×71.5×11.5max.	243×42	0.36×0.36	1/100	+5	−19
LM280X	—	*3	640×200	Yellow-green	270×104×11max.	236.4×78	0.36×0.36	1/200	+5	−20.5
LMG6270XNGR	—	*3	640×200	New-gray	265×90×8max.	221.2×73	0.33×0.33	1/200	+5	−22
LMG6272XNFR	—	*3	640×200	Black & white	265×90×8max.	221.2×73	0.33×0.33	1/200	+5	−22
LMG6273XNFR	—	*3	640×200	Black & white Anti-glare	265×90×8max.	221.2×73	0.33×0.33	1/200	+5	−22
LMG6280XNGR	—	*3	640×200	New-gray	270×116×8max.	217.2×96	0.33×0.45	1/200	+5	−22
LMG6282XNFR	—	*3	640×200	Black & white	270×116×8max.	217.2×96	0.33×0.45	1/200	+5	−22
LMG6283XNFR	—	*3	640×200	Black & white Anti-glare	270×116×8max.	217.2×96	0.33×0.45	1/200	+5	−22
LMG6111XTFR	—	*3	640×400	Black & white Anti-glare	288×173×7.5max.	223.17×143.97	0.33×0.33	1/200	+5	−20.5
LMG6150XUFR	—	*3	640×480	Black & white Anti-glare	272×178×9max.	202.37×152.77	0.31×0.31	1/240	+5	−21.5

EL Backlighted Versions

LMG6391QHGE	LMG6381QHGE	*1	256×64	New-gray	$160\times68\times\frac{9.0*4}{(9.5)max.}$	126.3×37	0.47×0.47	1/64	+5	−13
LMG6411PLGE	LMG6401PLGE	*1	240×128	New-gray	$159.4\times101\times\frac{9.0*4}{(9.5)max.}$	126×71	0.50×0.50	1/128	+5	−15
LMG6251ULGE	—	*3	480×128	New-gray	270×110×11.5max.	242×69	0.48×0.48	1/128	+5	−13
LMG6271XNGE	—	*3	640×200	New-gray	265×90×9max.	221.2×73	0.33×0.33	1/200	+5	−22
LMG6281XNGE	—	*3	640×200	New-gray	270×116×9max.	217.2×96	0.33×0.45	1/200	+5	−22
LMG6171XTBE	—	*3	640×400	Blue Anti-glare	256×146×9max.	197×125	0.30×0.30	1/200	+5	−22
LMG6173XTFE	—	*3	640×400	Black & white Anti-glare	256×146×9max.	197×125	0.30×0.30	1/200	+5	−22
LMG6151XUFE	—	*3	640×480	Black & white Anti-glare	272×178×9max.	202.37×152	0.31×0.31	1/240	+5	−22
LMG6221XUFE	—	*3	640×480	Black & white Anti-glare	260×160×9max.	183×138.4	0.28×0.28	1/240	+5	−22

CCFL Backlighted Versions

LM721XBNP	—	*3	320×200	Yellow	142×103×30max.	113×77	0.33×0.35	1/200	+5	−21.5
LMG6160XTFC	—	*3	640×400	Black & white Anti-glare	325×191.6×26max.	236×152	0.36×0.36	1/200	+5	−20.5
LMG6371XTBC	—	*3	640×400	Blue Anti-glare	250×145×10.6max.	196×124	0.30×0.30	1/200	+5	−22
LMG6471XTFC	—	*3	640×400	Black & white Anti-glare	250×145×10.6max.	196×124	0.30×0.30	1/200	+5	−22
LMG5040XUFC	—	*3	640×480	Black & white Anti-glare	256.5×160×10max.	183×137	0.28×0.28	1/242	+5	−22
LMG5060XUFC	—	*3	640×480	Black & white Anti-glare	250×172×10.5max.	196×150	0.30×0.30	1/240	+5	−20.5
LMG9050ZZFC	—	—	1024×768	Black & white Anti-glare	300×234×17max.	231×175	0.22×0.22	1/387	+5	−34
LMG9040ZZFC	—	—	1120×780	Black & white Anti-glare	316×230×31max.	236×166	0.205×0.205	1/390	+5	$^{+38}_{(+12)*7}$

Note *1 : HD61830 *2 : HD63645F/64645F *3 : HD66841 *4 : ( ) Shows the thickness of built-in controller type *7 : ( ) Shows the $V_{FC}-V_{SS}$

Liquid Crystal Displays

Character and Segment LCD Modules

Hitachi character LCD modules are ideal for general-purpose character display applications where numbers, letters, and symbols are presented. These products display 160 types of 5 x 7 dot character fonts, and 32 types of 5 x 10 dot character fonts.

Hitachi's broad line includes character LCD modules ranging from 1 to 4 lines in length, up to a maximum of 40 characters. A choice of EL or LED backlighted versions provides clear, highly legible displays. All models include built-in drivers and controllers.

Segment display LCD modules are well-suited for cost-effective 7-segment display applications. These products feature a built-in controller and driver, and operate from a single 5 volt power supply.

Character LCD Modules (without backlight)

Part No.	No. of char. (Char. × line)	Display color	External dimensions W×H×T (mm)	Effective viewing area W×H (mm)	Character dimensions W×H (mm)	Driving method (Duty)	Recommended power supply V_{DD}-V_{SS} (V)
LM054	8×1	Gray	84×44×12 max.	61×15.8	6.45×9.4	1/8	+5
LM015	16×1	Gray	80×36×12 max.	64.5×13.8	3.15×5.5	1/8	+5
H2570	16×1	Gray	80×36×12 max.	64.5×13.8	3.15×7.9	1/11	+5
LM020L	16×1	Gray	80×36×12 max.	64.5×13.8	3.07×5.73	1/16	+5
LM020XMBL[1]	16×1	New-gray	80×36×12 max.	64.5×13.8	3.07×5.73	1/16	+5
LM070L	20×1	Gray	105×39.0×11 max.	84.0×13.0	3.2×5.2	1/8	+5
LM038	20×1	Gray	182×35.5×13 max.	154.0×15.3	6.7×9.4	1/8	+5
LM027	24×1	Gray	126×36×12 max.	100×13.8	3.15×7.9	1/11	+5
H2571	32×1	Gray	174.5×33×13.4 max.	132.5×14	3.15×7.9	1/11	+5
H2572	40×1	Gray	182×35.5×13 max.	154.0×15.3	3.15×7.9	1/11	+5
LM058	40×1	Gray	290×60×13 max.	245×19	4.82×8.18	1/8	+5
LM052L	16×2	Gray	80×36×11 max.	64.5×13.8	2.95×3.8	1/16	+5
LM016L	16×2	Gray	84×44×12 max.	61×15.8	2.96×4.86	1/16	+5
LM016XMBL[1]	16×2	New-gray	84×44×12 max.	61×15.8	2.96×4.86	1/16	+5
LM032L	20×2	Gray	116×39×13 max.	83×18.6	3.2×4.85	1/16	+5
LM032XMBL[1]	20×2	New-gray	116×37×10.5 max.	83×18.6	3.2×4.85	1/16	+5
LM060L	24×2	Gray	116×39×13 max.	83×18.6	2.7×4.85	1/16	+5
LM017L	32×2	Gray	174.5×33×13.4 max.	141.19×16.75	3.45×4.85	1/16	+5
LM018L	40×2	Gray	182×35.5×13 max.	154×15.3	3.2×4.85	1/16	+5
LM018XMBL[1]	40×2	New-gray	182×35.5×13 max.	154×15.3	3.2×4.85	1/16	+5
LM041L	16×4	Gray	87×60×12 max.	61.8×25.2	2.95×4.15	1/16	+5
LM044L	20×4	Gray	98×60×12 max.	76×25.2	2.95×4.15	1/16	+5

1 Super Twisted Nematic (STN).

LED Backlighted Versions

Part No.	No. of char. (Char. × line)	Display color	External dimensions W×H×T (mm)	Effective viewing area W×H (mm)	Character dimensions W×H (mm)	Driving method (Duty)	Recommended Power supply V_{DD}-V_{SS} (V)*
LM087LN	16×1	Gray	90×36×14 max.	64.5×13.8	3.07×6.56	1/16	+5,(+5)
LM086ALN	16×2	Gray	90×36×14 max.	64.5×13.8	2.95×3.8	1/16	+5,(−)
LM093LN	16×2	Gray	90×44×13.8 max.	61.0×15.3	2.96×4.86	1/16	+5,(+5)
LM091LN	20×2	Gray	126×39×14 max.	83×18.6	3.2×4.85	1/16	+5,(+5)
LM092LN	40×2	Gray	192×35.5×14 max.	154×15.3	3.2×4.85	1/16	+5,(+5)

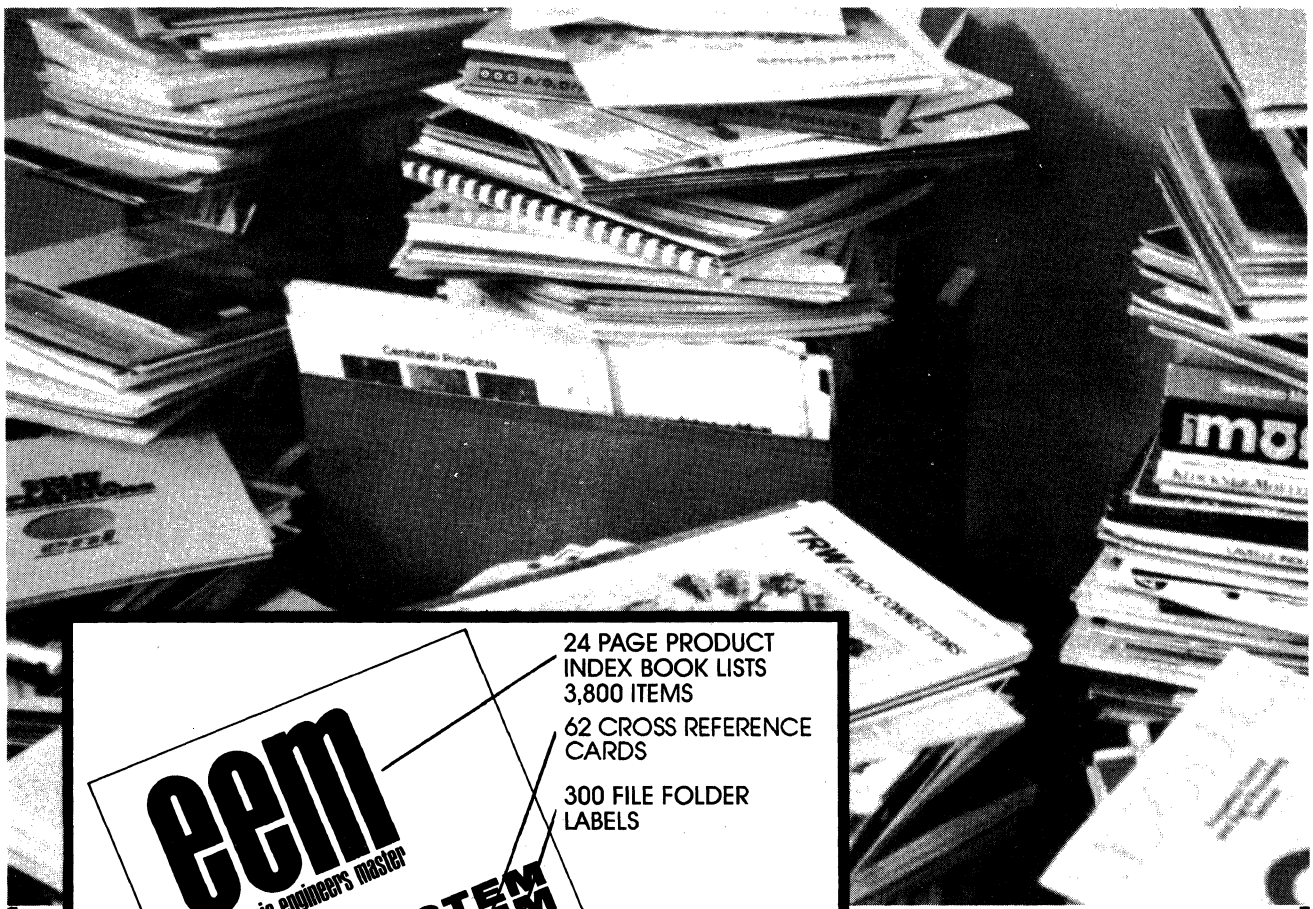
*(V_{LED})

Segment Display LCD Modules

Part No.	No. of char. (Char. × line)	Display color	External dimensions W×H×T (mm)	Effective viewing area W×H (mm)	Character dimensions W×H (mm)	Driving method (Duty)	Recommended Power supply V_{DD}-V_{SS} (V)*
LM039	16×1	Gray	87×27.5×11 max.	64.7×13.3	2.2×6.4	1/4	+5

Note: All part numbers listed above, unless otherwise noted, are Twisted Nematic (TN).

Hitachi America, Ltd., Electron Tube Division, 300 N. Martingale Road, Suite 600, Schaumburg, IL 60173 • 708/517-1144



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HOMALITE DISPLAY FILTERS AND SPECIFICATIONS

LOW REFLECTANCE CONTRAST ENHANCEMENT FILTERS

Product Description

In designing instruments with LED, LCD, CRT, gas discharge, plasma or vacuum fluorescent displays, an important design consideration is the human engineering factor.

For optimum contrast and readability, Homalite™ display filters are available in colors designed to meet requirements of a wide variety of displays. Glare is reduced with a low reflectance surface cast into the material —it can't chip or peel. By increasing contrast and reducing glare, the display can be read easily and accurately under varied lighting conditions.

Because Homalite materials are thermosetting plastics, the display filters are more rigid and resistant to impact, heat, abrasion and chemical attack than other plastic filters.

All our filters can be cleaned with soap and water, acetone, chlorinated and other commercial solvents or common glass cleaning preparations.

Homalite representatives can provide technical assistance to meet your design requirements. Sample chips in various colors are available upon request.

INSTRUMENT DISPLAY FILTERS

Sizes and Forms

Homalite can fabricate display filters to meet your requirements. This includes cutting to size, drilling holes, milling slots, steps and beveled edges, etc. Parts can be silkscreened, mirrored or coated for RFI/EMI shielding. See standard CRT filter sizes.

Homalite materials are available in standard thicknesses of 1/16", 3/32", and 1/8". Other thicknesses from 1/32" to over 2" are available upon request.

A protective, removable masking is available on one or both sides of fabricated parts. If masking is required, please specify when ordering.

If you choose to fabricate your own display filters, you can order Homalite materials in sheet form in two sizes: 21" x 31" and 33" x 45". Sheets will be supplied with masking on both sides. Instructions for fabrication are available upon request.

Filter Colors

Homalite filters are available In a wide range of standard colors which are designed for use with commonly available displays. Homalite can also color match and prepare filter material for specific application requirements or to duplicate the color of existing filters. Choosing the proper color will give sharp, clear characters with enhanced contrast between the information displayed and the background.

Light Emitting Displays and CRT'S

An important consideration in choosing the filter shade is the environment where the instrument will be used. For instance, if the display will be viewed in bright sunlight, you would select a darker shade than if the display were used in a room with fluorescent lighting.

Standard colors and spectral curves are as displayed. However, we would be pleased to match a specific color or work with you on a shade that meets your special application requirements.

Liquid Crystal Displays

Although LCD's do not emit light, reduction of glare from ambient light greatly improves readability. Homalite materials with the LR finish in clear or light gray (1295) are recommended for this type of display.

Spectral Transmission Data

Color	Shade	% of Transmission	Wavelength Nanometers
Gray	1245	45	N/A
	1250	22	N/A
	1265	30	N/A
	1295	60	N/A
Green	1425	25	565
	1436	36	500
	1440	40	565
	1452	50	505
Red	1600	44	655
	1670	71	655
Amber	1709	24	575
	1720	34	565
	1726	46	565
	1795	25	565
Blue	1500	55	450
	1558	80	440

Grades of Material

All grades shown below are available with LR (low-reflectance) surface.

	Description	Properties	UL Flammability Classification
H-100	Thermosetting polyester. Available in all colors.	General purpose applications. Excellent resistance to chemical attack. Scratch-resistant.	UL94HB
H-101	Thermosetting polyester. Available in all colors.	For high temperature applications. This self- extinguishing, fire retardant grade offers good heat distortion resistance.	UL94V-0 (thicknesses 1/8" and over) UL94HB (thicknesses up to 1/8")
H-911	Allyl diglycol carbonate. Available in clear and selected colors.	Highest optical qualities. Abrasion resistant—30 to 40 times more scratch-resistant than acrylics.	UL94HB

Low Reflectance Surface

Homalite filters reduce specular reflection associated with conventional face plates and filters. Unlike other filters, the low glare surface of Homalite filters is cast into the material. This surface is **not** a lamination or coating, so it cannot separate, chip, peel or rub off.

The Homalite low-reflectance surface, referred to as "LR", minimizes glare and improves readability.

Two low-reflectance surfaces are available.

LR-72—The most light diffusing surface. For mounting as close as possible to the light source, up to 1/2" distance.

LR-92—For mounting from 1/2" to 2" from the light source.

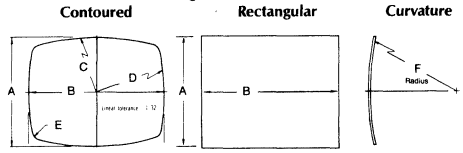
CRT FILTERS

Typical filter configurations for CRT sizes 5" to 19" are shown below in contoured and rectangular shapes. For 5" to 15" filters, the standard thickness is 1/16". For 19" filters, we recommend 3/32" thickness material. Other thicknesses available upon request.

When ordering filters, the letter C or R after the (Diagonal) Filter Size denotes contoured or rectangular shape. The spherical radius shown for each size applies to both contoured and rectangular shapes.

Homalite will fabricate filters to the exact size and shape requirement of specific monitors. For best results, please include measurements (width, length and spherical radius) to ensure proper fit. A mechanical assembly drawing of the monitor showing dimensions and mounting arrangements can be useful in establishing the proper configuration for your filter.

Filters can be supplied with or without adhesive tape for mounting.



Standard Dimensions*	Filter Size (Diagonal) 5"	9"	12"	15"	19"
A	3.62	5.87	7.88	9.50	12.87
B	4.62	7.97	10.32	11.83	15.97
C	14.19	22.00	39.00	60.00	15.00
D	13.38	22.00	18.00	49.00	32.60
E	0.44	0.68	0.75	0.81	1.50
F	14	27	25 or 24	25 or 24	47/21**

* All linear tolerances ±.030"
Curvature radius tolerance (F) ±1"

** Compound Radius

How to Order

When placing an order for Homalite filters, please include the following information:	Example
1. Material grade	H 100
2. Type of LR surface	LR 72
3. Color number (or clear)	1265
4. Masking required (one side or both sides)	2 Sides
5. Size: For fabricated filters, indicate width x length, thickness and tolerances. Please include drawing if available (Preferred)	10" x 8" ±.030" x .062" ±.015"
For sheet material, indicate either 21" x 31" or 33" x 45" and thickness	21" x 31"
For standard CRT applications, include diagonal size and whether filter shape is contoured (C) or rectangular (R)	12" R

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Send For Engineering Bulletin 126-128 for Spectral Transmission Curves and Engineering Bulletin 135 for Material Properties Chart

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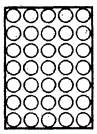
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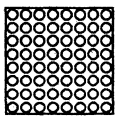
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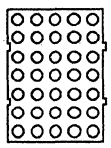
Dot Matrix Displays

0.7″ to 4.6″ high with dots from 2 to 20 mm diameter.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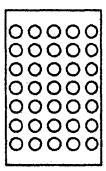
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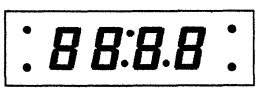
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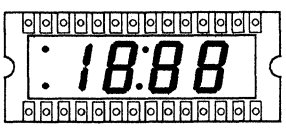
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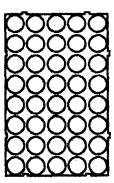
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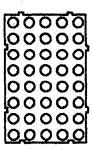
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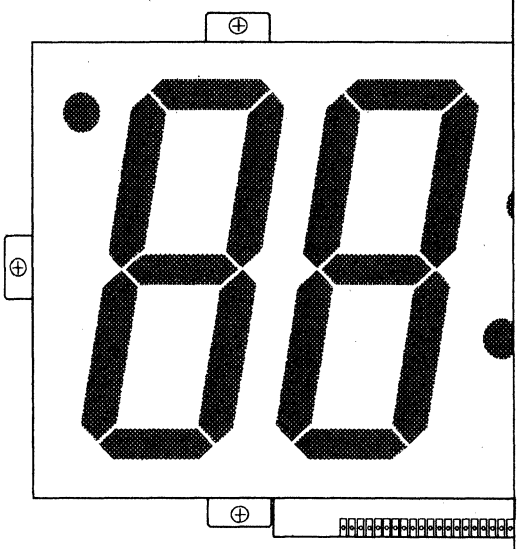

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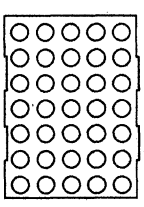
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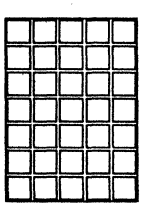
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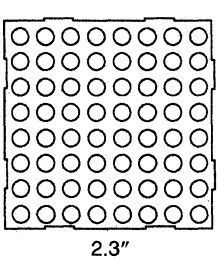
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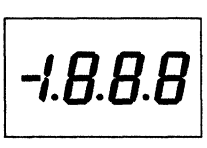

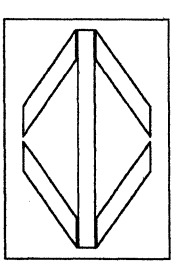



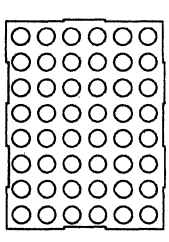
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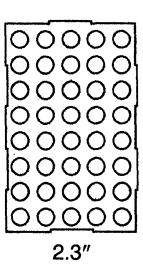
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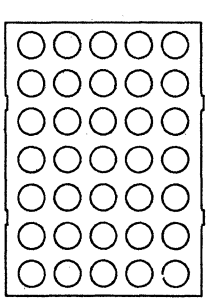
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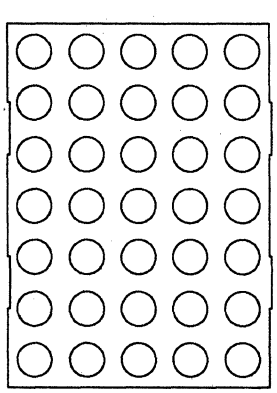
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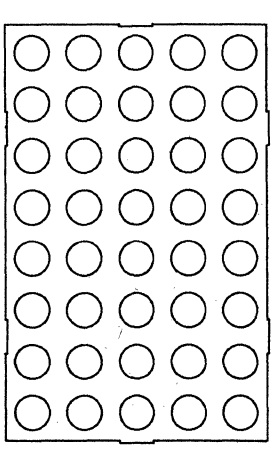
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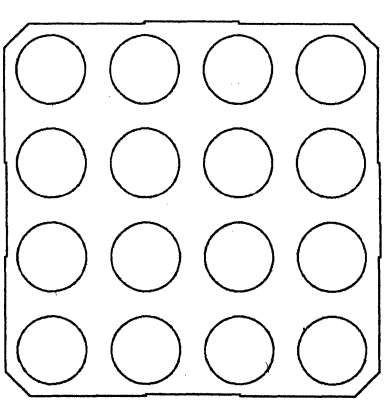
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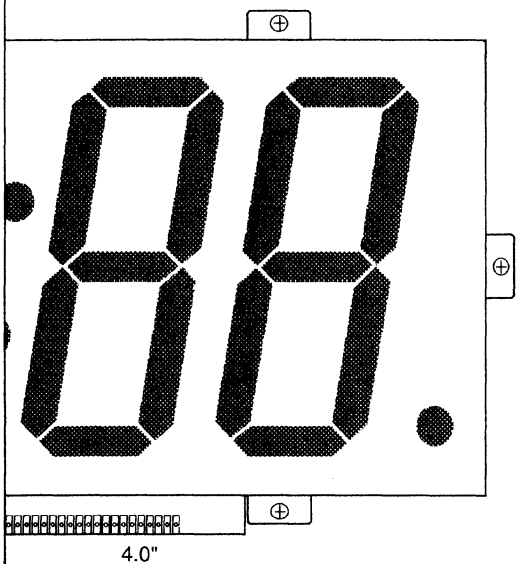
Clock Displays:
Character heights from 0.25 to 4″.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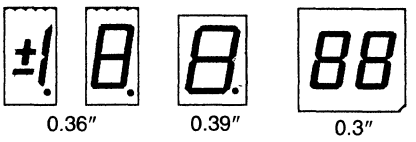
0.5" to 0.9"


1.8"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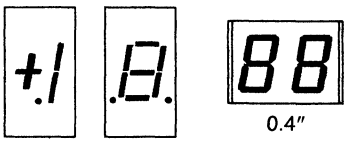
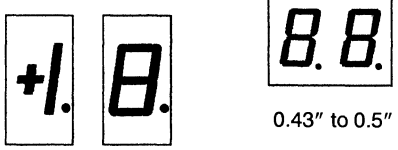
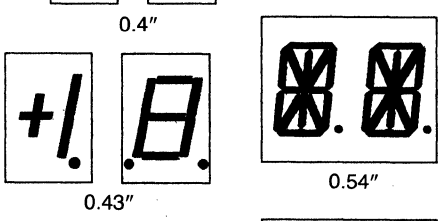
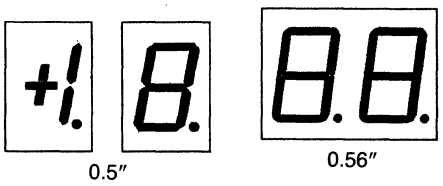

0.3″ 0.4″

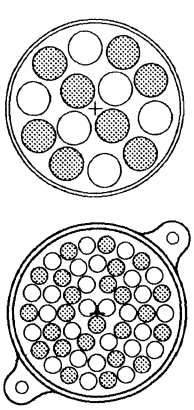

0.4″ 0.43″ to 0.5″

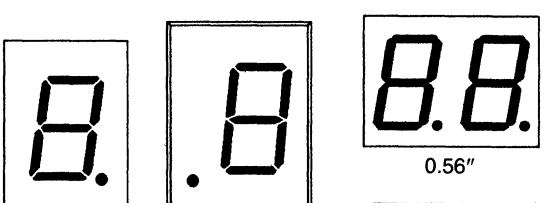
Segmented Displays:
0.27 to 4.0″ high characters in 1, 1½, 2, 3, & 4 digit configurations.

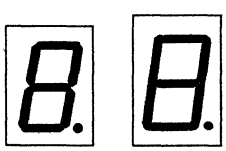

0.43″ 0.54″

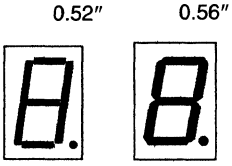

0.5″ 0.56″

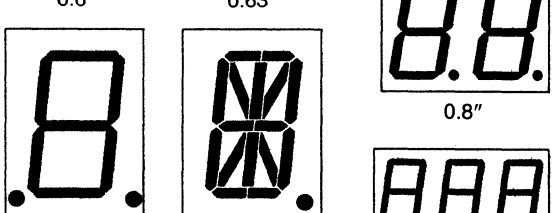
Lamp Clusters:
1 & 2″ diameter clusters with various lamp combinations.

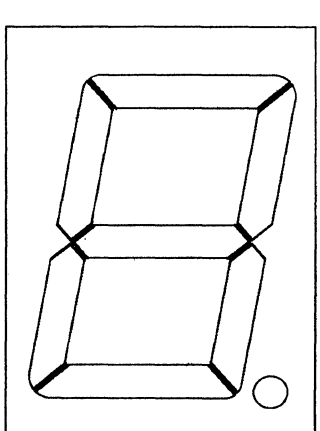


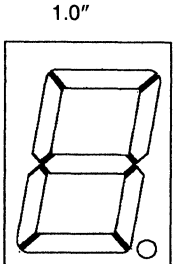

0.6″ 0.63″ 0.56″

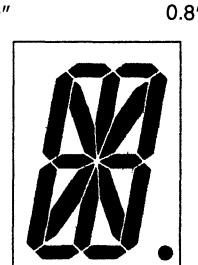

0.52″ 0.56″

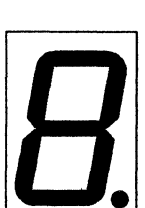

1.0″ 1.0″

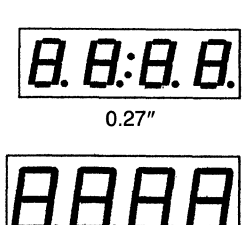

0.8″ 0.8″ 0.8″ 0.56″


4.0″


2.3″


2.3″


1.2 to 1.8″


0.27″ 0.56″

Component Products Division

LED Displays
HERCULES™ LED Displays offer a complete assortment of numeric and alphanumeric devices ranging from .27″ to 4.00″. Equivalents to popular HP, GI, TI, and Siemens displays are available in common anode and cathode configurations.

Liquid Crystal Displays
POLARIS™ LCDs with permanently fixed DIL pins are available in an assortment of models with character heights of .25″ to 3.0″ and 1 to 16 digits. Featured are reflective and transflective polarizers with commercial and high temperature/humidity fluids for almost every environment. Custom requirements are welcomed.

DAYSTAR™ ASCII LCD modules are intelligent modules available in 1×16, 2×16, 2×20, 2×40, 4×20 and 4×40 character configurations.

Liquid Crystal Display/Switch
Newest to CPD's product line is the PIXIE™ programmable graphic LCD switch module and intelligent controller.

The PIXIE integrates a low power LCD, utilizing super-twist technology, with LED backlighting for low lighting conditions and a custom IC driver into the keycap of a momentary contact switch providing a user friendly method for control and display applications.

Each PIXIE consists of 864 pixels in a 24×36 pixel matrix which provdes full screen graphics, or a 5×7 alphanumeric display, with 3 lines of up to 6 characters per line.

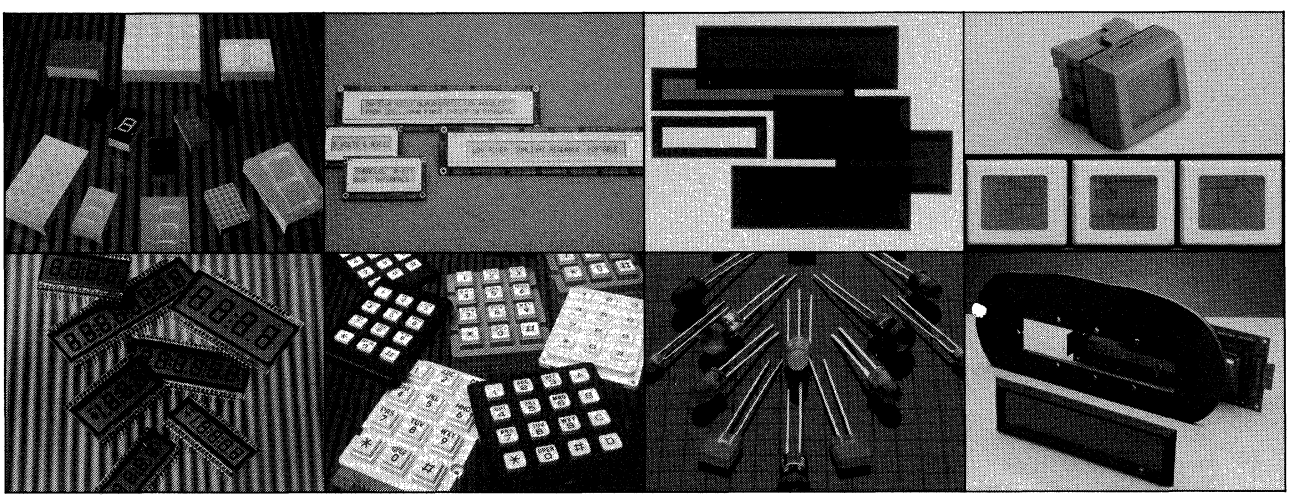
The PIXIE Controller is a graphics interface controller designed to interface to the IEE PIXIE Switch. The user can control up to 16 switches from one controller. The Controller allows the user access to the 127 factory generated graphics. It also allows the user to generate 128 graphics in either or both the GRAPHICS and TEXT mode when used with the PIXIEtalk™ software program. The IEE PIXIE Controller operates in conjunction with most computers and terminals available today.

Quality Keyboards
THRIFTSWITCH™ Keyboard products are offered in a variety of styles in 3×4 and 4×4 key formats. Both conductive silicone rubber and metal contact types with double-shot molded keys are offered with all popular output codes and most models can be supplied with an electrostatic shield to protect sensitive circuitry.

LED & Incandescent Lamps/Indicators
These high quality products are available in a range of styles, colors, and industry standard sizes from T-¾ (.094″ Dia.) to T-2 (.250″ Dia.). Various voltages and currents are available with complementary lens caps and support hardware for panel mounting. Contact factory for new surface mount LED lamps.

Display Mounting Hardware
ATLAS™ Mounting Hardware consists of a single piece, molded frame construction accommodating LED, LCD and Incandescent displays in widths up to 8 digits. Each is fitted with a colored filter or clear viewing screen available in polarized and unpolarized materials. Mounting rails, sockets, and several decoder/driver assemblies are available to complement the individual display component.

ATLAS 2™ Universal Sealed Bezel Systems has a full range of bezel sizes fitting popular display formats with custom designs available at surprisingly low cost. Eight different filter colors are offered in both standard plex and circular polarized material to improve your displays contrast ratio and reduce ambient glare. Each bezel system has threaded inserts on the backside and are available in both standard U.S. and metric versions simplifying attachment to the customer's front panel.



LED Displays | **LCD ASCII Modules** | **Display Mounting Hardware** | **PIXIE LCD Graphic Switch**

LCD Numeric & Custom Displays | **3×4 & 4×4 Keyboards** | **LED & Incandescent Lamps & Indicators** | **Sealed Display Bezel Systems**

(See Keyboards and Keypads on page B•1814)

IEE® THE DISPLAY MAKERS™
INDUSTRIAL ELECTRONIC ENGINEERS, INC.
7740 Lemona Avenue
Van Nuys, California 91409-9234
Tel.: (818) 787-0311 • Telex: 6831955 IEE INTL
FAX: (818) 376-1075

Industrial Products Division

Intelligent Displays, and Much More
IEE's Industrial Products Division offers a broad range of intelligent display modules, incorporating a variety of display technologies. Nearly all include on-board intelligent controllers to handle display control, refresh, and character generation. Most modules have on-board power converters. These features greatly simplify the customer's design tasks.

We also offer a wide assortment of accessories, including power supplies, contrast-enhancement filters, cables/connectors, and serial data converters. This comprehensive range of products, combined with the total customer support offered by our technical staff, helps make IEE the "one-stop" source for all your display needs.

Vacuum Fluorescent Family
The unbeatable combination of outstanding appearance, ease of use, and a broad choice of formats, have helped our FLIP™ intelligent VF display modules find wide use in applications such as industrial, medical and test equipment.

Display fields range from 10 to 240 bright, easy-to-read characters. The display color is a pleasant blue-green which may be filtered to any of a range of colors.

The FLIP product family includes 14-segment and second generation "No-Frills" budget lines, the "Industrial Strength" FLIP line, several ruggedized models, and a large group of extended operating-temperature range models. Our newest models take advantage of surface-mount technology, for the ultimate in compact packaging. Most of these models include enhanced features such as extended character sets and downloadable fonts.

Liquid Crystal Family
Our newest display technology is embodied in the DAYSTAR NOVA™ line of high-performance, ASCII-input LCD modules. Engineered for high reliability, they feature extra-large characters and an extra-wide operating-temperature range (−30 to +85°C).

These low-power, compact modules are ideal for battery-operated portable equipment, especially when sunlight readability is a must. Optional electroluminescent backlighting makes night-time viewing easy.

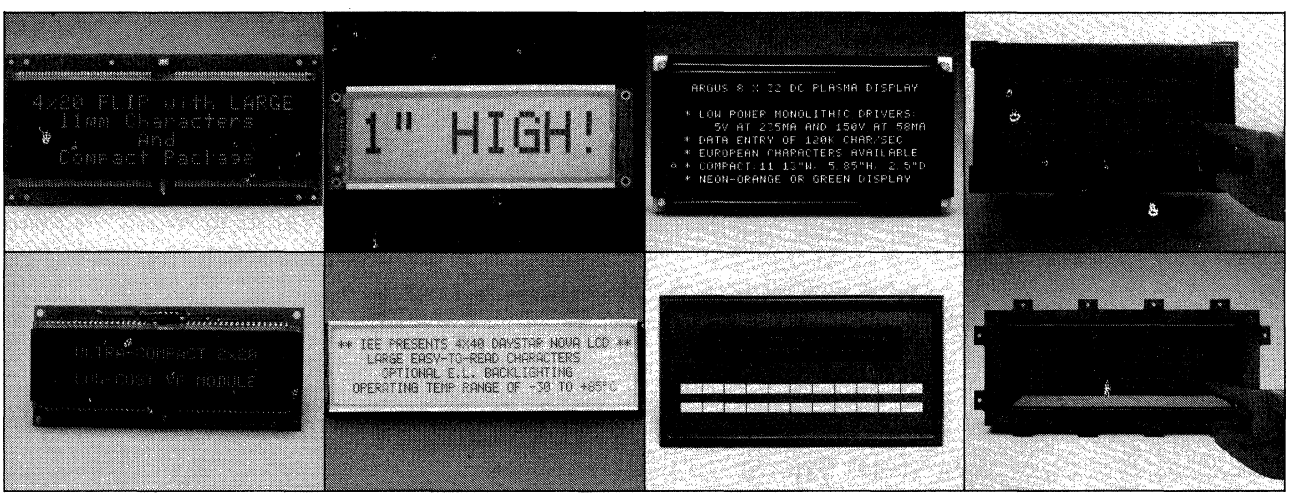
The SUPERNOVA™ family uses advanced LCD technology in the transmissive mode to create extra-large (4 to 6") characters for signs, message centers, and factory-floor annunciators. Many eye-catching colorful effects are possible using fluorescent backlighting.

DC Plasma Family
Especially well-suited to high-information-content applications, ARGUS™ DC plasma display modules use neon-orange or green 5×7 dot matrix panels to produce bright, easy-to-read, alphanumeric characters. Careful attention to package design has resulted in very compact modules.

In our most popular models, new high-voltage IC drivers have reduced power consumption considerably. ARGUS AIM™ modules require only low-voltage power supplies.

Interactive Display Modules
The PEP™ family of touch-entry display modules includes models based on ARGUS and FLIP displays. The newest 6×40 VF model is ultra compact, and features a sealed front-mount bezel. Coming soon are several graphic PEP modules using advanced high-brightness DC plasma technology.

Also new are the V.I.P.™ series of industrial mini-terminals. Ideal for operator interface panels, these inexpensive modules combine both display and data input functions in a single module. Several display formats and keypad layouts are available, user-changeable switch legends. Front-mounted versions with integral bezels are the latest addition to this family.



Large Character 4×20 VF Display	**Large Character, Wide Temperature 1×8 LCD Module**	**Low Power DC Plasma Display**	**Interactive Touch DC Plasma Display**
Low Cost 2×20 VF Display	**4×40, Wide Temperature LCD Module**	**Interactive Mini-Terminal**	**Interactive Touch VF Display Module**

(See Keyboards and Keypads on page B•1814)

THE DISPLAY MAKERS™
INDUSTRIAL ELECTRONIC ENGINEERS, INC.
7740 Lemona Avenue
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INFODEX

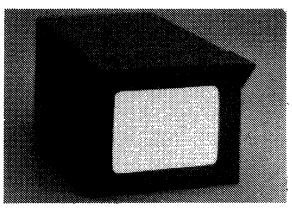
DISPLAY SYSTEMS TECHNOLOGIES

CRT & EL FLAT PANEL DISPLAYS

Military, Industrial or Medical Infodex can meet your needs.

CRT DISPLAYS

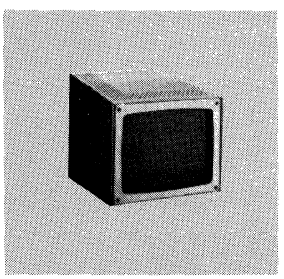
U.S. Army Cockpit TOW Missile Trainer



RD05-J5-149

5" diagonal raster CRT; ruggedized compact unit; 15.75KHz horizonal scan; sunlight readable; 28vdc

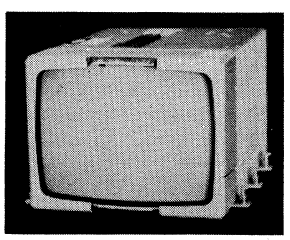
U.S. Air Force F-16 Training Simulator



RD07-J5/8-140

7" diagonal raster CRT; 15.75KHz and 26.25KHz horizontal scan rates; internal sensing of incoming line rate and automatic switching of scan to match incoming rate; 20MHz video BW; high resolution; 28vdc

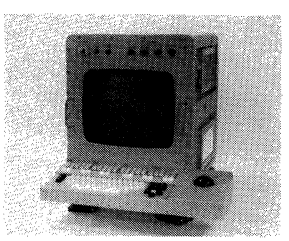
U.S. Navy Active Emission Sonar Display



RD09-M8-238

9" diagonal raster; MIL compliant; 26.25KHz horizontal scan; 25MHz video BW; 115V 3Ø 60Hz

U.S. Navy Shipboard Computer Display

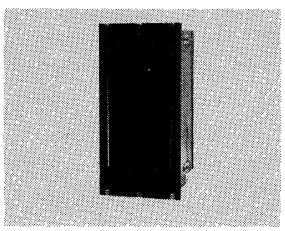


RD17-M10-214

17" diagonal raster CRT; 45MHz video BW; high resolution; MIL compliant; 50KHz horizontal scan; 115V 60Hz

ELECTROLUMINESCENT PANEL

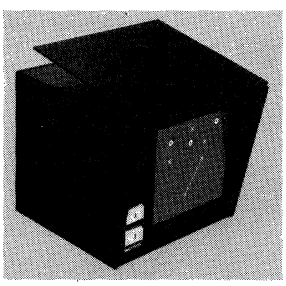
U.S. Navy Electronic Surveillance System



EL66M48

High brightness; 4 level gray scale, MIL-STD-1553B compatible

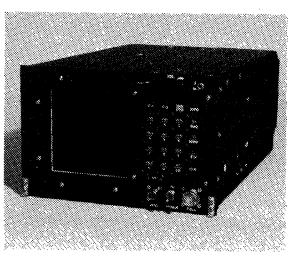
U.S. Army Vulcan Gun



EL66M44

High brightness; Custom interface; Used in rugged conditions: dust, rain & vibration

U.S. Navy EA6B Communication Jamming System



EL66J44A-064

High brightness; alpha numeric and graphic controller

MODEL	DISPLAY RESOLUTION	PEAK LUMINANCE*	CASE DIM. (METRIC)	ACTIVE PANEL AREA (METRIC)
EL66M44	256x256	110 FT-L	6"x6"x5" (150x150x130mm)	4"x4"(3.838x3.838) (97.5x97.5mm)
EL66M48	256x512	100 FT-L	6"x10"x3" (150x250x75mm)	4"x8"(3.838x7.676) (97.5x195mm)

*Unfiltered

Let us show you why Infodex should be your source for High Performance, High Resolution Monochrome and Color CRT, and Flat Panel EL displays...

INFODEX

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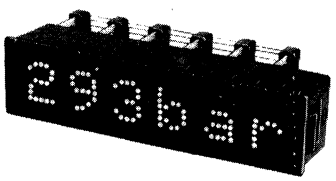
LED Displays

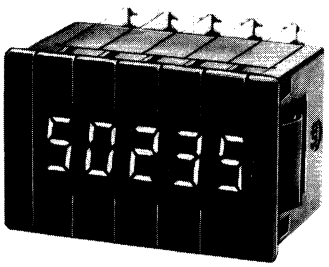
Custom configurations and easy installation. Individual digits snap together, then into panel cutout. Immediate price and delivery information.

Alphanumeric



33 X 20 mm Character Size
ASCII Decoder on-board
5 or 24 VDC operation

7 Segment



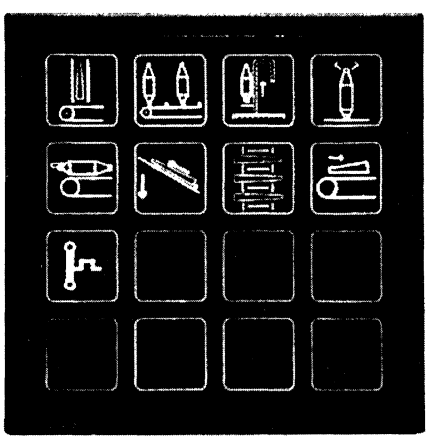
Direct Drive or Decoded
TTL, CMOS, or 24 VDC
Red or Green, 9-20 mm LED

Compact



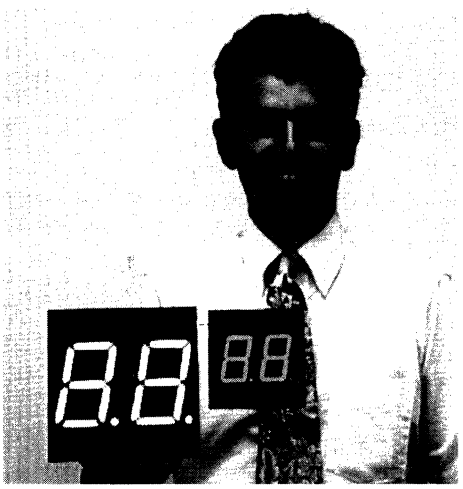
3 1/2 and 5 1/2 digits
Multiplexed BCD input
14.5 mm LEDs

Annunciator



Up to 16 custom symbols
Red, Green, or Yellow
LED Backlighting

Large Size



100 x 75 and 60 x 40 mm Character Size,
BCD logic, Timer and Counter functions,
24 VDC operation. Serial Interface.

call or send for free Design Guide

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201 Industrial Way West Eatontown, NJ 07724

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Tel. (908) 542-5151 Intl.
Fax (908) 542-2938

LITEON

Infrared Products

(1) Infrared Emitting Diodes

Package	Part No.	Photo	LENS Color	Wavelength mm	Aperture Radiant Indicance Eo Typ. mw/cm² 20 mA	Typical Viewing Angle $2\theta 1/2$
T-1, 3ϕ	LTE-209	F1	Clear	940	0.4	16°
T-1, 3ϕ	LTE-209C	F1	Smoke	940	0.4	16°
T-1, 3ϕ	LTE-239	F2	Clear	880	0.6	16°
T-1, 3ϕ	LTE-239C	F2	Smoke	880	0.6	16°
T-1, 3ϕ	LTE-4206	F3	Clear	940	1.0	16°
T-1 3/4, 5ϕ	LTE-2871	F4	Clear	940	1.6	16°
T-1 3/4, 5ϕ	LTE-2871C	F4	Smoke	940	1.6	16°
T-1 3/4, 5ϕ	LTE-4208	F5	Clear	940	1.4	20°
T-1 3/4, 5ϕ	LTE-4208C	F5	Smoke	940	1.4	20°
T-1 3/4, 5ϕ	LTE-4238	F5	Clear	880	1.4	20°
T-1 3/4, 5ϕ	LTE-4238C	F5	Smoke	880	1.4	20°
T-1 3/4, 5ϕ	LTE-5208A	F5	Clear	940	1.0	40°
T-1 3/4, 5ϕ	LTE-5208AC	F5	Smoke	940	1.0	40°
T-1 3/4, 5ϕ	LTE-5238A	F5	Clear	880	1.0	40°
T-1 3/4, 5ϕ	LTE-5238AC	F5	Smoke	880	1.0	40°
Side Look	LTE-302	F6	Clear	940	0.15	40°

(2) Phototransistors

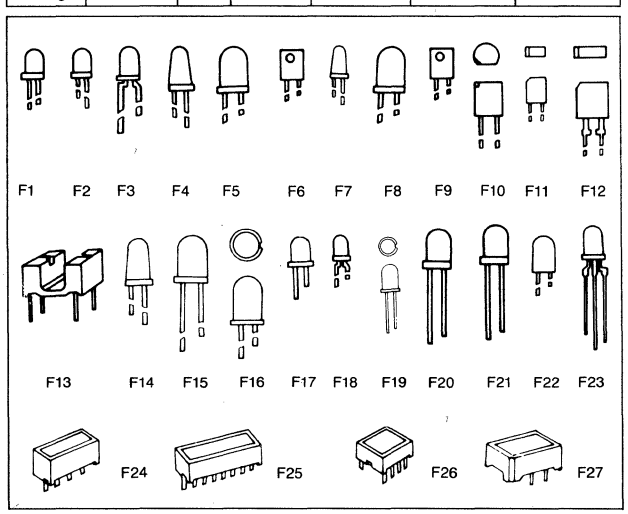
DEVICE		Photo	Light Current Typ. @ Ee = 1mw/cm²	Dark Current Max. @ Vce = 10V	V_{CE} (sat) Max. @ Ic = 0.5mA	V_{CEO} Min. @ Ic = 1mA
Package	Part No.					
T-1 3ϕ	LTR-209	F7	2 mA	100 nA	0.4 V	30 V
T-1 3/4 5ϕ	LTR-3208	F8	4 mA	100 nA	0.4 V	30 V
Side Look	LTR-301	F9	1 mA	100 nA	0.4 V	30 V

(3) Photodiodes

DEVICE		Photo	Is Typ. @ Ee = 0.05mw/cm²	Id (R) Max. @ V_R = 10V	$V_{(BR)R}$ Min. @ I_R = 100μA	Peak Sensitivity Wavelength λP Typ.
Package	Part No.					
Black Plastic	LTR-516AD	F10	2 μA	30 nA	30 V	950 nm
	LTR-526AD	F11	2 μA	30 nA	30 V	950 nm
	LTR-536AD		2 μA	30 nA	30 V	950 nm
	LTR-546AD	F12	2 μA	30 nA	30 V	950 nm

(4) Transmissive Switch

DEVICE		Photo	I_{RED} V_F Typ. @ I_F = 20 mA	Sensor V Min. @Le = 1 mA	Sensor Veco Min. @ Ie = 100 μA	Ic Min. @I_F = 20mA V_{CD} = 5V
Package	Part No.					
Housing Package	LTH-301	F13	1.6 V	30 V	5 V	500μA



LED Lamps and Light Bars

(1) Ultra Bright LED Lamps

Package	Photo	Part Number	Lens Colors	Intensity at If = 20 mA Typ: (mcd)
5ϕ Ultra Bright* LED Lamp	F14	LTL-353CKRL2	Clear-Non-Diffused	300
		LTL-353CKRH3	Clear-Non-Diffused	500
		LTL-353CKRH4	Clear-Non-Diffused	1000
	F15	LTL-4264H4	Red Transparent	270.0
		LTL-4264H3	Red Transparent	220.0
		LTL-4264L2	Red Transparent	150.0
		LTL-4264L1	Red Transparent	100.0
		LTL-4268H4	Clear-Non-Diffused	270.0
		LTL-4268H3	Clear-Non-Diffused	220.0
		LTL-4268L2	Clear-Non-Diffused	150.0
		LTL-4268L1	Clear-Non-Diffused	100.0
		LTL-4263	Red-Diffused	50
	F16	LTL-307C	Red-Diffused	38
3ϕ	F17	LTL-4262N	Red Transparent	80
		LTL-4266N	Clear-Non-Diffused	80

(2) Low Current LED Lamps

Package	Photo	Part Number	Lens Colors	Intensity at If = 20 mA Typ: (mcd)
T-1 ϕ	F18	LTL-4221NLC	Red Diffused	1.8
T-1 3/4	F19	LTL-307ELC	Red Diffused	2.0

(3) Dual Color Lamps

Package	Photo	Part Number	Lens Colors	Intensity at If = 20 mA Typ: (mcd)
Bipolar T-1 3/4	F-20	LTL-298E	Red Diffused	5.0
Bi-Color T-1 3/4 Standard Lamp	F21	LTL-298VJ	White Diffused	8.7
				1.2
		LTL-298WJ	White Diffused	8.7
				5.5
		LTL-293SJ	White Diffused	12.0
				19.0
Bi-color 4.6 ϕ	F22	LTL-313SJ	White Diffused	13.0
				38.0
Dual Color T-1 3/4	F23	LTL-52EG	White Diffused	5.0
				5.0

(4) Flash Lamps and Resistor Lamps

Flash Lamps		Blink Freq.	Lens Colors	Intensity Typ: (mcd)
Package	Part No.			
T-1 3/4	LTL-4263-FL	f = 2.2 HZ	Red Diffused	30
1" Lead	LTL-4213-FL	f = 2.2 HZ	Red Diffused	1.0
5ϕ	LTL-4233-FL	f = 2.2 HZ	Green Diffused	1.5

Liton offers 3ϕ and 5ϕ resistor lamps with operating voltage from 5V to 12V

(5) LED Light Bars

Package	Photo	Part Number	Lens Colors	Intensity at If = 20 mA Typ: (mcd)
8.9 x 3.8	F24	LTL-2300HR	White Diffused	9.0
		LTL-2500G	White Diffused	9.0
		LTL-2400Y	White Diffused	9.0
19.1 x 3.8	F25	LTL-2350HR	White Diffused	17.0
		LTL-2550G	White Diffused	17.0
		LTL-2450Y	White Diffused	17.0
8.9 x 8.9	F26	LTL-2655HR	White Diffused	17.0
		LTL-2855G	White Diffused	17.0
		LTL-2755Y	White Diffused	17.0
12.7 x 6.35 Rectangular Light Bar	F27	LTL-57173HR	Red Diffused	9.8
		LTL-54713G	Green Diffused	9.8
		LTL-53173Y	Yellow Diffused	9.8

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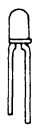
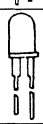
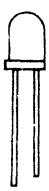
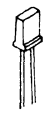
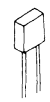
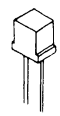
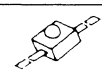
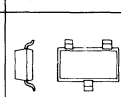
LED Lamps

Package	Photo	Part Number	Lens Colors	Intensity at If = 10mA Typ: (mcd)
T-1 Standard 0.5" Lead 3φ 0.1" Lead Pitch		LTL-201	Red Diffused	0.8
		LTL-211	Red Diffused	1.1
		LTL-221	Red Diffused	3.8
		LTL-231	Green Diffused	3.8
		LTL-232	Green Transparent	8.0
		LTL-251	Yellow Diffused	2.5
T-1 Standard 0.5" Lead 3φ 0.05" Lead Pitch		LTL-209	Red Diffused	0.8
		LTL-229	Red Diffused	3.8
		LTL-239	Greed Diffused	3.8
		LTL-259	Yellow Diffused	3.8
T-1 3/4 Standard 0.5" Lead 5φ 0.1" Lead Pitch		LTL-203	Red Diffused	0.8
		LTL-213	Red Diffused	1.1
		LTL-223	Red Diffused	3.0
		LTL-233	Green Diffused	3.0
		LTL-253	Yellow Diffused	3.0
T-1 Standard 1" Lead High Performance 3φ		LTL-4201N	Red Diffused	0.8
		LTL-4211N	Red Diffused	2.5
		LTL-4221N	Red Diffused	5.6
		LTL-4231N	Green Diffused	5.6
		LTL-4251N	Yellow Diffused	5.6
		LTL-4291N	Orange Diffused	5.6
T-1 3/4 Standard 1" Lead High Performance 5φ		LTL-4203	Red Diffused	0.8
		LTL-4213	Red Diffused	3.8
		LTL-4223	Red Diffused	8.7
		LTL-4224	Red Transparent	40.0
		LTL-4233	Green Diffused	8.7
		LTL-4234	Green Transparent	40.0
		LTL-4253	Yellow Diffused	8.7
		LTL-4254	Yellow Transparent	40.0
		LTL-4293	Orange Diffused	8.7
T-1 3/4 1" Lead Improved Bright 5φ		LTL-307E	Red Diffused	19.0
		LTL-307G	Green Diffused	12.6
		LTL-307Y	Yellow Diffused	12.6

Package	Photo	Part Number	Lens Colors	Intensity at If = 10mA Typ: (mcd)
Rectangular 2 x 5.0		LTL-3201A	Red Diffused	0.2
		LTL-3211A	Red Diffused	0.6
		LTL-3221A	Red Diffused	1.7
		LTL-3231A	Green Diffused	3.8
		LTL-3251A	Yellow Diffused	3.8
Rectangular 2.5 x 7.1		LTL-3213A	Red Diffused	0.4
		LTL-3223A	Red Diffused	1.7
		LTL-3233A	Green Diffused	1.7
		LTL-3253A	Yellow Diffused	1.7
		LTL-3293A	Orange Diffused	1.7
Rectangular 1.0 x 5.0		LTL-3217A	Red Diffused	0.8
		LTL-3237A	Green Diffused	1.7
		LTL-3257A	Yellow Diffused	1.7
		LTL-3277A	Amber Diffused	1.7
		LTL-3297A	Orange Diffused	1.7
Square Type 5.0 x 5.0		LTL-9213A	Red Diffused	0.6
		LTL-9223A	Red Diffused	1.7
		LTL-9233A	Green Diffused	1.7
		LTL-9253A	Yellow Diffused	1.7
		LTL-9293A	Orange Diffused	1.7
Rectangular Type (220" x 125") 5.6 x 3.2		LTL-33221AA	Red Diffused	5.6
		LTL-33231AA	Green Diffused	5.6
		LTL-33251AA	Yellow Diffused	5.6
Axial Subminiature 1.9φ		LTL-93BEK1	Water Clear	12.5
		LTL-93BGK1	Water Clear	15.0
		LTL-93BYK1	Water Clear	8.5
SOT-23 Surface Mount		LTL-907PK	Water Clear	1.7
		LTL-907LK	Water Clear	2.0
		LTL-907EK	Water Clear	2.0
		LTL-907NK	Water Clear	3.5

DOT MATRIX

Digit Picture	High Eff. Red Or Bright Red (GAP)		Green		Yellow		Orange		Description
	Part Number	Iv/Dot Ip = 48mA 1/8 Duty	Part Number	Iv/Dot Ip = 48mA 1/8 Duty	Part Number	Iv/Dot Ip = 48mA 1/8 Duty	Part Number	Iv/Dot Ip = 48mA 1/8 Duty	
0.3" (5 x 7)	LTP-305HR	1600µcd @ 10mA	LTD-305G	1600µcd @ 10mA					Anode Column, Cathode Row
0.7" (5 x 7) (2φ each dot.)	LTP-747HR LTP-757HR	2000µcd @ 10mA	LTP-747G LTP-757G	2000µcd @ 10mA	LTP-747Y LTP-757Y	2000µcd @ 10mA	LTP-747E LTP-757E	2000µcd @ 10mA	Anode Column, Cathode Row Cathode Column, Anode Row
1.2" (5 x 7) (3φ each dot)	LTP-1457AHR LTP-1557AHR	3000µcd @ 10mA	LTP-1457AG LTP-1557AG	3000µcd	LTP-1457AY LTP-1557AY	3000µcd	LTP-1457AE LTP-1557AE	3000µcd	Anode Column, Cathode Row Cathode Column, Anode Row
2.0" (5 x 7) (5φ each dot)	LTP-2057AHR LTP-2157AHR	4000µcd @ 10mA	LTP-2057AG LTP-2157AG	4000µcd @ 10mA	LTP-2507AY LTP-2157AY	4000µcd @ 10mA	LTP-2057AE LTP-2157AE	4000µcd @ 10mA	Anode Column, Cathode Row Cathode Column, Anode Row
2.3" (5 x 8) (5φ each dot.)	LTP-2058AHR LTP-2158AHR	4000µcd @ 10mA	LTP-2058AG LTP-2158AG	4000µcd @ 10mA	LTP-2058AY LTP-2158AY	4000µcd @ 10mA	LTP-2058AE LTP-2158AE	4000µcd @ 10mA	Anode Column, Cathode Row Cathode Column, Anode Row
2.3" (8 x 8)	LTP-2088AHR	4000µcd @ 10mA	LTP-2088AG	4000µcd @ 10mA	LTP-2088AY	4000µcd @ 10mA	LTP-2088AE	4000 mcd @ 10mA	Anode Column, Cathode Row
3.7" (16 x 16) (5φ each dot)	LTP-370FFHREC	3500µcd	LTP-370FFGEC	3500µcd	LTP-370FFYEC	3500µcd	LTP-370FFEEC	3500µcd	Anode Column, Cathode Row
4.0" (5 x 7)			LTP-4057AG LTP-4157AG	8000µcd @ 10mA	LTP-4057AY LTP-4157AY	8000µcd @ 10mA	LTP-4057AE LTP-4157AE	8000µcd @ 10mA	Anode Column, Cathode Row Cathode Column, Anode Row

Alpha Numeric

Digit Picture	Red		High Eff. Red. Or Bright Red (GAP)		Green		Yellow		Orange		Description
	Part Number	Avg. Iv. Type	Part Number	Avg. Iv Type	Part Number	Avg. Iv Type	Part Number	Avg. Iv Type	Part Number	Avg. Iv Type	
0.5"	LTP-587R	500µcd	LTP-587P	750µcd	LTP-587G	2000µcd	LTP-587Y	2000µcd	LTP-587E	2000µcd	C. Anode
	LTP-537R	@ 10mA	LTP-537P	@ 10mA	LTP-537G	@ 10mA	LTP-537Y	@ 10mA	LTD-537E	@ 10mA	C. Cathode
0.54"	LTP-3784R	400µcd			LTP-3784G	1800µcd			LTP-3784E	1800µcd	C. Cathode
	LTP-3784R	@ 10mA			LTP-3785G	@ 10mA			LTP-378E	@ 10mA	C. Cathode

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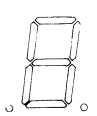
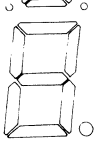
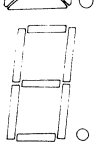
Seven Segment Single Digit LED Displays

Feature	Digit Size	Red		Bright Red		Green		Yellow		Orange		High Eff. Red		Description
		Part Number LTS.	Typ. Iv/SEG. @10mA	Part Number LTS.	Typ. Iv/SEG. @10mA	Part Number LTS.	Typ. Iv/SEG. @10mA	Part Number LTS.	Typ. Iv/SEG. @10mA	Part Number LTS.	Typ. Iv/SEG. @10mA	Part Number LTS.	Typ. Iv/SEG. @10mA	
	0.3″	311AR	500μcd	311AP	750μcd	311AG	2000μcd	311AY	2000μcd	311AE	2000μcd	311AHR	2000μcd	A
		312AR		312AP		312AG		312AY		312AE		312AHR		B
		313AR		313AP		313AG		313AY		313AE		313AHR		C
		315AR		315AP		315AG		315AY		315AE		315AHR		C
		316AR		316AP		316AG		316AY		316AE		316AHR		D
	0.36″	360R	500μcd	360P	750μcd	360G	750μcd	—	—	360E	2000μcd	360HR	2000μcd	E
		367R		367P		367G		—	—	367E		367HR		C
		368R		368P		368G		—	—	368E		368HR		F
	0.4″	4705AR	550μcd	4705AP	850μcd	4505AG	2200μcd	4805AY	2200μcd	4605AE	2200μcd	4905AHR	2200μcd	A
		4730AR		4730AP		4530AG		4830AY		4630AE		4930AHR		D
		4710AR		4710AP		4510AG		4810AY		4610AE		4910AHR		E
		4740AR		4740AP		4540AG		4840AY		4640AE		4940AHR		C
		4780AR		4780AP		4580AG		4880AY		4680AE		4980AHR		C
	0.43″	7751R	500μcd	7751P	750μcd	7671GN	2000μcd	7661YN	2000μcd	3731E	2000μcd	7651HR	2000μcd	B
		7760R		7760P		7673GN		7663YN		3733E		7653HR		C
		7756R		7756P		7676GN		7666YN		3736E		7656HR		A
	0.52″	546AR	500μcd	546AP	750μcd	546AG	2000μcd	546AY	2000μcd	546AE	2000μcd	546AHR	2000μcd	E
		547AR		547AP		547AG		547AY		547AE		547AHR		C
		548AR		548AP		548AG		548AY		548AE		548AHR		D
		549AR		549AP		549AG		549AY		549AE		549AHR		F
	0.56″	5301AR	600μcd	5301AP	950μcd	5601AG	2400μcd	5701AY	2400μcd	5501AE	2400μcd	—	—	E
		5303AR		5303AP		5603AG		5703AY		5503AE		—	—	C
	0.56″	6760R	600μcd	6760P	950μcd	6460G	2400μcd	6860Y	2400μcd	6660E	2400μcd	6960HR	2400μcd	E
		6780R		6780P		6480G		6880Y		6680E		6980HR		C
		6775R		6775P		6475G		6875Y		6675E		6975HR		D
		6795R		6795P		6495G		6895Y		6695E		6695HR		F
	0.8″	3401LR	600μcd	3401LP	950μcd	3401LG	2400μcd	3401LY	2400μcd	3401LE	2400μcd	—	—	B
		3403LR		3403LP		3403LG		3403LY		3403LE		—	—	G
		3406LR		3406LP		3406LG		3406LY		3406LE		—	—	A
	1.0″	10804R	1200μcd	10804P	2000μcd	10804G	4800μcd	10804Y	4800μcd	10804E	4800μcd	10804C	17000μcd	E
		10304R		10304P		10304G		10304Y		10304E		10304C		C
	1.02″	1720R	1200μcd	1720P	2000μcd	1720G	4800μcd	1720Y	4800μcd	1720E	4800μcd	—	—	E
		1740R		1740P		1740G		1740Y		1740E		—	—	D
		1723R		1723P		1723G		1723Y		1723E		—	—	C
		1743R		1743P		1743G		1743Y		1743E		—	—	F

Descriptions:

A — Universal, ±1 Overflow Rt. Hand Decimal
B — Common Anode, Rt. and Lt. Hand Decimal
C — Common Cathode, Rt. Hand Decimal
D — Common Anode, ±1 Overflow Rt. Hand Decimal
E — Common Anode, Rt. Hand Decimal
G — Common Cathode, ±1 Overflow Rt. Hand Decimal
H — Common Cathode
I — Common Anode
J — Common Cathode, Rt. Hand Decimal ±1.8
K — Common Anode, Rt. Hand Decimal ±1.8
L — Common Cathode, Alphanumeric Display
M — Common Anode, Alphanumeric Display

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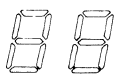
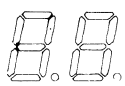
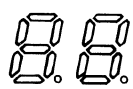
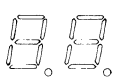
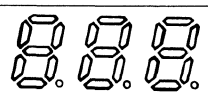
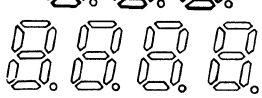
Seven Segment Dual Digit LED Displays

Feature	Digit Size	Red		Bright Red		Green		Yellow		Orange		High Eff. Red	
		Part Number LTD.	Typ. Iv/SEG. @10mA	Part Number LTD.	Typ. Iv/SEG. @10mA	Part Number LTD.	Typ. Iv/SEG. @10mA	Part Number LTD.	Typ. Iv/SEG. @10mA	Part Number LTD.	Typ. Iv/SEG. @10mA	Part Number LTD.	Typ. Iv/SEG. @10mA
	0.3″	322R 323R	400μcd	322P 323P	650μcd	322G 323G	1600μcd	—	—	—	—	—	—
	0.4″	432RC 482RC	220μcd	432PC 482PC	300μcd	432GC 482GC	800μcd	—	—	432EC 482EC	800μcd		
	0.43″	524R	400μcd	524P	600μcd	542G	1600μcd	524Y	1600μcd	524E	1600μcd	—	—
	0.5″	535R 585R	500μcd	535P 585P	750μcd	535G 585G	2000μcd	535Y 585Y	2000μcd	535E 585E	2000μcd	535HR 585HR	2000μcd
	0.56″	5321AR 5323AR 5327AR 5328AR	600μcd	5321AP 5323AP 5327AP 5328AP	950μcd	5621AG 5623AG 5627AG 5628AG	2400μcd	5721AY 5723AY 5727AY 5728AY	2400μcd	5521AE 5523AE 5527AE 5528AE	2400μcd	—	—
	0.56″	6710R 6740R 6730R 6750R	600μcd	6710P 6740P 6730P 6750P	950μcd	6410G 6440G 6430G 6450G	2400μcd	6810Y 6840Y 6830Y 6850Y	2400μcd	6610E 6640E 6630E 6650E	2400μcd	6910HR 6940HR 6930HR 6950HR	2400μcd

Seven Segment Multiple Digit LED Displays

Feature	Digit Size	Red		Bright Red		Green		Yellow		Orange		High Eff. Red	
		Part Number LTC.	Typ. Iv/SEG. @10mA	Part Number LTC.	Typ. Iv/SEG. @10mA	Part Number LTC.	Typ. Iv/SEG. @10mA	Part Number LTC.	Typ. Iv/SEG. @10mA	Part Number LTC.	Typ. Iv/SEG. @10mA	Part Number LTC.	Typ. Iv/SEG. @10mA
	0.52″	5636R	500μcd	5836P	750μcd	5836G	2000μcd	5836Y	2000μcd	5836E	2000μcd	5836HR	2000μcd
	0.52″	5737R	500μcd	5837P	750μcd	5837G	2000μcd	5837Y	2000μcd	5837E	2000μcd	5837HR	2000μcd

Photocouplers

Model No. 4N Series	Features	Package	*1 Output		With Base Terminal	Isolation Voltage Viso (Vrms)	Collector emitter Voltage VECO (V)	Current Transfer Ratio CTR		Response time t_r		Turn-on Time t_{on}	
		6-pin DIP	SPT	DPT				MIN. (%)	I_F (mA)	TYP. (Ωs)	R_L (Ω)	MAX. (μs)	I_C (mA)
LTV4N25	General purpose type	○	○		○	2,500	30	20	10	3	100	—	—
LTV4N26	General purpose type	○	○		○	1,500	30	20	10	3	100	—	—
LTV4N27	General purpose type	○	○		○	1,500	30	10	10	3	100	—	—
LTV4N28	General purpose type	○	○		○	500	30	10	10	3	100	—	—
LTV4N32	High transfer efficiency type	○		○	○	2,500	30	500	10	—	—	5	50
LTV4N33	High transfer efficiency type	○		○	○	1,500	30	500	10	—	—	5	50
LTV4N35	General purpose type	○	○		○	3,550	30	100	10	—	—	3	2
LTV4N37	General purpose type	○	○		○	1,500	30	100	10	—	—	3	2

Model No. 800 Series	Features	Package			*1 Output		Isolation Voltage Viso (Vrms)	Current Transfer Ratio CTR		Response time t_r	
		4-pin DIP	8-pin DIP	16-pin DIP	SPT	DPT		MIN. (%)	I_F (mA)	TYP. (μs)	R_L(Ω)
LTV814	AC input type (1-channel)	○			○		5,000	20	±1	4	100
LTV817	General purpose type (1-channel)	○			○		5,000	50	5	4	100
LTV827	General purpose type (2-channel)		○		○		5,000	50	5	4	100
LTV847	General purpose type (4-channel)			○	○		5,000	50	5	4	100

LITE-ON INC., 720 S. Hillview Drive, Milpitas, California 95035 • 408-946-4873 • FAX: 408-942-1527

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

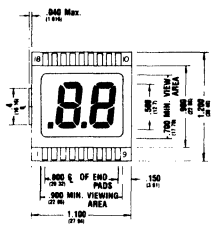
Yugoslavia Federal Institute of Standardization

LXD

Liquid Crystal Displays

direct drive displays

Part #29



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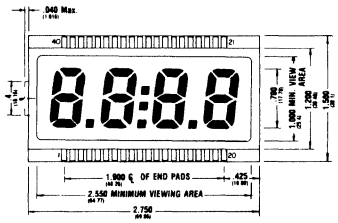

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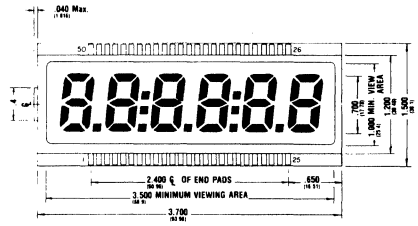

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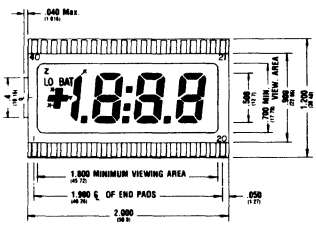

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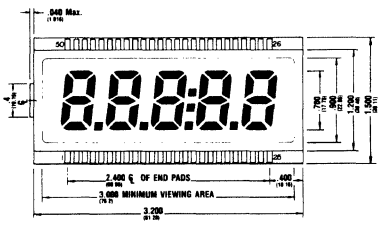

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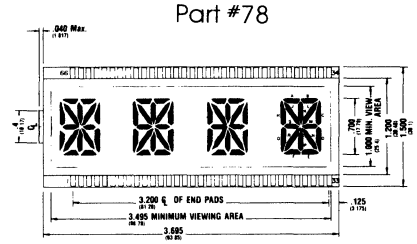

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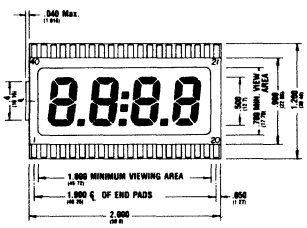

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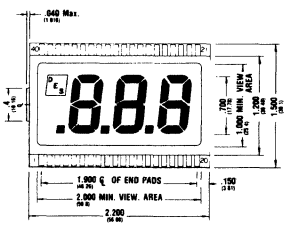

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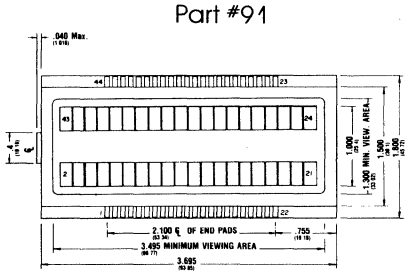

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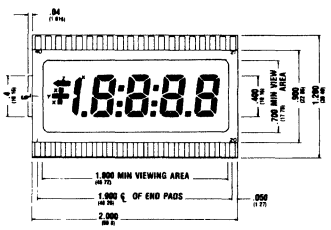

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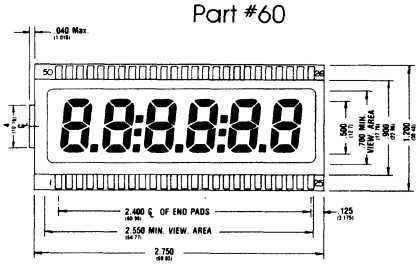
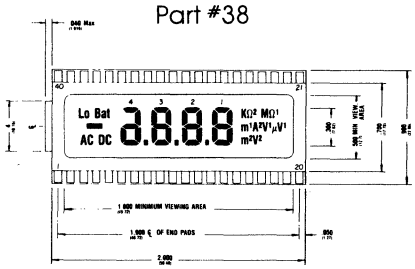


multiplexed displays

Part #38



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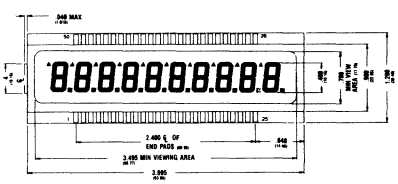

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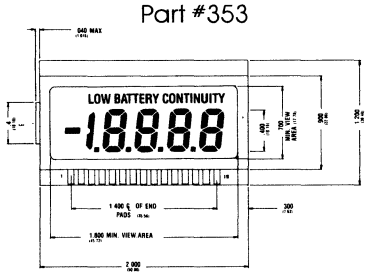
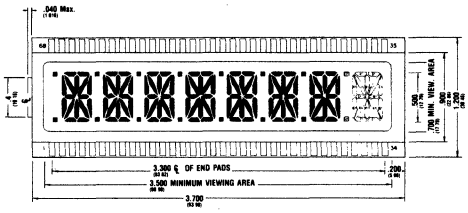


LXD

Liquid Crystal Displays

alphanumeric multiplexed displays

Part #76



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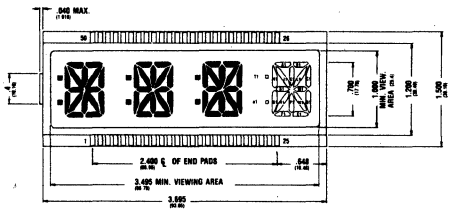
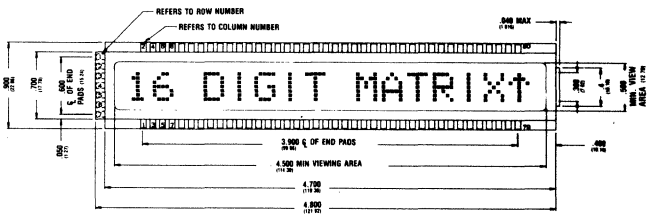


dot matrix displays

Part #94



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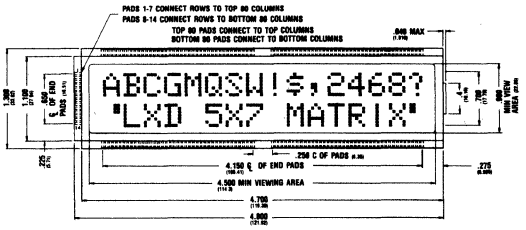

part numbering system

EXAMPLE 123 D 6 R 03 F GH MSZ

BASIC DISPLAY TYPE (123)

TERMINATION (D)

- D Standard pins (large glass on rear of display)
- E Standard edge type (large glass on front of display)
- H Standard edge type (large glass on front of display) with HEAT SEAL CONNECTOR ATTACHED.
- N Standard pin construction (large glass on rear of display) but with NO PINS ATTACHED
- R Standard pin construction (large glass on rear of display) with pins and RTV OVERCOAT

FLUID (6)

LIQUID CRYSTAL OPTIONS (R)

- 2 −40°C to +94°C Wide range, multiplexable, outdoor
- 3 −40°C to +85°C Cost effective, wide range, multiplexable, outdoor
- 5 −10°C to +60°C Standard inexpensive, not multiplexable
- 6 −40°C to +104°C Wide viewing angle
- 8 −20°C to +61°C Low threshold, multiplexable, indoor

VIEWING MODE

- D Dichroic Display
- F Positive Image, Transflective Display
- N Positive Image, Transmissive Display
- P Negative Image, Reflective Display
- R Positive Image, Reflective Display
- T Negative Image, Transmissive Display
- W Negative Image, Transflective Display

GLASS CODE (03)

F Fast response, wide viewing angle if applicable

POLARIZER (GH)

- H Reflective
- K Transflective
- GH High Humidity, Reflective
- KG High Humidity, Transflective

ADDITIONAL MODIFICATIONS (MSZ)

MODIFICATIONS

- B Clipped pin to 0.185"
- C Clipped pin to 0.160"
- D Clipped pin 0.125" minimum
- J JEDEC 4, MIL-STD-810C
- M Mask on front of display
- N Mask on rear of display
- *P Colored polarizer on front of display
- *R Colored reflector on rear of display
- S Customer part numer must appear on device
- Z Other unique customer requirements

2 Red	4 Yellow	6 Blue
3 Orange	5 Green	7 Violet

LXD INC., 7650 First Place, Cleveland, Ohio 44146 • 216-786-8700 • FAX 216-786-8711 • Sales 216-786-8710

Liquid Crystal Displays

capability	benefit
Wide Temperature Operation:	-40 to 104°C
First Minima Technology:	Widest viewing, fast response
Low Power:	CMOS drive, long battery life
Custom Design:	Uniquely identifies your product
Large Area Displays:	Sign and video applications

custom design services

LXD will design and manufacture custom displays to meet your special requirements. Possibilities include large area displays up to 13.5 inches square, special characters, legends and symbols which convey the exact information that you intend for your application.

Our application staff is available for consultation on design criteria and will help guide your selections to achieve the best mix of performance and economy.

LXD will prepare and submit engineering documents from our CAD design system for your approval which then become a part of the permanent record and act as a control documents on the design.

Prototype displays are produced using production tooling, equipment, methods and procedures. You can be assured that parts that you evaluate and qualify are "production quality" in every respect.

100% domestic manufacture

Every display that we sell is manufactured in our new 37,000 square foot factory near Cleveland, Ohio. A modern clean room facility and automated in-line process provide consistent quality and reliability in the finished product.

Critical and proprietary chemical formulations are maintained and produced in our on-site chemistry laboratory. These compounds make it possible for LXD displays to withstand test conditions of 121°C and 15 PSI, superheated steam, for over 100 hours without failure, (testing performed without polarizers).

Domestic manufacture also means that you face a shorter pipeline for material. Access and responsiveness are improved with phones being serviced until 6:00 PM (Eastern) for your convenience.

quality philosophy

"Quality" is more than a buzz-word, it is a state of mind that can be found throughout the LXD organization. We have implemented defined quality measures at every stage in our production process. Statistical Process Control, SPC, methods monitor activity in the factory and warn of variations in process or procedure.

Materials are qualified and with each new receipt inspected to assure continued conformance to specification. Vendor control and feedback are an integral part of LXD's quality program. Lot control throughout the factory allows traceability back to the raw materials.

100% of the product going through the factory receives inspection for electrical and mechanical characteristics. Aesthetic criteria are evaluated at several stages prior to shipment and special handling procedures and protective materials are used to prevent damage.

call LXD for your display needs

Contact LXD or see our authorized manufacturers representative in your area. We will be pleased to discuss your requirements and how LXD can serve you.

Reception: (216) 786-8700
Sales: (216) 786-8710
24 Hour FAX: (216) 786-8711

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94043 • 415/960-6000 • FAX: 415-965-6272

OPTOELECTRONIC PRODUCTS—FLUORESCENT INDICATOR PANEL DISPLAYS

Vacuum Fluorescent Indicator Panels are more effective and reliable than other display systems. An exceptionally wide variety of sizes, styles and configurations are available from NEC. The table below provides a brief glimpse at a few selected standard types. Hundreds of others are available.

The principal advantages of FIPs is their inherent brilliance and sharpness. They can be driven directly from MOS ICs and operate at voltages as low as 10V.

The normal color of an FIP is blue-green. This is filterable to red, orange or yellow with very little visual loss. The basic blue-green color is far less fatiguing to the human eye than colors in the red-orange end of the spectrum.

For complete details on NEC FIPs, ask for the FIP Selector Guide.

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions				
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)	L.P. (mm)	L.L. (mm)
FIP16X1EA	16	5×7	3.95	2.3	$26.0^{+0.8}_{-0.3}$	$82.0^{+0.8}_{-0.3}$	7.4 MAX.	2.54	14.0
FIP16X1CA	16	5×7	5.05	3.3	$34.0^{+0.8}_{-0.3}$	$100.0^{+0.8}_{-0.3}$	8.5 MAX.	2.54	14.0
FIP16XM1DA/FIP16D11X	16	5×7, DP, COMMA, CURSOR (▽)	11.3	7.25	43.2 MAX.	$208.0^{+0.8}_{-0.3}$	9.9 MAX.	2.54	14.0
FIP16X2BA	32 16×2 line	5×7	5.38	3.03	$39.0^{+0.7}_{-0.5}$	$98.0^{+0.8}_{-0.5}$	$7.8^{+0.7}_{-0.5}$	2.0	10.0
FIP16XM2AA/FIP32A11X	32 16×2 line	5×7, DP, COMMA, 2 line	11.3	7.25	60.0±1.0	208.0±1.0	13.0 MAX.	2.54	14.0
FIP20X1DB	20	5×7	9.0	6.3	41.0±0.5	$208.0^{+1.0}_{-0.5}$	8.0±0.7	2.54	14.0
FIP20X1KA	20	5×12	15.85	6.4	42.4±1.0	208.0±1.0	9.5±0.7	2.54	14.0
FIP20X1LB	20	5×7	5.0	3.5	$20.5^{+0.7}_{-0.5}$	$115.7^{+0.8}_{-0.5}$	6.1±0.7	2.54	6.2
FIP20X2CA	40 20×2 line	5×7, DP, COMMA, 2 line	11.3	7.25	60.0±1.0	252.0±1.0	12.0 MAX.	2.54	16.0
FIP20X2AA/FIP40C5X	40 20×2 line	5×7, 2 line	5.05	3.55	$41.0^{+0.8}_{-0.3}$	$125.0^{+0.8}_{-0.3}$	7.8±0.7	2.54	14.0
FIP18X2AA	36 18×2 line	5×7, DP, COMMA, 2 line	9.1	6.4	60.0±1.0	208.0±1.0	11.3±0.7	2.54	14.0
FIP20X3AA/FIP60A5X	60 20×3 line	5×7, 3 line	5.05	3.55	49.0±1.0	138.0±1.0	11.0 MAX.	2.0	10.2
FIP20X4AA	80 20×4 line	5×7, 4 line	11.3	7.25	90.0±1.0	240.0±1.0	13.3±0.7	2.54	10.0
FIP40X1AA/FIP40A5X	40	5×7, CURSOR	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0±0.7	10.0 MAX.	2.54	7.0
FIP40X1DA/FIP40E5X	40	5×7	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0±0.7	10.0 MAX.	2.54	8.76

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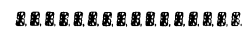
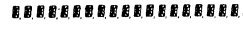
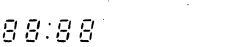
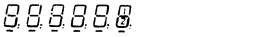
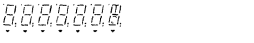
OPTOELECTRONIC PRODUCTS - FLUORESCENT INDICATOR PANEL DISPLAYS (cont.)

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions				
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)	L.P. (mm)	L.L. (mm)
FIP40X2CC	80 40×2 line	5×7, CURSOR	5.05	3.55	$49.0^{+0.8}_{-0.3}$	220.0±0.7	12.2 MAX.	2.54	14.0
FIP40X6AA	240 40×6 line	5×7, CURSOR, 6 line	5.0	3.5	90.0 MAX.	250.0±1.0	14.0 MAX.	2.0	20.0
FIP128GX20AA/ FIP36A10XT	—	128×20, GRAPHIC	29.7	191.7	60.0±1.0	238.0±1.0	13.0 MAX.	2.54	14.0
FIP48GX7AA/FIP48A8XT	—	48×7, GRAPHIC	7.9	57.1	34.0±1.0	93.0±1.0	9.5 MAX.	2.54	7.4
FIP16A5R FIP16A5CR	16		5.0	3.0	20.0±1.0	110.0±1.5	8.0 MAX.	2.54	10.0
FIP16A11R	16		10.7	6.35	31.0±1.0	200.0±1.5	8.0±0.7	2.54	7.4
FIP16B13R	16		12.5	7.0	33.0±1.0	205.0±1.0	10.0 MAX.	5.08	10.0
FIP20B6R	20		6.0	3.0	22.8±1.0	134.0±1.0	9.2 MAX.	2.54	14.0
FIP20B9AR	20		9.0	5.0	33.0±1.0	205.0±1.0	9.6 MAX.	2.54	14.0
FIP80B5R	80 40×2 line	14 segment CURSOR, COMMA, 2 line	5.0	3.0	39.0±1.0	250±1.0	9.7±0.7	2.54	10.0
FIP4H5	4		5.0	2.5	14.5±1.0	41.0±1.0	6.5±0.7	2.54	8.0
FIP4Q8S FIP4Q8AS	4		8.0	4.4	20.0±1.0	48.0±1.0	6.5±0.7	2.54	8.2 5.0
FIP4F8S	4		7.6	3.6	24.5±1.0	55.4±1.0	$6.5^{+0.5}_{-1.0}$	2.54	8.7
FIP4C9B	4		8.5	5.0	28.5±1.0	78.2±1.0	7.5±0.7	2.54	20.0
FIP5B15	5		15.0	8.0	33.0±1.0	98.0±1.0	7.8±0.7	2.54	5.2
FIP6C13	6		12.5	6.8	33.0±1.0	98.0±1.0	7.8±0.7	4.0	10.5
FIP7B13	7		13.0	6.0	33.0±1.0	98.0±1.0	8.0±0.7	2.54	7.4

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94043 • 415/960-6000 • FAX: 415-965-6272

OPTOELECTRONIC PRODUCTS,—FLUORESCENT INDICATOR PANEL DISPLAYS

World's first Chip-In-Glass FIP Modules give you beauty that lasts.

NEC has removed something that used to stand between you and truly reliable fluorescent displays. We took the anode and grid driver ICs out of their packages. Then mounted the bare chips directly on the display substrate. Result: a trimmed-down, cost-efficient display that solves a host of reliability problems.

Now, for the first time, the display drivers are on-board —in a vacuum-sealed glass envelope that provides the ideal protective environment. On-board ICs permit a drastic reduction in the number of lead terminals. By reducing leads, we further increase dependability. Create a more compact design. And lower costs to you.

MINI-MODULES: UP TO 50% SMALLER AND 33% LIGHTER.

We use surface-mount technology to trim our modules even more. Board height is up to 50% less than conventional modules and weight is reduced by up to 33%.

Chip-In-Glass FIPs come in four models: 20 characters x 1 line; 20 x 2; 40 x 1; or 40 x 2. All models offer a 5 x 7 dot character format. The display is brilliant and easy to read from virtually any angle.

FIPs run on a 5V power source. Interface readily with your system bus. Execute numerous commands. Fonts include: ASCII-7, ECMA-7 (General European, German, Scandinavian, Spanish) and JIS.

If you want beauty that lasts through the years, get the bare facts on NEC's Chip-In-Glass FIP modules.

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions		
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)
FC20X1RA-AB	20	5 x 7 DOT MATRIX, CURSOR	5.05	3.55	29	194	24
FC20X1SA-AB	20	5 x 7 DOT MATRIX	9	6.3	30	259	24
FC20X2JA-AB	40	5 x 7 DOT MATRIX	5.05	3.55	34	194	24
FC40X1LA-AB	40	5 x 7 DOT MATRIX, CURSOR	5.05	3.55	29	280	24
FC40X2EA-AB	80	5 x 7 DOT MATRIX, CURSOR	5.35	3.55	40	270	28

LARGE MODULES AND GRAPHICS

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions		
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)
FM40X6AA-FB	240	5 x 7 DOT MATRIX, CURSOR	5.0	3.5	110	264	45
FM80X2AA-A	160	5 x 7 DOT MATRIX, CURSOR	3.5	2.05	66	388	43
FM180GX48BA-CA	GRAPHIC	180 x 48 DOT MATRIX	—	—	90	200	45
FM240GX64AA-AA	GRAPHIC	240 x 64 DOT MATRIX	—	—	79	164	45
FM256GX64AB-AA	GRAPHIC	256 x 64 DOT MATRIX	—	—	93	230	45

Nissei Electronics

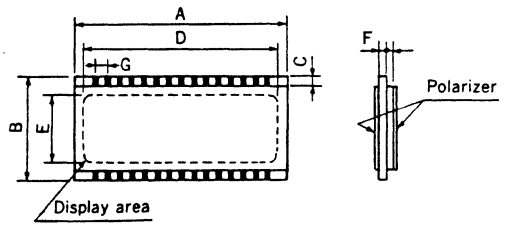
LCDs
CUSTOM & STANDARD

CUSTOM LCD DESIGN SPECIFICATION CHECK LIST

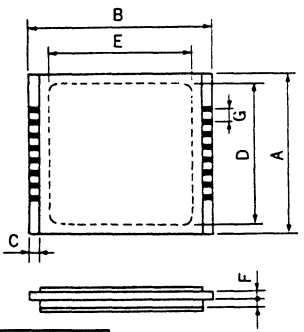
Custom LCD panels are designed and manufactured to meet your particular needs. Please check the following points, when ordering custom design LCS Panels. For outline dimensions A and B of LCD panels, it is recommended to refer the "Selection Guide of Glass Dimensions" shown on attached sheet.

1. Panel dimensions

● Vertical terminal type
☐ Top ☐ Bottom ☐ Top and Bottom



● Horizontal terminal type
☐ Left ☐ Right ☐ Left and Right



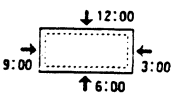
Symbol	Parameter	Dimensions (mm)	Symbol	Parameter	Dimensions (mm)
A	Glass size		D, E*	Display area	X
B	Glass size		F*	Glass thickness (1.1, 0.7, 0.5 mm)	
C*	Size of terminal		G	Pitch of terminal	

Note C*: In the case of pin-connected LCD panels, the dimension should normally be 2.5mm.
D, E*: The window frame of the case should be designed smaller than this dimension.

2. Operation mode
☐ TN positive
☐ TN negative
☐ STN positive
☐ STN negative

3. Display condition
☐ Reflective type
☐ Transmissive type
☐ Transflective type
☐ Others

4. Viewing angle direction
☐ 12 : 00
☐ 3 : 00
☐ 6 : 00
☐ 9 : 00



5. Terminal
☐ Rubber connector
☐ Pin terminal
(No. of pins pcs)
☐ Special treatment of pin
☐ Heat seal
☐ FPC

6. Driving method and environmental conditions
☐ Static
☐ Dynamic
_____Duty _____Bias
● Driving voltage _____V
● Driving frequency _____Hz
● Driving LSI _____
● Operating tem. ____℃～____℃
● Storage tem. ____℃～____℃

7. Options
☐ Separate type polarizer (fron/back)
☐ Non-glare polarizer
☐ Color polarizer (color)
☐ Black mask color
☐ Print (color)
☐ Display color matching

8. Quotation and others
● Quantity _____ /month
_____ /total lot
● Applications _____
● Quotation date _____
● Block copy Yes, No
● Request for module Yes, No

9. Planned quantity and schedule

Item	Submission of block copy	Approval of drawings	Delivery of engineering samples	Approval of engineering samples	Delivery of commercial samples	Initial mass production
Date						
Quantity	----------	----------		----------		

Nissei Electronics, 460 E. Middlefield Rd., Mountain View, CA 94043 Tel: (714) 458-6633/ (415) 969-5511 Fax: (714) 458-0707 / (415) 961-7259

SELECTION GUIDE OF GLASS DIMENSIONS

In designing custom LCD, select outline dimensions of glass from the following combinations, for shorter development time and economy purposes.

(The method of selection)

1. Select dimension A from Table 1 or 2 below.

TABLE 1	A	162	108	81	65	54	46	40	36	32mm
TABLE 2	A	145	96	72	58	48	41	36	32	29mm

2. When dimension of terminal D is less than 3.0 mm, total length of B+C to be selected from Table 3 or 4 below.

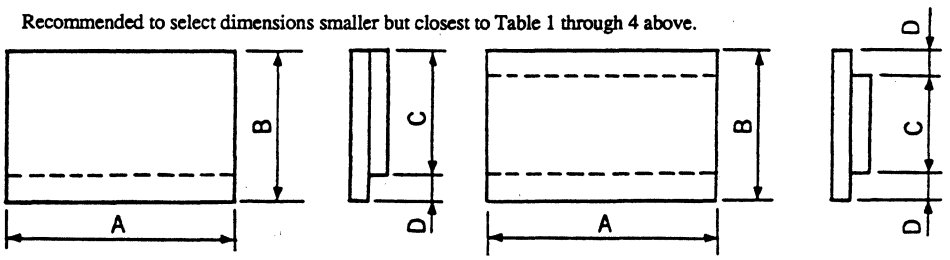
Use Table 3, when dimension of A is from Table 1.

TABLE 3	B + C	143	95	71	57	47	41	35	31	28	26mm

Use Table 4, when dimension of A is from Table 2.

TABLE 4	B + C	161	107	80	64	53	46	40	35	32	29mm

Recommended to select dimensions smaller but closest to Table 1 through 4 above.



Single sided terminal type

Both sided terminal type

STANDARD SPECIFICATIONS FOR LCD PANELS

■ Electro-optical Characteristics

Parameter		Unit	TN type						STN type	
			General-purpose				Wide temp. range		General -purpose	
			Static	1/2D,1/2B	1/3D,1/3B	1/4D,1/3B	Static	1/2D,1/2B	1/16D,1/4B	1/64D,1/9B
Driving voltage		V	3, 5	3, 5	3, 5	3, 5	3, 5	5	5, 8	20
Storage temp. range		℃	-20~60	-20~60	-20~60	-20~60	-40~85	-40~85	-20~60	-20~60
Operating temp. range		℃	-10~50	0~40	0~40	0~40	-30~80	-20~80	0~40	0~40
Response rise time	25℃	ms	50	100	100	100	30	30	100	150
	0℃	ms	300	300	500	600	100	100	200	300
Response decay time	25℃	ms	70	100	100	100	50	50	150	250
	0℃	ms	300	300	500	600	100	100	600	700
Viewing angle, Vertically		degree	-10~40	10~40	10~40	10~40	-10~40	10~40	-30~30	-30~30
Viewing angle, Horizontally		degree	-30~30	-30~30	-30~30	-30~30	-30~30	-30~30	-40~40	-40~40

(Note) Electro-optical characteristics not shown herein are available on request.

■ Typical Environmental Specifications

Parameter	General-purpose		Wide temperature range	
High temperature storage	Storage at 70℃	240 hours	Storage at 85℃	500 hours
Low temperature storage	Storage at -20℃	240 hours	Storage at -40℃	500 hours
Humidity resistance	Storage at 40℃, 90%RH	240 hours	Storage at 60℃, 90%RH	500 hours
Temperature cycle	-20℃ 30min.→ R.T. 5min.→ 70℃ 30min.	5 cycles	-40℃ 60min.→ R.T. 5min.→ 85℃ 60min.	20 cycles
High temperature operating	Operating at 40℃	240 hours	Operating at 60℃	500 hours
Low temperature operating	Operating at 0℃	240 hours	Operating at -30℃	500 hours

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CHARACTER DOT STANDARD LCD MODULES

ITEM	PRODUCT CODE	NBR OF DISPLAY CHARACTERS (Chars x Lines)	MODULE DIMENSIONS (mm)	VIEWING AREA (mm)	CHARACTER SIZE (mm)	DOT CONFIGURATION	MODULE TYPE (TN or STN)	HITACHI EQUIVALENT (Prod Code)
1 2 3	Dev.* Dev.* Dev.*	8 x 2			2.95 x 4.85	5 x 7 + CURSOR	TN STN (Yellow) STN (Gray)	
4 5 6	NDM1601S NDM1601SZ1 NDM1601SZ2	16 x 1	80 x 36 x 12	64.5 x 13.5	3.07 x 5.73	5 x 7 + CURSOR	TN STN (Yellow) STN (Gray)	HITACHI LM020L
7 8 9	NDM1602 NDM1602Z1 NDM1602Z2	16 x 2	80 x 36 x 11	64.5 x 13.5	2.95 x 3.80	5 x 7 + CURSOR	TN STN (Yellow) STN (Gray)	HITACHI LM052L
10 11 12	NDM2002 NDM2002Z1 NDM2002Z2	20 x 2	116 x 38 x 11	82.0 x 18.0	3.20 x 4.85	5 x 7 + CURSOR	TN STN (Yellow) STN (Gray)	HITACHI LM070L
13 14 15	NDM2004 NDM2004Z1 NDM2004Z2	20 x 4	98 x 60 x 12	76.0 x 25.2	2.95 x 4.15	5 x 7 + CURSOR	TN STN (Yellow) STN (Gray)	HITACHI LM04L
16 17 18	NDM2402 NDM2402Z1 NDM2402Z2	24 x 2	118 x 36 x 13	93.5 x 15.8	3.20 x 4.85	5 x 7 + CURSOR	TN STN (Yellow) STN (Gray)	HITACHI LM060L
19 20 21	NDM4002 NDM4002Z1 NDM4002Z2	40 x 2				5 x 7 + CURSOR	TN STN (Yellow) STN (Gray)	

1. DRIVING METHOD: 5V, 1/16D, 1/4B
2. ENVIRONMENTAL SPECIFICATION:
   TN OPERATING 0~50° C, STORAGE -20~70° C
   (OPTION; WIDE TEMPERATURE RANGE TYPE)
   STN OPERATING 0~50° C, STORAGE -20~60° C
3. VIEWING DIRECTION: TN 6 O'CLOCK (OPTION; TN 12 O'CLOCK)
4. OPERATION MODE: POSITIVE (OPTION; NEGATIVE)
5. DISPLAY CONDITION: REFLECTIVE (OPTION; EL OR LED BACKLIGHT TYPE)

CHARACTER DOT STANDARD PANELS

ITEM	PRODUCT CODE	NBR OF DISPLAY CHARACTERS (Chars x Lines)	PANEL DIMENSIONS W x H x T (mm)	VIEWING AREA W x H (mm)	CHARACTER SIZE (mm)	DOT CONFIGURATION	DOT SIZE (mm) DOT GAP (mm)	PANEL TYPE (TN or STN)
1 2 3	DLC6310 DLC6310Z1 DLC6310Z2	8 x 2	40.0 x 26.0 (21.0)x 2.7	36.0 x 17.0	2.95 x 4.85	5 x 7 + CURSOR	0.545 x 0.645 0.055	TN STN (Yellow) STN (Gray)
4 5 6	DLC61020 DLC6102Z1 DLC6102Z2	16x 1	70.0 x 22.6 (19.0) x 2.7	64.7 x 14.5	3.07 x 5.73	5 x 7 + CURSOR	0.55 x 0.75 0.08	TN STN (Yellow) STN (Gray)
7 8 9	DLC61010 DLC6101Z1 DLC6101Z2	16 x 2	70.0 x 22.6 (19.0) x 2.7	64.7 x 14.5	2.95 x 3.80	5 x 7 + CURSOR	0.55 x 0.50 0.05	TN STN (Yellow) STN (Gray)
10 11 12	DLC62060 DLC6206Z1 DLC6206Z2	20 x 2	90.0 x 30.0 (24.6) x 2.7	84.0 x 18.6	3.20 x 4.85	5 x 7 + CURSOR	0.60 x 0.65 0.05	TN STN (Yellow) STN (Gray)
13 14 15	DLC6205 DLC6205Z1 DLC6205Z2	20 x 4	93.85 x 38.1 (30.48) x 2.7	77.9 x 24.9	2.95 x 4.15	5 x 7 + CURSOR	0.55 x 0.55 0.05	TN STN (Yellow) STN (Gray)
16 17 18	DLC6309 DLC6309Z1 DLC6309Z2	24 x 2	105.5 x 25.0 (21.0) x 2.7	94.5 x 16.5	3.20 x 4.85	5 x 7 + CURSOR	0.60 x 0.65 0.05	TN STN (Yellow) STN (Gray)
19 20 21	DLC6312 DLC6312Z1 DLC6312Z2	40 x 2	160.0 x 27.5 (22.5) x 2.7	154.4 x 15.8	3.20 x 5.55	5 x 7 + CURSOR	0.60 x 0.65 0.05	TN STN (Yellow) STN (Gray)

1. DRIVING METHOD : 5V, 1/16D, 1/4B
2. ENVIRONMENTAL SPECIFICATION :
   TN OPERATING 0~50° C , STORAGE -20~70° C
   (OPTION: WIDE TEMPERATURE RANGE TYPE)
   STN OPERATING 0~40° C , STORAGE -20~60° C
3. VIEWING DIRECTION: TN 6 O'CLOCK (OPTION: TN 12 O'CLOCK)
4. OPERATION MODE : POSITIVE (OPTION: NEGATIVE)
5. DISPLAY CONDITION : REFLECTIVE (OPTION: TRANSMISSIVE, TRANSFLECTIVE)

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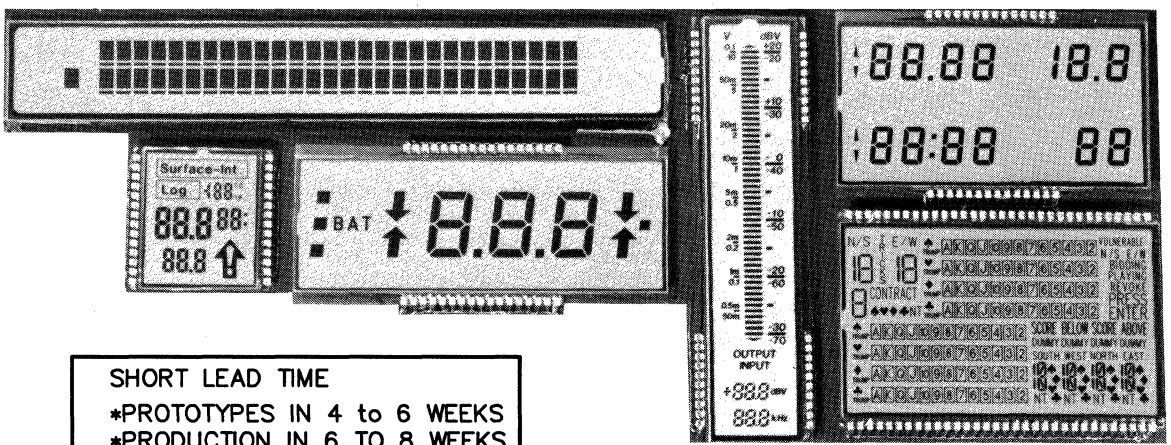
OCULAR LIQUID CRYSTAL DISPLAYS

HIGH QUALITY CUSTOM AND STANDARD LIQUID CRYSTAL DISPLAY PRODUCTS AT COMPETITIVE PRICING.



SHORT LEAD TIME
*PROTOTYPES IN 4 to 6 WEEKS
*PRODUCTION IN 6 TO 8 WEEKS

EXPEDITING SERVICE AVAILABLE ON SPECIAL REQUEST

Ocular Inc. specializes in full custom Liquid Crystal Display manufacturing. A complete line of standard devices are also available from our catalog.

Ocular is a service oriented company. Our engineering department will assist you in developing the LCD from a conceptual idea to reality. Our photomasks are CAD generated to cut design time and ensure accuracy. We can also provide the elastomeric connectors, LED backlightings, and metal or injection molded plastic bezels to meet your overall design needs.

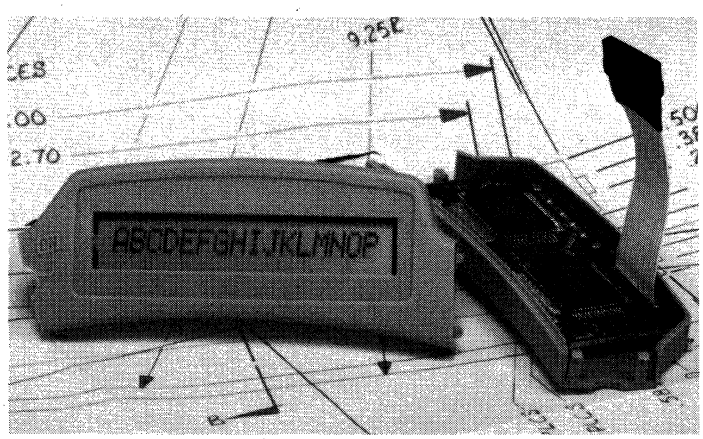
Equipped with advanced array processing capability, Ocular's LCD products feature:

* COMPETITIVE PRICING
* HIGH QUALITY AND RELIABILITY STANDARDS
* HIGH CONTRAST AND BRIGHTNESS
* QUICK SWITCHING TIME
* LOW POWER CONSUMPTION
* LARGE SIZE PANELS UP TO 35" SQUARE
* WIDE TEMPERATURE RANGE

CUSTOM LCD MODULES

Built to your specifications, Ocular's custom LCD modules significantly reduce your manufacturing overhead associated with the assembly of LCDs and the LCD driver electronics. It helps streamline your manufacturing cost and increases your production throughput.

Our engineers are highly experienced and can help you to design a module that is cost effective and reliable. Our flexible manufacturing line can handle virtually any size requirements. We are geared to serve you whether your volume requirements are in the 100's or 100K's.



OCULAR CUSTOM MODULE FEATURES:

* Economical
* Reliable and high Quality
* Optional back lighting key pads and other hardware.
* Rugged metal or injection molded plastic housing.
* Software development at affordable cost.

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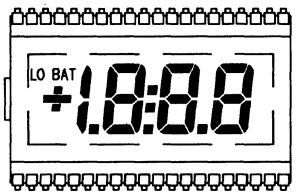
OCULAR STANDARD LCD PRODUCTS

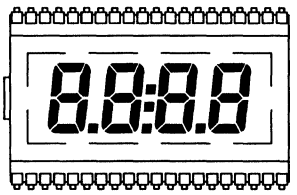
MODEL 51, CHARACTER HEIGHT 0.35"



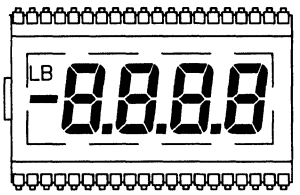
MODEL 36, CHAR. HEIGHT 0.50"



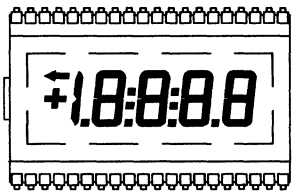
MODEL 40, CHAR. HEIGHT 0.35", 0.50", 0.70", 1.00"



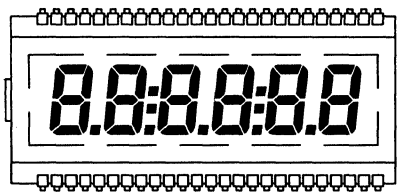
MODEL 41, CHAR. HEIGHT 0.50"



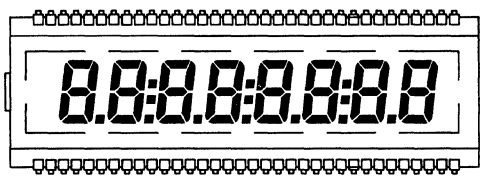
MODEL 45, CHAR. HEIGHT 0.35"



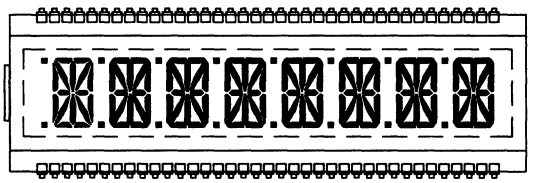
MODEL 60, CHAR. HEIGHT 0.50", 0.70", 1.00".



MODEL 81, CHAR. HEIGHT 0.50"



MODEL 80, CHAR. HEIGHT 0.50"



STANDARD LCD ORDERING OPTIONS:

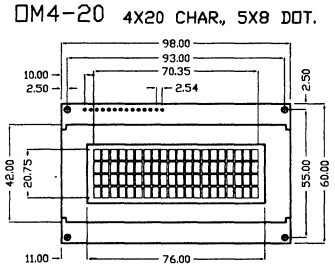
TEMPERATURE RANGE	OPERATING	STORAGE
INDUSTRIAL GRADE	-40°C TO 85°C	-55°C TO 90°C
COMMERCIAL GRADE	-10°C TO 55°C	-20°C TO 60°C

POLARIZER MODE	CONNECTOR
REFLECTIVE TRANSFLECTIVE TRANSMISSIVE	DUAL IN LINE PINS ELASTOMERIC (NOT AVAILABE ON ALL MODELS)

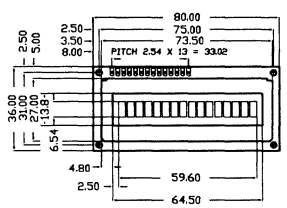
STANDARD INTELLIGENT LCD MODULES

Shown below are some of OCULAR's LCD modules. Designed to conform to the industry standards, Ocular's standard LCD modules can be used as drop in replacements, both electrically and mechanically, for most existing designs.

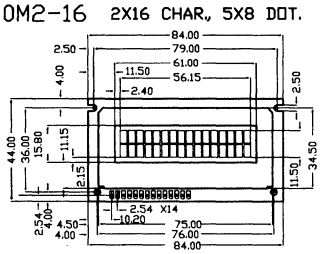
OM4-20 4X20 CHAR., 5X8 DOT.



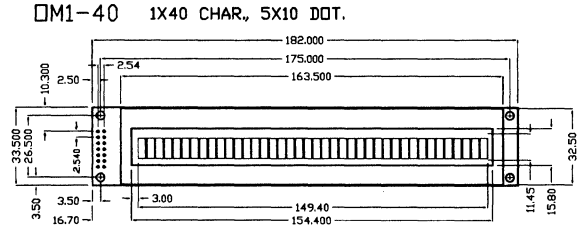
OM1-16 1X16 CHAR. 5X8 DOT



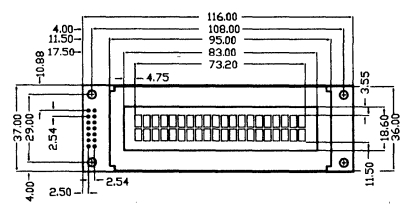
OM2-16 2X16 CHAR., 5X8 DOT.



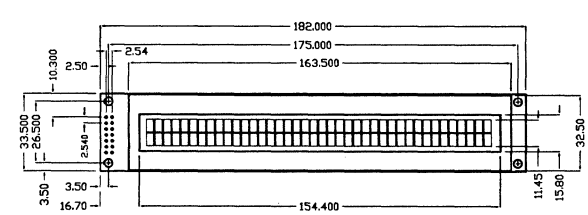
OM1-40 1X40 CHAR., 5X10 DOT.



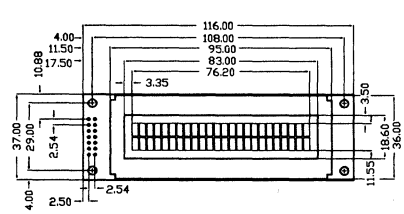
OM2-20 2X20 CHAR., 5X8 DOT.



OM2-40 2X40 CHAR., 5X8 DOT



OM2-24 2X24 CHAR. 5X8 DOT



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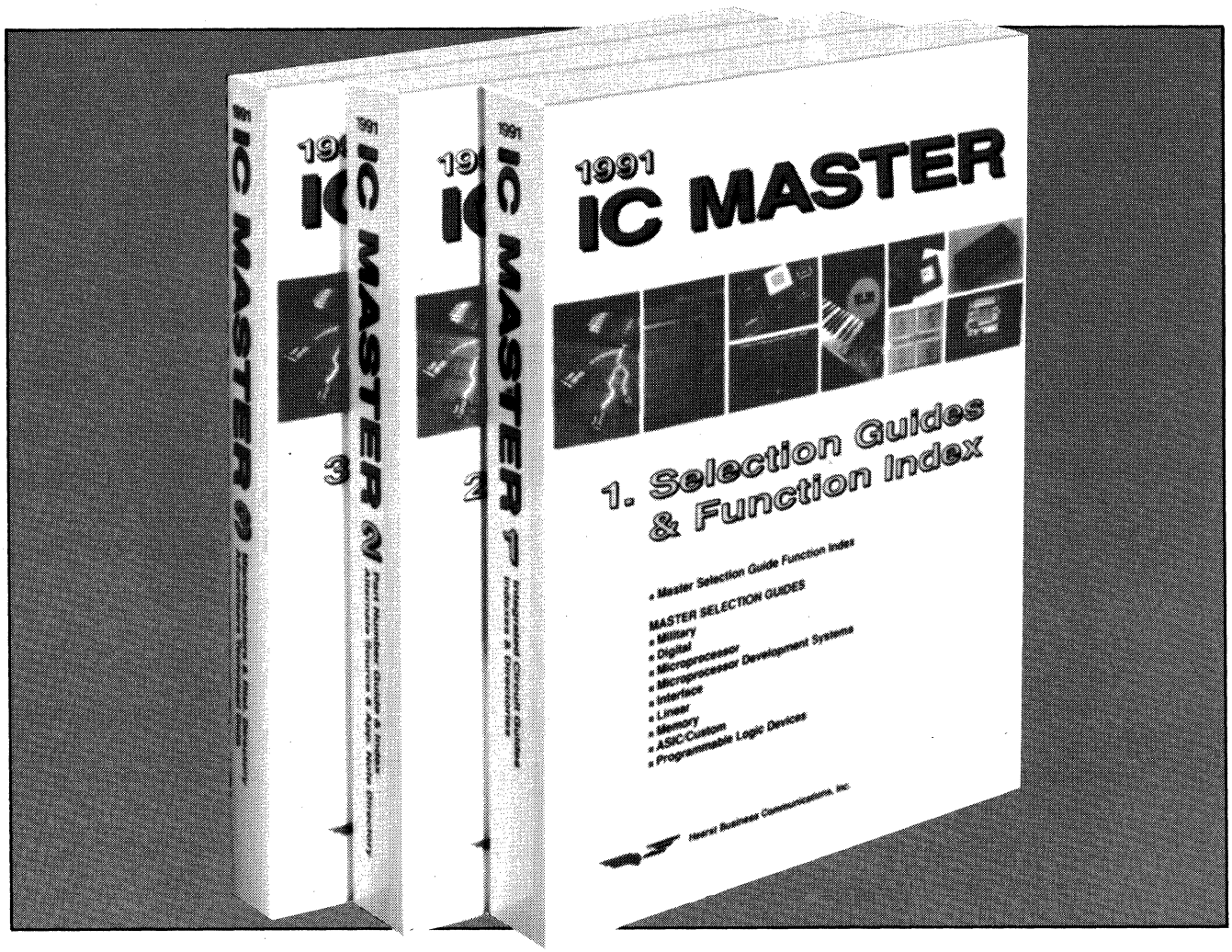

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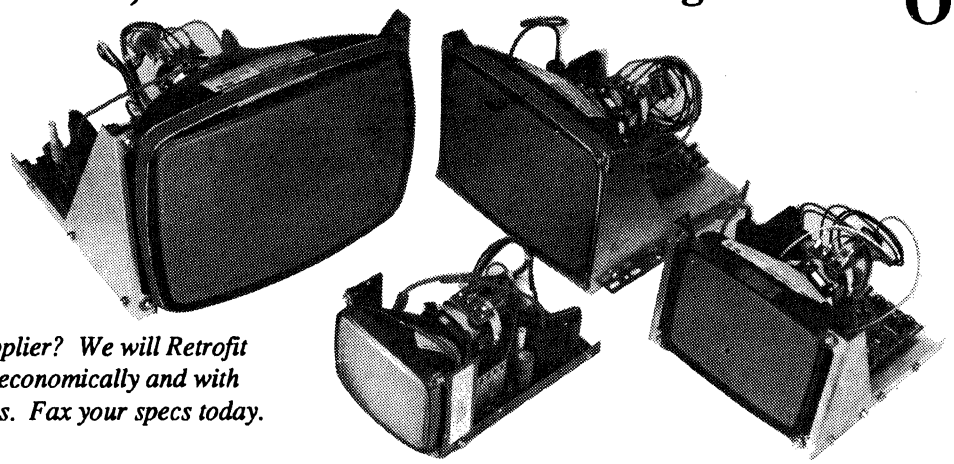
Chassis, Kit & Tube Mount Configurations



Is your existing design being discontinued/price escalated by your supplier? We will Retrofit your existing design, economically and with our upgraded features. Fax your specs today.

Our Standard Practice: Customize to your input signal & mechanical requirements

Quality Features

- All circuitry on one PCB for reliability
- Accepts TTL or Composite Video signals
- All controls easily accessible from monitor top
- Highlighted Video feature compatible with the IBM PC/compatible Hightlighted Video
- Display thermally stabilized
- Electronic horizontal video centering
- Protected against incorrectly applied sync signals
- Display can be run without signal applied
- Vertical oscillator easily changed from 47 to 63 Hz.
- Vertical sync input polarity easily changed
- 0°, 5° or 10° tilt standard on 7", 9" and 12" chassis models
- Meets UL, CSA and DHHS rules on radiation

Options

- Wide range of Phosphors
- Remote Brightness and Contrast
- Kit form or space saving chassis
- 120 VAC Power Supply
- +12VDC power connector
- 10 or 20 pin header
- TTL/Composite Video on one board

Specifications

Input Signals:

TTL

Signal: Positive Polarity +2.5V to +5.0V. Reverse polarity signals may require board modification
Video Input Impedance: 470 ohms
Bandwidth: Within 3db from 10Hz to 26MHz
Vertical Input Impedance: greater than 1K ohms
Typical Signal: 180 microseconds
Acceptable Range: 100 to 1200 microseconds
Horizontal Input Impedance: Greater than 6K Ohms
Typical Signal: 4.5 microseconds
Acceptable Range: 2.5 to 30 microseconds

Composite Video:

Signal: 0.7V to 1.8V of composite peak to peak video
Input Impedance: 75 ohms
Bandwidth: Within 3db from 10Hz to 26MHz

Geometric Distortion:

Within 2% EIA standard DOT/Ball chart. Variation between adjacent characters <10% in alphanumeric display application.

Scanning Frequencies:

Factory adjusted for operation within 1kHz of center frequencies at 15.7kHz, 18.6kHz, 21.6kHz, 31.5kHz or 44 kHz.

Monitor Size	Mount Style	CRT SPECIFICATIONS Neck	Deflection	View Area	Power @12VDC	Center Resolution	Dimensions (Inches) Height	Width	Depth	Weight (Lbs) Kit	Shipping
5" Diagonal	Chassis	20mm	70°	15 in² max	650mA	650 Lines	4.60	4.88	8.61	3.0	4.5
7" Diagonal	Chassis	20mm	85°	26 in² max	1150mA	700 Lines	5.90	7.95	8.20	10	12
9" Diagonal	Chassis	20mm	85°	35 in² max	1150mA	750 Lines	7.25	9.50	9.50	10	12
9" Diagonal	Yoke	20mm	85°	35 in² max	1150mA	750 Lines	PCB: 5.33 x 7.010			10	12
12" Diagonal	Chassis	20mm	90°	55 in² max	1250mA	900 Lines	9.25	11.50	11.00	11	13
12" Diagonal	Yoke	20mm	90°	55 in² max	1250mA	900 Lines	PCB: 5.33 x 7.010			10	12

OVI **OMNI VISION INC.**
High Quality Monochrome Monitors
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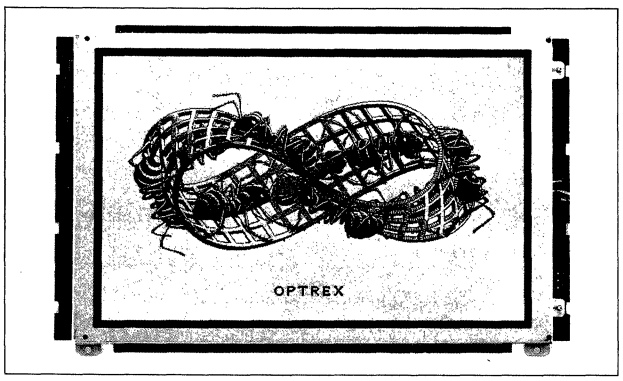
Optrex Corporation.

LIQUID CRYSTAL DISPLAY MODULE

Graphic Type/**DMF** Series



Features

(1) Low voltage operation, Low power consumption.
(2) Compact, Light, Thin.
(3) Graphic, Figure, and Character display.
(4) High contrast, Wide viewing angle as Super TN LCDP are employed.
(5) Large area display as CRT.
(6) Black and White Technology now available.
(7) Choices of EL or CCT Backlighting.

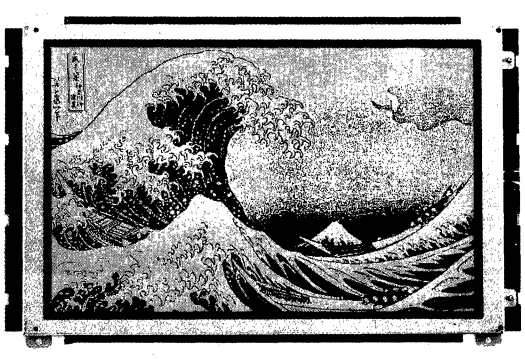
Standard Module Formats:

Dot Pixels (W×H)	*1) Type No.	Dot Size (W×H mm)	Dot Pitch (W×H mm)	Module Dimensions (W×H×D mm)	Viewing Area (W×H mm)	Driving Methods (duty/bias)		*2) Variation				
								R	EL	FL	OHP	BW
112×128	DMF5002N	0.49×0.50	0.53×0.54	90.6×110.0×12.8	66.0×77.0	1/128D	1/12B	○	○	—	—	—
160×128	DMF608N	0.55×0.55	0.60×0.60	129.0×102.0×11.2	101.0×82.0	1/64D	1/9B	○	○	—	—	—
	DMF5001N	0.54×0.54	0.58×0.58	129.0×102.0×12.8	101.0×82.0	1/128D	1/12B	○	○	—	—	—
	DMF5003NY-FW*5)	0.54×0.54	0.58×0.58	(152.0×112.0×23.0)	(101.0×82.0)	1/128D	1/12B	—	—	○	—	—
240×64	DMF633N	0.48×0.48	0.53×0.53	180.0×75.0×15.0	132.0×39.0	1/32D	1/6B	○	○	—	—	—
	DMF5005N*5)	0.49×0.49	0.53×0.53	(180.0×65.0×12.0)	(132.0×39.0)	1/64D	1/9B	○	○	—	—	—
240×128	DMF660N	0.40×0.40	0.45×0.45	144.0×104.0×12.5	114.0×64.0	1/128D	1/12B	○	○	—	—	—
256×128	DMF682N*5)	0.43×0.43	0.47×0.47	(147.0×116.0×12.0)	(127.0×70.0)	1/64D	1/9B	○	○	—	—	—
480×64	DMF612N	0.41×0.41	0.47×0.47	260.00×58.0×12.0	229.5×36.0	1/64D	1/9B	○	○	—	—	—
480×128	DMF605AN	0.41×0.41	0.47×0.47	259.0×90.0×12.6	229.5×66.0	1/64D	1/9B	○	○	—	—	—
	DMF624AN	0.41×0.41	0.47×0.47	259.0×90.0×12.6	229.5×66.0	1/64D	1/9B	○	○	—	—	—
	DMF6102N*5)	0.43×0.43	0.47×0.47	(268.0×94.0×12.6)	(229.5×66.0)	1/128D	1/12B	○	○	—	—	—
640×200	DMF651AN	0.32×0.46	0.35×0.49	275.0×132.0×12.6	232.0×106.0	1/200D	1/13B	○	○	○	—	—
	DMF6107NWU-FW*5)	0.32×0.46	0.35×0.49	(296.0×152.0×19.8)	(232.0×106.0)	1/200D	1/13B	—	—	○	—	○
640×400	DMF666AN	0.33×0.33	0.36×0.36	282.0×183.0×13.0	238.5×152.0	1/200D	1/13B	○	○	○	—	○
	DMF665NB	0.33×0.33	0.36×0.36	378.0×260.0×24.0	238.5×152.0	1/200D	1/12B	—	—	—	○	—
	DMF675NB*5)	0.29×0.29	0.32×0.32	(263.0×191.0×5.0)	(210.0×131.0)	1/200D	1/13B	—	—	—	○	—
	DMF694NWU-FW*5)	0.33×0.33	0.36×0.36	282.0×201.0×27.0	238.0×152.0	1/200D	1/13B	—	—	○	—	○
640×480	DMF6106N*5)	0.30×0.30	0.33×0.33	(271.0×195.4×13.5)	(219.0×166.0)	(1/240D	1/14B)	○	○	—	—	—

Neutral Mode, Yellow Mode and Blue Mode etc, are available.

Various types of back light are available in its series, and stated with following abbreviations.
R. . . . .Reflective Type EL...With EL
FL. . . .With Cold Cathode Fluorescent Tube
OHP . .Transmissive for OHP
BW . . .Black and White with FL

- **FOR ON-SITE DEMONSTRATIONS AND IN-DEPTH TECHNICAL ASSISTANCE REGARDING STANDARD AND *CUSTOM* DISPLAY REQUIREMENTS, PLEASE CONTACT US FOR AN IMMEDIATE RESPONSE:**



SATORI ELECTRIC (AMERICA) INC.
3830 DEL AMO BLVD., SUITE 101, TORRANCE, CA 90503
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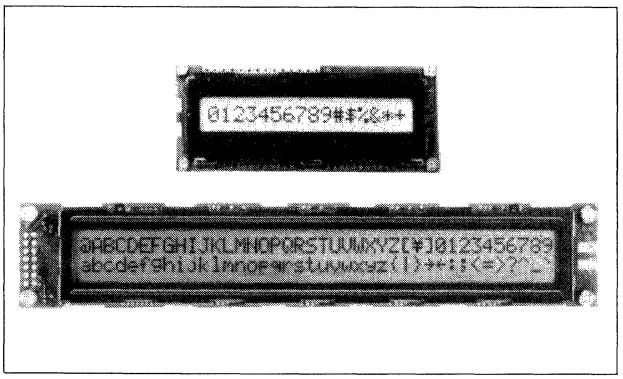
Optrex Corporation.

LIQUID CRYSTAL DISPLAY MODULE

Character Type/DMC Series



Features

(1) 8-bit or 4-bit MPU interface is available.
(2) 160 JIS type characters such as Alphabet, Numeral and Kana and 32 special characters and symbols can be displayed by internal character generator (ROM).
(3) Random symbols can be displayed by character generator (RAM).
(4) Many instructional functions by means of program such as "clear display," "home cursor," "on/off cursor," "blink character," "shift display," "shift cursor," "read/write display data," etc. are available.
(5) Compact and light weight design enable easy assembly on device.
(6) Single "+5V" power supply (except for Extended Temperature Type).
(7) Low power consumption.

Standard Module Formats:

Display Format	*1) Type No.	Display Fonts	Character Size (W×H mm)	Dot Size (W×H mm)	Module Dimensions (W×H×D mm)	*2) Variation						
						TN Type				*3) NTN Type		
						R	H	EL	LED	R	EL	LED
16 characters×1 line	DMC16106A	5×11 dots	3.2×8.2	0.6×0.7	80×36×10	○	○	○	—	—	—	—
	DMC16106C	5×8 dots	3.2×5.95	0.6×0.7	80×36×10	○	○	○	—	—	—	—
	DMC16117A	5×8 dots	3.2×5.95	0.6×0.7	80×36×10	○	○	○	—	○	○	—
	DMC16128	5×7 dots+Cursor	4.84×9.66	0.92×1.1	122×33×11	○	○	○	—	—	—	—
	DMC16129	5×7 dots+Cursor	4.84×9.66	0.92×1.1	122×33×11	○	○	○	—	—	—	—
	DMC16101A-EB	5×11 dots	8.2×3.2	0.7×0.6	85×36×10	—	—	○	—	—	—	—
	DMC16105-LY	5×8 dots	3.2×5.95	0.6×0.7	80×36×15	—	—	—	○	—	—	—
	DMC16188-LY	5×8 dots	6.0×14.54	1.152×1.765	151×50×14.2	—	—	—	○	—	—	○
16 characters×2 lines	DMC16207	5×8 dots	2.95×5.55	0.55×0.65	80×44×11	○	○	○	—	○	○	—
	DMC16230	5×7 dots+Cursor	4.84×9.66	0.92×1.1	122×44×11	○	○	○	—	○	○	○
	DMC16249B	5×8 dots	2.95×4.35	0.55×0.5	80×36×11	○	○	○	—	○	○	—
	DMC16202-LY	5×8 dots	2.95×5.55	0.55×0.65	84×45×15.1	—	—	—	○	—	—	○
	DMC16204	5×8 dots	2.95×5.55	0.55×0.65	84×40×10.9	○	—	—	○	—	—	—
	DMC16204-LY	5×8 dots	2.95×5.55	0.55×0.65	80×40×16.1	○	—	—	○	—	—	—
16 characters×4 lines	DMC16433	5×8 dots	2.95×4.75	0.55×0.55	87×60×11	○	○	○	—	○	○	—
20 characters×1 line	DMC20171	5×7 dots+Cursor	3.2×5.55	0.6×0.65	182×33.5×13	○	○	○	—	—	—	—
20 characters×2 lines	DMC20215	5×8 dots	3.2×5.55	0.6×0.65	116×44×11	○	○	○	—	○	—	—
	DMC20261	5×8 dots	3.2×5.55	0.6×0.65	116×37×11	○	○	○	—	○	○	○
20 characters×4 lines	DMC20434	5×8 dots	2.95×4.75	0.55×0.55	98×60×11	○	○	○	—	○	○	○
	DMC20481-LY	5×8 dots	2.95×4.75	0.55×0.55	98.5×61×15.6	—	—	—	○	—	—	○
24 characters×1 line	DMC24138	5×11 dots	3.2×8.2	0.6×0.7	118×36×11	○	○	○	—	○	—	—
24 characters×2 lines	DMC24227	5×8 dots	3.2×5.55	0.6×0.65	118×36×11	○	○	○	—	○	○	—
32 characters×1 line	DMC32132	5×11 dots	3.2×8.2	0.6×0.7	174.5×31×11	○	○	○	—	—	—	—
32 characters×2 lines	DMC32216	5×8 dots	3.2×5.55	0.6×0.65	175×44×11	○	○	○	—	—	—	—
	DMC32239	5×8 dots	3.45×5.55	0.65×0.65	174.5×31×11	○	○	○	—	○	○	—
40 characters×1 line	DMC40131	5×11 dots	3.2×8.2	0.6×0.7	182×33.5×11	○	○	○	—	—	—	—
40 characters×2 lines	DMC40202-LY	5×8 dots	3.2×5.55	0.6×0.65	182×34.5×15.1	—	—	—	○	—	—	○
	DMC40205-LY	5×8 dots	3.2×5.55	0.6×0.65	170×31.5×15.5	—	—	—	○	—	—	—
	DMC40218	5×8 dots	3.2×5.55	0.6×0.65	182×33.5×11	○	○	○	—	○	○	○
40 characters×4 lines	DMC4057	5×8 dots	2.78×4.89	0.5×0.55	190×54×10	○	○	○	—	○	○	○
	DMC40401N	5×8 dots	2.78×4.89	0.5×0.55	190×54×11	—	—	—	—	○	—	○

OPTREX LCD Character Modules are available in many backlighting options as well as in standard TN and N-TN Fluid Technologies.

Type	Operating Temp.	Storage Temp.
Normal Temp.	0°C ~ +50°C	−20°C ~ +70°C
Extended Temp.	−20°C ~ +70°C	−30°C ~ +80°C

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PHILIPS DISCRETE SEMICONDUCTORS

LIQUID CRYSTAL DISPLAYS

LIQUID CRYSTAL DISPLAYS, STANDARD

Extended Type Number	Illumination Mode	Reliability Grade	Drive Method	Operating Voltage (V_{op}) (V)	Mounting Technology	Recommended Driver IC(s)
LHA142U-22	transmissive	extended	direct	7.5 to 9.5	fixed-pin	PCF8576
LTA141R-12	reflective	commercial	direct	3 to 6	fixed-pin	PCF8576
LTA141F-12	transflective	commercial	direct	3 to 6	fixed-pin	PCF8576
LTA141R-22	reflective	extended	direct	3 to 6	fixed-pin	PCF8576
LTA141F-22	transflective	extended	direct	3 to 6	fixed-pin	PCF8576
LTA331R-11	reflective	commercial	MUX 1:16	5	elastomer	
LTA331F-11	transflective	commercial	MUX 1:16	5	elastomer	
LTA332R-11	reflective	commercial	MUX 1:16	5	elastomer	
LTA332F-11	transflective	commercial	MUX 1:16	5	elastomer	
LTA341R-11	reflective	commercial	MUX 1:16	5	elastomer	
LTA341F-11	transflective	commercial	MUX 1:16	5	elastomer	
LTA342R-11	reflective	commercial	MUX 1:16	5	elastomer	
LTA342F-11	transflective	commercial	MUX 1:16	5	elastomer	
LTA343R-11	reflective	commercial	MUX 1:16	5	elastomer	
LTA343F-11	transflective	commercial	MUX 1:16	5	elastomer	
LTD101R-11	reflective	commercial	direct	3 to 6	elastomer	PCF2112,PCF1172,PCF8577
LTD132R-11	reflective	commercial	MUX 1:2	2.8	elastomer	PCF8576
LTD133F-21	transflective	extended	MUX 1:2	5	elastomer	PCF1175
LTD201R-11	reflective	commercial	direct	3 to 6	elastomer	PCF2112,PCF8577
LTD202R-12	reflective	commercial	direct	3 to 6	fixed-pin	PCF2112,PCF8577
LTD202R-22	reflective	extended	direct	3 to 6	fixed pin	PCF2112,PCF8577
LTD202F-22	transflective	extended	direct	3 to 6	fixed pin	PCF2112,PCF8577
LTD203R-11	reflective	commercial	direct	3 to 6	elastomer	PCV2112,PCF8576
LTD203R-21	reflective	extended	direct	3 to 6	elastomer	PCF2112,PCF8576
LTD203F-21	transflective	extended	direct	3 to 6	elastomer	PCF2112,PCF8576
LTD211R-11	reflective	commercial	MUX 1:2	2.8	elastomer	PCF2111,PCF8576,PCF8577
LTD211F-11	transflective	commercial	MUX 1:2	2.8	elastomer	PCF2111,PCF8576,PCF8577
LTD211R-21	reflective	extended	MUX 1:2	2.8	elastomer	PCF2111,PCF8576,PCF8577
LTD211F-21	transflective	extended	MUX 1:2	2.8	elastomer	PCF2111,PCF8576,PCF8577
LTD221R-11	reflective	commercial	direct	3 to 6	elastomer	ICL7106,PCF2112,PCF8577
LTD221R-12	reflective	commercial	direct	3 to 6	fixed pin	ICL7106,PCF2112,PCF8577
LTD221F-12	transflective	commercial	direct	3 to 6	fixed pin	ICL7106,PCF2112,PCF8577
LTD221R-22	reflective	extended	direct	3 to 6	fixed pin	ICL7106,PCF2112,PCF8577
LTD221F-22	transflective	extended	direct	3 to 6	fixed pin	ICL7106,PCF2112,PCF8577
LTD221R-11	reflective	commercial	direct	3 to 6	elastomer	PCF2112,PCF8577
LTD222R-12	reflective	commercial	direct	3 to 6	fixed pin	PCF2112,PCF8577
LTD222F-12	transflective	commercial	direct	3 to 6	fixed pin	PCF2112,PCF8577
LTD222R-21	reflective	extended	direct	3 to 6	elastomer	PCF2112,PCF8577
LTD222F-21	transflective	extended	direct	3 to 6	elastomer	PCF2112,PCF8577
LTD222R-22	reflective	extended	direct	3 to 6	fixed pin	PCF2112,PCF8577
LTD222F-22	transflective	extended	direct	3 to 6	fixed pin	PCF2112,PCF8577
LTD224R-11	reflective	commercial	direct	3 to 6	elastomer	PCF2111(x2), PCF8576
LTD225R-11	reflective	commercial	direct	3 to 6	elastomer	ICL7106,PCF8577
LTD226R-11	reflective	commercial	direct	3 to 6	elastomer	PCF2112(x2),PCF8576
LTD226R-12	reflective	commercial	direct	3 to 6	fixed pin	PCF2112(x2),PCF8576
LTD226F-12	transflective	commercial	direct	3 to 6	fixed pin	PCF2112(x2),PCF8576
LTD226R-21	reflective	extended	direct	3 to 6	elastomer	PCF2112(x2),PCF8576
LTD226F-21	transflective	extended	direct	3 to 6	elastomer	PCF2112(x2),PCF8576
LTD226R-22	reflective	extended	direct	3 to 6	fixed pin	PCF2112(x2),PCF8576
LTD226F-22	transflective	extended	direct	3 to 6	fixed pin	PCF2112(x2),PCF8576
LTD227R-12	reflective	commercial	direct	3 to 6	fixed pin	ICL7103,ICM7211,PCF8576
LTD227R-22	reflective	extended	direct	3 to 6	fixed pin	ICL7103,ICM7211,PCF8576
LTD227F-22	transflective	extended	direct	3 to 6	fixed pin	ICL7103,ICM7211,PCF8576
LTD228R-12	reflective	commercial	direct	3 to 6	fixed pin	PCF2112(x2),PCF8576
LTD229R-12	reflective	commercial	direct	3 to 6	fixed pin	PCF2112(x2),PCF8577(x2)
LTD229R-22	reflective	extended	direct	3 to 6	fixed pin	PCF2112(x2),PCF8577(x2)
LTD229F-22	transflective	extended	direct	3 to 6	fixed pin	PCF2112(x2),PCF8577(x2)
LTD231R-11	reflective	commercial	MUX 1:3	3.1	elastomer	PCF8576,TSC805
LTD232R-21	reflective	extended	MUX 1:3	3.1	elastomer	ICL7129,PCF8576
LTD233R-11	reflective	commercial	MUX 1:2	2.8	elastomer	PCF2111(x2),PCF8576
LTD234R-21	reflective	extended	MUX 1:4	4.5	elastomer	PCF8576
LTD235R-12	reflective	commercial	MUX 1:3	3.1	fixed pin	PCFR8566
LTD241R-12	reflective	commercial	direct	3 to 6	fixed pin	PCF2112,PCF2577
LTD241R-22	reflective	extended	direct	3 to 6	fixed pin	PCF2112,PCF2577
LTD241F-22	transflective	extended	direct	3 to 6	fixed pin	PCF2112,PCF2577
LTD242R-12	reflective	commercial	direct	3 to 6	fixed pin	PCF2112,PCF8577
LTD242R-22	reflective	extended	direct	3 to 6	fixed pin	PCF2112,PCF8577
LTD242F-22	transflective	extended	direct	3 to 6	fixed pin	PCF2112,PCF8577
LTD261R-12	reflective	commercial	direct	3 to 6	fixed pin	PCF2112,PCF8577
LTD261R-22	reflective	extended	direct	3 to 6	fixed-pin	PCF2112,PCF8577
LTD261F-22	transflective	extended	direct	3 to 6	fixed-pin	PCF2112,PCF8577
LTD262R-12	reflective	commercial	direct	3 to 6	fixed pin	PCF2112(x3),PCF8576(x2)
LTD262R-22	reflective	extended	direct	3 to 6	fixed pin	PCF2112(x3),PCF8576(x2)
LTD262F-22	transflective	extended	direct	3 to 6	fixed pin	PCF2112(x3),PCF8576(x2)
LTD263R-12	reflective	commercial	direct	3 to 6	fixed pin	PCF2112(x2),PCF8577(x2)
LTD263R-22	reflective	extended	direct	3 to 6	fixed pin	PCF2112(x2),PCF8577(x2)
LTD264R-22	reflective	extended	direct	3 to 6	fixed pin	PCF2112(x2),PCF8577(x2)
LTD264F-22	transflective	extended	direct	3 to 6	fixed pin	PCF2112(x2),PCF8577(x2)
LTD321R-12	reflective	commercial	direct	3 to 6	fixed pin	HEF4754V,PCF8576
LTD351R-11	reflective	commercial	MUX 1:2	2.8	elastomer	PCF2111(x4),PCF8576(x3)

LIQUID CRYSTAL DISPLAYS, TWISTED NEMATIC MODULES

Number Of Characters	Type Number	Outline Dimension (mm)	Viewing Area (mm)	Character Format	Character Size (mm)	Φ Opt	Drive Method	Supply Voltage	Illumination Mode	Comments
1 × 16	LTM233R-10	92.5 × 25.0 × 11.0	65.8 × 11.	7 Segment	3.20 × 6.00	270	Mux 1.20	+ 5V	Reflective	—
	LTM541R-10	87.0 × 27.5 × 11.0	64.7 × 13.	7 Segment	2.20 × 6.40	270	Mux 1:40	+ 5V	Reflective	—
	LTN111R-10	80.0 × 36.0 × 12.0	64.5 × 13.	5 × 7 + Cur	3.07 × 6.56	270	Mux 1:16	+ 5V	Reflective	—
	LTN111R-50	80.0 × 36.0 × 12.0	64.5 × 13.	5 × 7 + Cur	3.07 × 6.56	90	Mux 1:16	+ 5V	Reflective	—
	LTN111F-10	80.0 × 36.0 × 12.0	64.5 × 13.	5 × 7 + Cur	3.07 × 6.56	270	Mux 1:16	+ 5V	Transflective	EL B/L, LXL111-G
	LTN111F-50	80.0 × 36.0 × 12.0	64.5 × 13.	5 × 7 + Cur	3.07 × 6.56	90	Mux 1:16	+ 5V	Transflective	EL B/L, LXL111-G
	LPH3575-1	80.0 × 36.0 × 12.0	64.5 × 13.	5 × 7 + Cur	3.07 × 6.56	270	Mux 1:16	+ 5V	Reflective	Black Bezel
2 × 16	LTN211R-10	84.0 × 44.0 × 12.0	61.0 × 15.	5 × 7 + Cur	2.96 × 5.56	270	Mux 1:16	+ 5V	Reflective	—
	LTN211F-10	84.0 × 44.0 × 12.0	61.0 × 15.	5 × 7 + Cur	2.96 × 5.56	270	Mux 1:16	+ 5V	Transflective	EL B/L, LXL211-G
	LTN211R-50	84.0 × 44.0 × 12.0	61.0 × 15.	5 × 7 + Cur	2.96 × 5.56	90	Mux 1:16	+ 5V	Reflective	—
	LTN211R-50	84.0 × 44.0 × 12.0	61.0 × 15.	5 × 7 + Cur	2.96 × 5.56	90	Mux 1:16	+ 5V	Transflective	EL B/L, LXL211-G
	LTN211-LED	84.0 × 44.0 × 14.5	61.0 × 15.	5 × 7 + Cur	2.96 × 5.56	270	Mux 1:16	+ 5V	Transflective	LED B/L Built In
	LTN2212R-10	80.0 × 36.0 × 11.0	61.0 × 16.	5 × 7 + Cur	2.95 × 5.55	270	Mux 1:16	+ 5V	Reflective	—
	LPH3511-1	84.0 × 44.0 × 12.0	61.0 × 15.	5 × 7 + Cur	2.96 × 5.56	270	Mux 1:16	+ 5V	Reflective	Black Bezel
2 × 20	LTN221R-10	116.0 × 37.0 × 11.0	83.0 × 18.	5 × 7 + Cur	3.20 × 5.55	270	Mux 1:16	+ 5V	Reflective	—
	LTN221F-10	116.0 × 37.0 × 11.0	83.0 × 18.	5 × 7 + Cur	3.20 × 5.55	270	Mux 1:16	+ 5V	Transflective	EL B/L, LXL221-G

PROVIDENCE PIKE, SLATERSVILLE, RI 02876, 401/762-3800, FAX 401/767-4497

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PHILIPS DISCRETE SEMICONDUCTORS

LIQUID CRYSTAL DISPLAYS

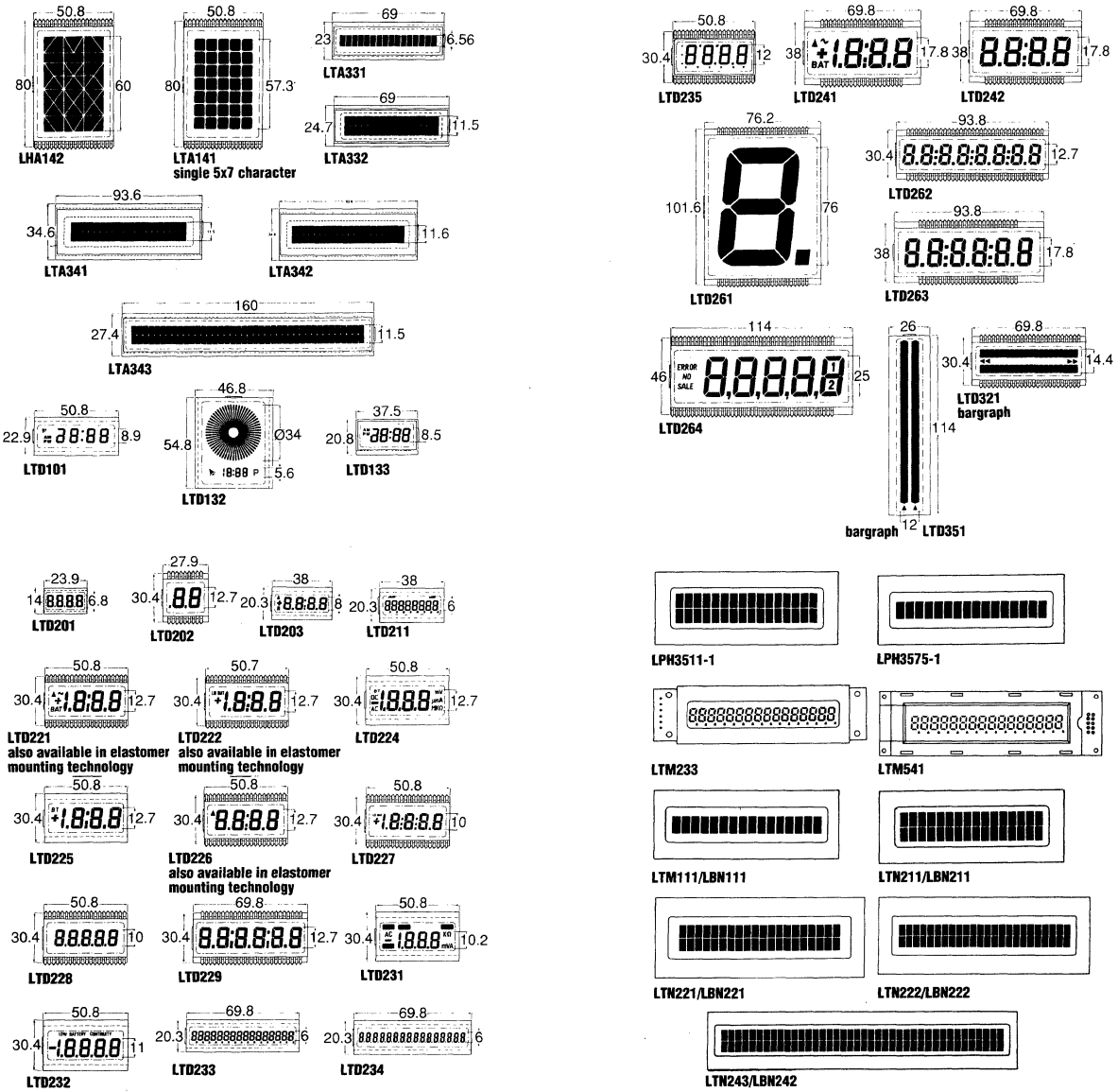
LIQUID CRYSTAL DISPLAYS, TWISTED NEMATIC MODULES (Cont.)

Number Of Characters	Type Number	Outline Dimension (mm)	Viewing Area (mm)	Character Format	Character Size (mm)	Φ Opt	Drive Method	Supply Voltage	Illumination Mode	Comments
2 × 24	LTN222R-10	116.0 × 37.0 × 11.0	83.0 × 18.	5 × 7 + Cur	2.70 × 5.55	270	Mux 1:16	+ 5V	Reflective	—
	LTN222F-10	116.0 × 37.0 × 11.0	83.0 × 18.	5 × 7 + Cur	2.70 × 5.55	270	Mux 1:16	+ 5V	Transflective	EL B/L, LXL211-G
2 × 40	LTN243R-10	182.0 × 33.5 × 11.0	154.4 × 15.8	5 × 7 + Cur	3.20 × 5.55	270	Mux 1:16	+ 5V	Reflective	—
	LTN243F-10	182.0 × 33.5 × 11.0	154.4 × 15.8	5 × 7 + Cur	3.20 × 5.55	270	Mux 1:16	+ 5V	Transflective	EL B/L, LXL242-G
	LTN243R-50	182.0 × 33.5 × 11.0	154.4 × 15.8	5 × 7 + Cur	3.20 × 5.55	90	Mux 1:16	+ 5V	Reflective	—

LIQUID CRYSTAL DISPLAYS, SUPER TWISTED NEMATIC MODULES

Number Of Characters	Type Number	Outline Dimension (mm)	Viewing Area (mm)	Character Format	Character Size (mm)	Φ Opt	Drive Method	Supply Voltage	Illumination Mode	Comments
1 × 16	LBN111R-10	80 × 36 × 12	64.5 × 13.8	5 × 7 + Cur	3.07 × 6.56	270	Mux 1:16	+ 5V	Reflective	Green Mode Stn
	LBN111R-30	80 × 36 × 12	64.5 × 13.8	5 × 7 + Cur	3.07 × 6.56	270	Mux 1:16	+ 5V	Reflective	Blue Mode Stn
2 × 16	LBN211R-10	84 × 44 × 12	61.0 × 15.8	5 × 7 + Cur	2.96 × 5.56	270	Mux 1:16	+ 5V	Reflective	Green Mode Stn
	LBN211R-30	84 × 44 × 12	61.0 × 15.8	5 × 7 + Cur	2.96 × 5.56	270	Mux 1:16	+ 5V	Reflective	Blue Mode Stn
2 × 20	LBN221R-10	116 × 37 × 11	83.0 × 18.6	5 × 7 + Cur	3.20 × 5.55	270	Mux 1:16	+ 5V	Reflective	Green Mode Stn
	LBN221R-30	116 × 37 × 11	83.0 × 18.6	5 × 7 + Cur	3.20 × 5.55	270	Mux 1:16	+ 5V	Reflective	Blue Mode Stn
2 × 24	LBN222R-10	116 × 37 × 11	83.0 × 18.6	5 × 7 + Cur	2.70 × 5.55	270	Mux 1:16	+ 5V	Reflective	Green Mode Stn
	LBN222R-30	116 × 37 × 11	83.0 × 18.6	5 × 7 + Cur	2.70 × 5.55	270	Mux 1:16	+ 5V	Reflective	Blue Mode Stn
2 × 40	LBN242R-10	182 × 33.5 × 11	154.4 × 15.8	5 × 7 + Cur	3.20 × 5.55	270	Mux 1:16	+ 5V	Reflective	Green Mode Stn
	LBN242R-30	182 × 33.5 × 11	154.4 × 15.8	5 × 7 + Cur	3.20 × 5.55	270	Mux 1:16	+ 5V	Reflective	Blue Mode Stn

LCD FORMATS



PROVIDENCE PIKE, SLATERSVILLE, RI 02876, 401/762-3800, FAX 401/767-4497

SAMTRON LCD

Since it began producing B/W picture tubes in the early 1970s for the first time in Korea, Samsung Electron Devices (SED) added its new business lines for color picture tubes (CPTs), monitors, terminals in the 1980s.

Also SED currently manufactures a wide variety of computer products, LCDs and VFDs — a further step toward becoming a frontrunner in the world's visual and data display products manufacturing industry.

In May, 1990, SED started to run a new LCD plant including STN production line whose capacity is the largest in the world.

But not satisfied with those achievement, SED not only improves the quality of its products, but also diversifies the models and functions of them to make better and cheaper products.

SED's new brand name, SAMTRON is now, loved by consumers throughout the world.

In the near future, SED will become the frontrunner of the world's visual data display products industry, making such advanced products as TFT for color TV or high resolution and high reliability display goods.

1 APPLICATIONS

- Telephone
- Facsimile Machine
- Electronic Typewriter
- Pos Terminal
- Copy Machine
- Hand Carry Game Machine
- Word Processor
- Laptop Computer
- Portable Data Terminal Equipment
- Over Head Projection
- Fish Finder
- Other Display Devices

2 FEATURES

- Wide viewing angle and high contrast image
- Low voltage and low power consumption
- Thin, light and compact
- High reliability and quality
- Wide range of operating temperature
- A variety of backlights

3 EXPLANATION OF MODEL NO

U	C	1	6	1	0	1	S	N	A	R	5	X
①	②	③	③	④	⑤	⑤	⑥	⑦	⑧	⑨	⑩	⑪

① Symbol of LCD Module
② Module Types: C: Character, G: Graphic
③ Character Type: Number of characters per line, Graphic Type: Number of row dots
④ Character Type: Number of lines, Graphic Type: Number of column dots
⑤ Development Number: Successive No (00-99)
⑥ LCD Mode: LCD Type+LCD Color
⑦ Backlight Mode: Backlight Type+Backlight Color
⑧ Temperature Range+Viewing Direction+Power Supply
⑨ Polarizer Type+LCD Mode
⑩ Chassis Mode+Connector Mode
⑪ Revision Number (0-9 or A-Z)

4 INFORMATION ON ORDERING

- Model No
- Display Mode (TN, STN) and background color (Yellow Green, Blue, Neutral...)
- Backlight (None, E/L, LED, CCFL) and backlight color
- Temperature Range (Normal, Extended)
- Viewing direction (6:00, 12:00, ...)
- Power Supply (Single source, Double source)
- Polarizer Type (Reflective, Transflective (Positive, Negative), Transmissive (Positive, Negative)
- Chassis Plating (NiCr, Dacro)
- Connector (Non, Pin (Straight, Right-Angle), Flexible Cable)

SAMTRON LCD

Only for TN type

TYPE	OPERATING TEMP.	STORAGE TEMP.
NORMAL	0°C~+50°C	−20°C~+70°C
EXTENDED	−20°C~+70°C	−30°C~+80°C

■ CHARACTER MODULES

NO. OF DISPLAY CHAR.×LINE	MODEL NO.	CHARACTER SIZE FONTS	MODULE SIZE (W×H×T)	HOLE-HOLE DISTANCE (W×H)	VIEWING AREA (W×H)	CHARACTER SIZE (W×H)	DOT SIZE (W×H)
8×1	UC-081-01	5×7 DOTS WITH CURSOR	84×44×10	79(76)×36	61×15.8	6.45×10.75	1.25×1.3
16×1	UC-161-01	5×7 DOTS WITH CURSOR	80×36×10.5	75×31	64.5×13.8	3.07×6.56	0.55×0.75
	UC-161-02	5×7 DOTS WITH CURSOR	80×38.7×10.5	75×31	64.5×13.8	3.07×6.56	0.55×0.75
	UC-161-03	5×7 DOTS	115×35×10	110×30	99×13	4.9×7.95	0.9×1.05
	UC-161-04	5×7 DOTS WITH CURSOR	80×36×10	75×31	64.5×13.8	3.07×6.56	0.55×0.75
	UC-161-05	5×7 DOTS WITH CURSOR	85×32.6×10.5	80×31	61×16	2.95×7.15	0.55×0.75
	UC-161-06	5×7 DOTS WITH CURSOR	80×36×10.5	75×31	64.5×13.8	3.15×6.3	0.55×0.7
	UC-161-07	5×10 DOTS WITH CURSOR	80×36×10	75×31	64.5×13	3.2×8.2	0.6×0.7
	UC-161-08	5×7 DOTS WITH CURSOR	122×33×11	115×25	99×13	4.84×9.66	0.92×1.1
	UC-161-10	5×7 DOTS WITH CURSOR	80×36×8	75×31	65.6×13.8	3.2×6.6	0.6×0.7
16×2	UC-162-01	5×7 DOTS WITH CURSOR	84×44×10.5	79(76)×36	64.5×13.8	2.78×4.89	0.5×0.55
	UC-162-02	5×7 DOTS WITH CURSOR	80×36×10.5	75×31	64.5×13.8	2.78×4.89	0.5×0.55
	UC-162-03	5×7 DOTS WITH CURSOR	122×44×10.5(15)	115×37	99×24	4.84×9.66	0.92×1.1
	UC-162-04	5×7 DOTS WITH CURSOR	85×36×10.5	80×31	64.5×13.8	2.78×4.89	0.50×0.55
	UC-162-05	5×7 DOTS WITH CURSOR	84×37×10	77.5×*	64×16.4	3.15×5.5	0.59×0.64
	UC-162-06	5×7 DOTS WITH CURSOR	84×44×10	79(76)×36	61×15.8	2.96×5.56	0.56×0.66
	UC-162-07	5×7 DOTS WITH CURSOR	85×32.6×10.5	80×31	61×16	2.95×5.55	0.55×0.65
	UC-162-08	5×7 DOTS WITH CURSOR	80×36×10.5	75×31	64.5×13.8	2.95×4.35	0.55×0.5
	UC-162-09	5×7 DOTS WITH CURSOR	80×30×10	77×24	63.5×15.8	2.96×5.56	0.56×0.66
	UC-162-10	5×7 DOTS WITH CURSOR	84×44×11	79 (76)×36	61×16	2.95×5.55	0.55×0.65
	UC-162-11	5×7 DOTS WITH CURSOR	84×45×15	79 (76)×36	61×16	2.95×5.55	0.55×0.65
	UC-162-12	5×7 DOTS WITH CURSOR	90×36×15	75×31	64.5×13.8	2.95×4.35	0.55×0.5
16×4	UC-164-01	5×7 DOTS WITH CURSOR	87×60×10	82×55	61.8×25.2	2.95×4.75	0.55×0.55
20×1	UC-201-01	5×7 DOTS WITH CURSOR	116×38×10	108×29	83×18.6	3.20×5.95	0.6×0.7
	UC-201-02	5×7 DOTS WITH CURSOR	182×33.5×11	175×26.5	154×15.3	6.7×11.5	1.3×1.3
20×2	UC-202-01	5×7 DOTS WITH CURSOR	116×37×10	108×29	83×18.6	3.2×5.55	0.6×0.65
	UC-202-04	5×7 DOTS WITH CURSOR	115×38×10	108×29	83×18.6	3.2×5.55	0.6×0.65
	UC-202-05	5×7 DOTS WITH CURSOR	116×37×11	108×29	83×18.6	3.2×5.55	0.6×0.65
	UC-202-06	5×7 DOTS WITH CURSOR	95×30×10	92×24	80.3×15.8	3.2×5.55	0.6×0.65
	UC-202-07	5×7 DOTS WITH CURSOR	126×37×15	108×29	83×18.6	3.2×5.55	0.6×0.65
20×4	UC-204-01	5×7 DOTS WITH CURSOR	98×60×11	93×55	76×25.2	2.95×4.75	0.55×0.55
24×1	UC-241-01	5×7 DOTS WITH CURSOR	126×36×10.6	121×31	100×13.8	3.07×6.56	0.55×0.75
24×2	UC-242-01	5×7 DOTS WITH CURSOR	118×36×10	113×31	93.5×15.8	3.15×5.75	0.55×0.55
	UC-242-02	5×7 DOTS WITH CURSOR	108.5×34.8×10	*	93.5×15.8	3.15×5.75	0.55×0.55
	UC-242-03	5×7 DOTS WITH CURSOR	118×36×11	113×31	93.5×15.8	3.20×5.55	0.6×0.65
40×1	UC-401-01	5×7 DOTS WITH CURSOR	182×38.5×11	175×26.5	154.5×15.8	3.05×6.56	0.55×0.75
40×2	UC-402-01	5×7 DOTS WITH CURSOR	182×35×11	175×28	154.5×15.8	3.2×5.55	0.6×0.65
	UC-402-02	5×7 DOTS WITH CURSOR	182×33.5×10	175×26.5	154.5×15.8	3.15×5.55	0.55×0.6
	UC-402-03	5×7 DOTS WITH CURSOR	170×30×10	167×24	155.1×15.8	3.2×5.55	0.6×0.65
	UC-402-04	5×7 DOTS WITH CURSOR	170×31.5×15	167×23.2	151.6×14.2	3.2×5.55	0.6×0.65
40×4	UC-404-01	5×7 DOTS WITH CURSOR	190×55×10	183×48	147×29.5	2.78×4.89	0.5×0.55
80×2	UC-802-01	5×7 DOTS WITH CURSOR	259.8×38.9×11	252.6×31.7	222×16.5	2.2×4.35	0.4×0.5

NO. OF DISPLAY CHAR.×LINE	MODEL NO.	DRIVING METHOD (DUTY)	APPROX. WEIGHT (g)	BACK-LIGHT					
				TN			STN		
				NONE	EL	LED	NONE	EL	LED
8×1	UC-081-01	1/8	35	○	○		○	○	
16×1	UC-161-01	1/16	25	○	○		○	○	
	UC-161-02	1/16	25	○	○		○	○	
	UC-161-03	1/16	28	○	○		○	○	
	UC-161-04	1/16	25	○	○		○	○	
	UC-161-05	1/16	26	○	○		○	○	
	UC-161-06	1/8	25	○	○		○	○	
	UC-161-07	1/11	25	○	○		○	○	
	UC-161-08	1/8	29	○	○		○	○	
	UC-161-10	1/16	25	○			○		
16×2	UC-162-01	1/16	30	○	○		○	○	
	UC-162-02	1/16	30	○	○		○	○	
	UC-162-03	1/16	35	○	○	○	○	○	○
	UC-162-04	1/16	31	○	○		○	○	

SAMTRON LCD

NO. OF DISPLAY CHAR.×LINE	MODEL NO.	DRIVING METHOD (DUTY)	APPROX. WEIGHT (g)	BACK-LIGHT					
				TN			STN		
				NONE	EL	LED	NONE	EL	LED
16×2	UC-162-05	1/16	31	○			○		
	UC-162-06	1/16	31	○	○		○	○	
	UC-162-07	1/16	30	○	○		○	○	
	UC-162-08	1/16	30	○	○		○	○	
	UC-162-09	1/16	30	○			○		
	UC-162-10	1/16	30	○	○		○	○	
	UC-162-11	1/16	32			○			○
	UC-162-12	1/16	33			○			○
16×4	UC-164-01	1/16	50	○	○		○	○	
20×1	UC-201-01	1/16	44	○	○		○	○	
	UC-201-02	1/8	48	○	○		○	○	
20×2	UC-202-01	1/16	45	○	○		○	○	
	UC-202-04	1/16	45	○	○		○	○	
	UC-202-05	1/16	45	○	○		○	○	
	UC-202-06	1/16	43	○			○		
	UC-202-07	1/16	60			○			○
20×4	UC-204-01	1/16	55	○	○		○	○	
24×1	UC-241-01	1/16	45	○	○		○	○	
24×2	UC-242-01	1/16	45	○	○		○	○	
	UC-242-02	1/16	48	○	○		○	○	
	UC-242-03	1/16	48	○	○		○	○	
40×1	UC-401-01	1/16	75	○	○		○	○	
40×2	UC-402-01	1/16	80	○	○		○	○	
	UC-402-02	1/16	80	○	○		○	○	
	UC-403-03	1/16	76	○			○		
	UC-404-04	1/16	100			○			○
40×4	UC-404-01	1/16	125	○	○		○	○	
80×2	UC-802-01	1/16	150	○			○		

■ GRAPHIC MODULES

DOTS PIXELS (W×H)	MODEL NO.	MODULE SIZE (W×H×T)	HOLE-HOLE DISTANCE (W×H)	VIEWING AREA (W×H)	DOT PITCH (W×H)	DOT SIZE (W×H)	DRIVING METHOD (DUTY)	APPROX. WEIGHT (g)
120×32	UG-12A-01	152×56×15	140×46	90×32	0.70×0.49	0.65×0.75	1/32	120
240×64	UG-24B-01	180×75×13.8	176×64	132×39	0.53×0.53	0.48×0.48	1/64	150
	UG-24B-02	180×75×10.5	176×64	132.6×39	0.53×0.53	0.48×0.48	1/64	150
	UG-24B-03	180×65×12	176×54	132×39	0.53×0.53	0.49×0.49	1/64	185
	UG-24B-04	149×57×13	145×46	117×41	0.47×0.47	0.44×0.44	1/64	120
240×128	UG-24D-01	144×104×12.5	138×100	114×64	0.45×0.45	0.4×0.4	1/128	150
	UG-24D-02	176×96×12	168×88	135×76	0.53×0.53	0.49×0.49	1/128	200
256×128	UG-25D-01	147×116×12	135×108	127×70	0.47×0.47	0.43×0.43	1/64	170
480×64	UG-48B-01	296.8×76.2×11.7	262×67	239.4×38.1	0.49×0.49	0.44×0.44	1/64	190
	UG-48B-02	180×120×13.8	262×67	240×38	0.49×0.49	0.44×0.44	1/64	180
	UG-48B-03	260×58×12	252×50	229.5×36	0.47×0.47	0.41×0.41	1/64	190
480×128	UG-48D-01	270×110×11.1	262×102	242×69	0.48×0.48	0.43×0.43	1/128	190
	UG-48D-02	268×94×12.6	260×86	231.5×66	0.47×0.47	0.43×0.43	1/128	190
640×200	UG-64E-01	270×152×12	260×146	248×114	0.375×0.525	0.335×0.475	1/200	450
	UG-64E-02	270×150×16	262×142	234×104	035×0.49	0.32×0.46	1/200	480
	UG-64E-03	270×104×13	258×98	236.4×78	0.36×0.36	0.33×0.33	1/200	290
640×400	UG-64H-01	270×198×13.5	262×190	236×153.6	0.36×0.36	0.33×0.33	1/200	540
	UG-64H-02	290×170×12	282×162	236×152	0.36×0.36	0.33×0.33	1/200	500
640×400 (B/W)	UG-64H-03	270×198×13.5	262×190	236×153.6	0.36×0.36	0.33×0.33	1/200	540
640×480 (B/W)					0.30×0.30	0.27×0.27		

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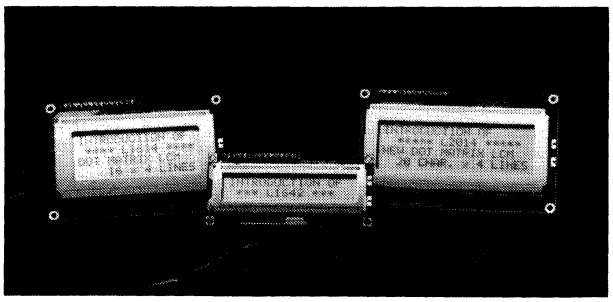
SII
Seiko Instruments

LIQUID CRYSTAL DISPLAYS

DOT MATRIX MODULES

Seiko Instruments USA Inc.(SII) Dot Matrix Character Modules were designed with your application in mind. The expanded range offers a wide variety of sizes, all using industry standard controllers and drivers. They are now available with our grey-mode Supertwist option for enhanced contrast and viewing angle. The compact modules are also available with an electroluminescent (EL) backlight or LED panel for use in dark environments.

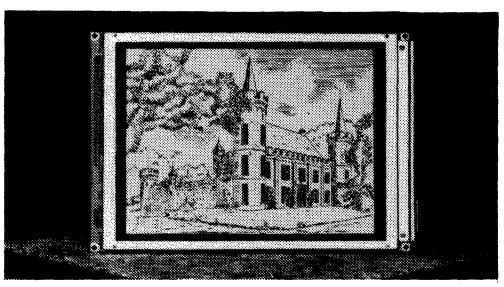


- ☐ 5 x 7 Dot Matrix plus cursor
- ☐ Character generator and data RAM on board
- ☐ Compact, lightweight and low cost
- ☐ Single 5 volt input
- ☐ 4 or 8 bit parallel interface
- ☐ EL or LED backlight available
- ☐ Wide temperature option available

Model	No. Characters x No. Lines	Outside Dim. (W x H x D)	Character Size	Dot Size (W x H)
M1641	16 x 1 line	80 x 36 x 11.3	3.07 x 5.73	0.55 x 0.75
L1651	16 x 1 line	151 x 40 x 11	6.00 x 14.54	1. 52 x 1.765
M1632	16 x 2 lines	85 x 30 x 11.3	2.78 x 4.27	0.50 x 0.55
L1642	16 x 2 lines	80 x 36 x 11.3	2.95 x 3.80	0.55 x 0.50
L1652	16 x 2 lines	122 x 44 x 11.3	4.84 x 9.66	0.92 x 1.10
L1614	16 x 4 lines	87 x 60 x 11.6	2.95 x 4.15	0.55 x 0.55
L2012	20 x 2 lines	116 x 37 x 11.3	3.20 x 4.85	0.60 x 0.65
L2014	20 x 4 lines	98 x 60 x 11.6	2.95 x 4.15	0.55 x 0.55
L2432	24 x 2 lines	118 x 36 x 11.3	3.20 x 4.85	0.60 x 0.65
L4042	40 x 2 lines	182 x 33.5 x 11.3	3.20 x 4.85	0.60 x 0.65
M4024	40 x 4 lines	190 x 54 x 11.3	2.78 x 4.27	0.50 x 0.55

GRAPHIC MODULES

SII offers a wide variety of graphic LCD modules featuring Supertwist (STN) technology. Their excellent contrast and viewing angle solve many of the problems associated with large LCD displays. Our new FSTN technology provides the desirable black and white display when combined with CFL edgelighting.



Options

- ☐ Standard 4 or 8 bit parallel interface
- ☐ Reflective, transflective, or transmissive polarizers
- ☐ Positive or Negative (transmissive only) image
- ☐ CFL or EL backlighting
- ☐ Black and white using FSTN technology

Model	Dot Format (Col. x Row)	Outside Dim. (W x H x D)	Viewing Area (W x H)	Dot Size (W x H)
F1016	100 x 64	140 x 110 x 14.3	100 x 68	0.85 x 0.85
G191C	192 x 128	98 x 86 x 13.4	77.5 x 54	0.33 x 0.33
G2436	240 x 64	180 x 75 x 11.3	134 x 41	0.49 x 0.49
G2446[1,2]	240 x 64	193 x 79 x 15.1	134 x 41	0.49 x 0.49
G242C[1,2]	240 x 128	180 x 110 x 15.1	134 x 76	0.47 x 0.47
G321C[2]	320 x 200	166 x 134 x 15.1	128 x 110	0.34 x 0.48
G482C[3]	480 x 128	270 x 110 x 12	242 x 69	0.45 x 0.45
G648D	640 x 200	270 x 150 x 12	239 x 104	0.32 x 0.46
G644F	640 x 400	270 x 198 x 12	236 x 153.6	0.33 x 0.33
G645F[2]	640 x 400	324 x 190 x 18	218 x 138.8	0.30 x 0.30
G642G[2]	640 x 480	272 x 209.4 x 14.7	220 x 168	0.30 x 0.30
G643G[2]	640 x 480	255.5 x 172 x 10.6	208 x 153	0.27 x 0.27

1. Includes built-in controller 2. Available with CFL edgelight 3. Serial interface

CUSTOM DISPLAYS

With over 15 years of custom LCD experience, SII can meet your needs for custom LCDs or custom Liquid Crystal Display Modules (LCM). Special type styles or graphic patterns are possible in glass sizes from 1/4" x 1/2" up to 10" x 7". Static drive up to 1/240 duty cycle, colored polarizers, and a variety of backlighting methods round out Seiko Instruments custom capabilities. Complete design and applications assistance is only a phone call away. Contact SII when your design calls for custom LCDs or LCMs, you will like the results.

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SHARP

LCD Units

Sharp character type LCD Unit operates under the control of a 4 or 8-bit microcomputer

Features

- Interface with either 4-bit or 8-bit microprocessor.
- Display data RAM
  80 x 8 bits (80 characters).
- Character generator ROM
  160 different 5 x 7 dot-matrix character patterns.
- Character generator RAM
  8 different user programmed 5 x 7 dot-matrix patterns.
- Display data RAM and character generator RAM may be accessed by the microprocessor.
- Numerous instructions
  Clear Display, Cursor Home, Display ON/OFF, Cursor ON/OFF, Blink Character, Cursor Shift, Display shift.
- Built-in reset circuit is triggered at power ON.
- Built-in oscillator.

TN-FEM LCD UNITS

Number of characters	Model No.	Type*1				Unit outline dimensions W x H x D (mm)*2	Effective viewing area W x H (mm)	Character size W x H (mm)
		I	II	III	IV			
16 x 1	LM16152A	R	—	P	6	115 x 35 x 12	99 x 13	4.9 x 7.95
	LM16152D/E/H	M	L	P	6	115 x 39.5 x 16	99 x 13	4.9 x 7.95
	LM165159D/E/H	M	L	P	12	115 x 39.5 x 16	99 x 13	4.9 x 7.95
	LM16155	R	—	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155K	R	—	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155M	M	E	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155N	M	E	P	12	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155S	R	—	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
16 x 2	LM16255	R	—	P	6	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16255K	R	—	P	12	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16255M	M	E	P	6	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16255S	R	—	P	6	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16257	R	—	P	6	85 x 32.6 x 11	61 x 15.8	2.96 x 4.86
	LM162A01	T	L	P	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM162B01	T	L	N	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM162A02	T	L	P	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM162B02	T	L	N	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
20 x 2	LM20255	R	—	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM20255M	M	E	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM20255S	R	—	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM20256	R	—	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM202A02	T	L	P	6	115 x 36 x 16	83 x 18.6	3.2 x 4.85
	LM202B02	T	L	N	6	115 x 36 x 16	83 x 18.6	3.2 x 4.85
24 x 2	LM24255	R	—	P	6	115 x 36 x 11	83 x 18.6	2.7 x 4.85
40 x 2	LM40255	R	—	P	6	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40255K	R	—	P	12	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40255M	M	E	P	6	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40255S	R	—	P	6	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM402A01	T	L	P	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85
	LM402B01	T	L	N	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85
	LM402X01	T	L	P	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85
	LM402Y01	T	L	N	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85

STHC LCD UNITS

16 x 2	LM16A21	R	—	P	—	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16X21A	T	L	P	—	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM16X21B	T	L	N	—	84 x 44 x 16	61 x 15.8	2.96 x 4.86
20 x 2	LM20A21	R	—	P	—	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM20X21A	T	L	P	—	115 x 36 x 16	83 x 18.6	3.2 x 4.85
40 x 2	LM40A21	R	—	P	—	182 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40X21A	T	L	P	—	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85
	LM40X21B	T	L	N	—	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85

*1 Type I: Transmissive: T / Transflective: M / Reflective: R
Type II: LED backlight is built in.: L / EL backlight can be installed.: E
Type III: Positive: P / Negative: N
Type IV: 6 o'clock viewing direction: 6 / 12 o'clock viewing direction: 12
*2 D (Depth): max. value
*3 Ta = 25°C

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SHARP

LCD Units

Sharp, unchallenged leader in the field of LCD units, is about to revolutionize the field.

Sharp's capacity for technological development is creating greater possibilities for LCD applications.

Since 1973, when Sharp introduced the use of the LCD in electronic calculators for the first time in the world, new fields of application have been rapidly developed due to constant technological improvements. This commitment to improvement has resulted in LCD units with superior readability over a wide range of adverse conditions.

As demand for large-size and high-resolution LCD units increased, Sharp responded by adding quality features, including high contrast, wide viewing angle and wide temperature range displays. Sharp's innovative approach to LCD design has led to LCD units which are lightweight, thin and power-saving for better cost performance with high reliability.

Paper white mode Film Compensated Super Twist LCD unit—Sharp's Latest LCD technology.

A large portion of the information we regularly read is in the form of black letters printed on white paper. This same format has long been desired for the LCD, as well.

Sharp has taken the lead in developing and mass-producing a paper white mode Film Compensated Super Twist (TSTN) LCD unit capable of reproducing an image close to the printed page to which most individuals are accustomed. This advanced display, almost equivalent to a CRT, is about to change the current image of the LCD entirely.

With nearly 3 times higher contrast and a wider viewing angle compared to conventional Super Twisted High Contrast (STHC) LCD units, this new product, with built-in CCFT backlight, is the answer to brighter and clearer displays. Paper white mode TSTN LCD units are ideal for OA equipment, from personal computers to word processors.

Table of Graphic Display Type LCD Units

Dot format W × H (Dots)	Dot pitch W × H (mm)	Model No.	Type				Contrast ratio	Brightness*3 (nt)
			Panel*1	Color mode	Backlight*2	Structure		
240 × 64	0.47 × 0.47	LM24013W	STN	Yellow-green	—	Reflective	7	—
	0.53 × 0.53	LM24014W	STN	Yellow-green	—	Reflective	7	—
		LM24014H	STN	Light gray	EL	Transflective		10
240 × 128	0.53× 0.53	LM24009W	STN	Greenish white	—	Reflective	6	—
		LM24010Z	DSTN	Black & white	CCFT (E)	Transmissive	20	35
320 × 240	0.36 × 0.36	LM32004T	STN	Blue & white	CCFT (D)	Transmissive	4.5	60
640 × 200	0.33 × 0.33	LM64053W	STN	Yellow-green	—	Reflective	6	—
	0.35 × 0.49	LM64032W	STN	Yellow-green	—	Reflective	4.5	—
		LM64032M	STN	Yellow-green	EL	Transflective		15
		LM64012C	STN	Light gray	CCFT (E)	Transmissive	4	100
	0.325 × 0.65	LM64050W	STN	Yellow-green	—	Reflective	5	—
		LM64050M	STN	Yellow-green	EL	Transflective	4.5	15
640 × 400	0.33 × 0.33	LM64P402	TSTN	Black & white	CCFT (D)	Transmissive	15	100
640 × 480	0.27 × 0.27	LM64P70	TSTN	Black & white	CCFT (E)	Transmissive	12	35
		LM64P762	TSTN	Black & white	CCFT (E)	Transmissive	13	40
	0.30 × 0.30	LM64P722	TSTN	Black & white	CCFT (E)	Transmissive	13	40
		LPM64P80	TSTN	Black & white	CCFT (E)	Transmissive	13	35
	0.31 × 0.31	LM64P60	TSTN	Black & white	CCFT (E)	Transmissive	13	60
		LM64P62	TSTN	Black & white	CCFT (D)	Transmissive	14	100
		LM64N661	TSTN	Black & white	—	Transmissive	14	—
	0.36 × 0.36	LM64P64	TSTN	Black & white	CCFT (D)	Transmissive	14	50
1,024 × 768	0.22 × 0.22	LM10P10	TSTN	Black & white	CCFT (E)	Transmissive	8	50

*1 Panel
- STN : Super Twisted Nematic
- DSTN: Double Super Twisted Nematic
- FSTN: Film Super Twisted Nematic
- TSTN: Triple Super Twisted Nematic

*2 Backlight
- EL : Electro Luminescent (Option)
- CCFT (D): Cold Cathode Fluorescent Tube (Direct lighting type)
- CCFT (E): Cold Cathode Fluorescent Tube (Edge lighting type)
- HCFT (D): Hot Cathode Fluorescent Tube (Direct lighting type)

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SHARP

LCD Units

Sharp LCD units are the result of a fully integrated process, from initial development to final inspection.

Sharp offers a diverse line of LCD units, small, medium and large. And with the addition of the Film Compensated Super Twist LCD unit to the large-size graphic display line and the Super Twisted High Contrast LCD unit to the character display line, even wider range of choices can now be offered.

Sharp's high quality LCD units guarantee high reliability for a wide variety of applications. This attractive product line is the ultimate response to customers' needs, from large-size displays for computers to displays for precision machinery.

Please feel free to consult us about custom-designed units to match your specific applications.

TSTN LCD Unit

Demand for even higher display quality is increasing with a trend toward larger, higher-resolution LCD units. Sharp has succeeded in developing and mass producing paper white mode TSTN LCD units with image quality approaching that of the printed page.

Features

- Advanced start-to-finish production system to maximize the product quality.
- A broad range of products, from 240x64 to 1024x768 dot display formats.
- Thin, lightweight and compact in design.
- Low drive voltage and low power consumption.
- A bright, high contrast, Film Compensated Super Twist (TSTN) LCD with a wide viewing angle, adopted for the large-size LCD unit.
- Backlit models are also available offering the optimum readability under diverse lighting conditions.

(Ta = 25°C) **Table of Graphic Display Type LCD Units**

Unit outline dimensions W × H × D (max.) (mm)	Weight (g)	Supply voltage (V)	Power consumption		Remark	Model No.
			Panel (mW)	Backlight (including Inverter) (W)*3		
149 × 57 × 11.5	100	+5.0, −12.0	30	—		LM24013W
180 × 65 × 10.5	120	+5.0, −12.0	75	—	Controller built-in type	LM24014W
				0.5		LM24014H
176 × 96 × 12	200	+5.0, −17.5	343	—		LM24009W
194 × 96 × 22	430	+5.0, −21.0	395	2		LM24010Z
166 × 130 × 18	420	+5.0, −24.0	580	1.75		LM32004T
287 × 98 × 10	320	+5.0, −25.0	94	—		LM64053W
256 × 144 × 12	320	+5.0, −21.1	534	—	Light gray mode type is also available. (LM640329)	LM64032W
				4	Transmissive type is also available. (LM64032X)	LM64032M
274 × 142 × 21	790	+5.0, −21.1	526	5		LM64012C
256 × 180 × 13	570	+5.0, −19.8	407	—		LM64050W
256 × 180 × 16	650	+5.0, −21.1	526	5.5		LM64050M
300 × 182 × 23	700	+5.0, −14.3	430	5		LM64P402
257 × 158.5 × 9.5	425	+5.0, −16.6	410	2.3	High speed LCD driver built-in type*4	LM64P70
	420	+5.0, −17.8	500	2	Fast response LCD	LM64P762
263 × 169 × 9	420	+5.0, −17.8	500	2	Fast response LCD	LM64P722
260 × 174 × 7	380					LM64P80
288 × 200 × 14	950	+5.0, −16.6	410	5.5		LM64P60
280 × 180 × 24.2	855	+5.0, −16.1	447	5	High speed LCD driver built-in type is also available.*4	LM64P62
267.8 × 236 × 8.5	530	+5.0, −16.3	498	—	For overhead projection application	LM64N661
310 × 260 × 23	970	+5.0, −16.3	347	5		LM64P64
312 × 230 × 18.5	1,300	+5.0, +27	555	7	<UD>	LM10P10

*3 Values measured using EL backlight and inverter recommended by SHARP.
*4 Allowable max. frame frequency for LCD driver is 120 Hz.
(Other models: 80 Hz)
For optimum quality display, 59 Hz to 85 Hz is recommended.

Note 1) Unless otherwise specified, typical values are shown.
Note 2) <UD>: Under development
Note 3) Unless otherwise specified, inverter for backlight and controller are not inlcuded in the unit.

SHARP ELECTRONICS CORP., Micro Electronics Group, 5700 N.W. Pacific Rim Blvd., Camas, WA 98607 • 206-834-2500 • Fax 206-834-8903 • Telex 496-08472 (SHARP CAM)

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SHELLY LCD GRAPHIC DISPLAY MODULES

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- TN, Supertwist and F-STN modules
- Sizes from 120 × 32 to 1170 × 780
- EL or CFL Backlighting
- Gray, Yellow or Blue Background
- White on Black or Black on White
- Color available January 1992

GRAPHIC LCD DISPLAY MODULES

PART NUMBER	DISPLAY FORMAT	DUTY CYCLE	FLUID TYPE	VIEW ANGLE	VIEW MODE	COLOR	BACK LIGHT	EL CFL INVERTER
SGM01280032A1	120 × 32	1/32	T,H,S,F	1,2	A,B,C	Y,B,G,W	N,W,E	SDA5V07A
SGM01200064A1	120 × 64	1/32	T,H,S,F	1,2	A,B,C,D,E	Y,B,G,W	N,W,E	SDA5V07A
SGM02400064A1	240 × 64	1/32	T,H,S,F	1,3	A,B,C,D,E	Y,B,G,W	N,W,E	SDA5V07A
SGM02400064B1	240 × 64	1/64	T,H,S,F	1,3	A,B,C,D,E	Y,B,G,W	N,W,E	SDA5V07A
SGM02400064C1	240 × 64	1/64	S,F	1,3	A,B,C	Y,B,G,W	N,W,E	SDA5V07A
SGM02400128A1	240 × 128	1/128	S,F	1,3	C	B,W	C	CFL*
SGM02560128A1	256 × 128	1/64	T,H,S,F	1,3	A,B,C	Y,B,G,W	N,W,E	SDA5V07A
SGM03200200A1	320 × 200	1/200	S,F	2	E	B,W	C	CFL*
SGM04800064A1	480 × 64	1/64	T,H,S,F	1,2,3,4	A,B,C	Y,B,G,W	N,W,E	SDA5V12A
SGM04800128A1	480 × 128	1/64	T,H,S,F	1,2,3,4	A,B,C	Y,B,G,W	N,W,E	SDA5V11A
SGM06400064A1	640 × 64	1/64	S,F	1,2	A	Y,B,W	N	None
SGM06400200B1	640 × 200	1/200	S,F	1,2	A,B,C	Y,B,W	N,W,E	SDA5V11A
SGM06400200C1	640 × 200	1/200	T,S,F	1,2	E	B,W	C	CFL*
SGM06400200D1	640 × 200	1/200	S,F	2	E	B,W	C	CFL*
SGM06400400A1	640 × 400	1/200	S,F	2,4	C	B,W	C	CFL*
SGM06400400B1	640 × 400	1/200	S,F	4	A,C,E	Y,B,W	N,E,W	SDA5V12A
SGM06400480A1	640 × 480	1/240	F	2,4	E	W	C	CFL*
SGM06400480B1	640 × 480	1/240	F	4	E	W	C	CFL*
SGM06400480M1*	640 × 480	1/240	S,F	4	E	W	C	CFL*
SGM06400480L1*	640 × 480	1/240	S,F	4	E	W	C	CFL*
SGM06400480E1	640 × 480	1/240	S,F	2	E	B,W	C	CFL*
SGM06400480F1*	640 × 480	1/240	S,F	4	E	B,W	C	CFL*
SGM06400480K1*	640 × 480	1/240	S,F	4	E	B,W	C	CFL*
SGM11200780A1	1120 × 780	1/390	F	4	E	W	C	CFL*

CFL INVERTER

NOTE: WHEN THE POWER INPUT VOLTAGE IS:

+12VDC - USE MODEL SDA12F06

+24VDC - USE MODEL SDA24F02

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SHELLY LCD GRAPHIC DISPLAY MODULES

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GRAPHIC LCD DISPLAY MODULES

CONTROLLER CARD	OVERALL DIMENSION W x H x D (mm)	VIEWING DIMENSION W x H (mm)	DOT PITCH (mm)	POWER SUPPLY	TEMPERATURE RANGE OPER (°C)	STORAGE (°C)
SGC-01	(152 x 56 x 15)	(90 x 32)	0.70 x 0.80	+5 – 5	0 +40	–20 +60
SGC-01	(124 x 64 x 15)	(70.5 x 39.5)	0.53 x 0.53	+5 – 5	0 +40	–20 +60
SGC-01	(180 x 75 x 15)	(132 x 39)	0.53 x 0.53	+5 – 5	0 +40	–20 +60
SGC-01	(180 x 75 x 12)	(132 x 39)	0.53 x 0.53	+5 –12	0 +40	–20 +60
SGC-01	(180 x 75 x 12)	(132 x 39)	0.53 x 0.53	+5 –12	0 +40	–20 +60
SGC-06	(128 x 77 x 24)	(78 x 44.5)	0.30 x 0.30	+5 –23	+ 5 +40	–20 +60
SGC-02B	(200 x 110 x 12)	(128 x 66.5)	0.48 x 0.48	+5 –12	0 +40	–20 +60
	(152 x 98.5 x 24)	(102 x 66)	0.30 x 0.30	+5 –23	+ 5 +40	–20 +60
SGC-02B	(290 x 73 x 12)	(246 x 38)	0.50 x 0.50	+5 –12	0 +40	–20 +60
SGC-02B	(290 x 110 x 12)	(237 x 67)	0.48 x 0.48	+5 –12	0 +40	–20 +60
	(299.5 x 53 x 10)	(248 x 32)	0.38 x 0.38	+5 –12	0 +40	–20 +60
SGC-16	(270 x 110 x 12)	(240 x 79)	0.36 x 0.36	+5 –20	0 +40	–20 +60
SGC-16	(252 x 104 x 12)	(216 x 84)	0.33 x 0.396	+5 –23	0 +40	–20 +60
SGC-16	(324 x 120 x 19)	(216 x 84)	0.33 x 0.396	+5 –23	+ 5 +40	–20 +60
SGC-16	(324 x 190 x 19)	(238 x 154)	0.36 x 0.36	+5 –23	+ 5 +40	–20 +60
SGC-16	(250 x 145 x 9)	(197 x 125)	0.30 x 0.30	+5 –23	0 +40	–20 +60
SGC610/620	(272 x 200 x 16)	(215 x 163)	0.32 x 0.32	+5 +35	+ 5 +40	–20 +60
SGC610/620	(272 x 200 x 11)	(215 x 163)	0.32 x 0.32	+5 –22	+ 5 +40	–20 +60
SGC610/620	(250 x 172 x 11)	(194 x 149)	0.30 x 0.30	+5 –23	+ 5 +40	–20 +60
SGC610/620	(250 x 172 x 11)	(194 x 149)	0.30 x 0.30	+5 –23	+ 5 +40	–20 +60
SGC610/620	(295 x 227 x 22)	(220 x 166)	0.33 x 0.33	+5 +32	+ 5 +40	–20 +60
SGC610/620	(244 x 158 x 9.5)	(179 x 135)	0.27 x 0.27	+5 –23	+ 5 +40	–20 +60
SGC610/620	(244 x 158 x 9.5)	(179 x 135)	0.27 x 0.27	+5 –23	+ 5 +40	–20 +60
SGC610/620	(297 x 214 x 16)	(216 x 152)	0.188 x 0.188	+5 +36	+10 +40	–10 +50

PART NUMBER

SGM XXXX XXXX XX X X X X X

- GRAPHICS
- DOTS: ROW
- DOTS: COLUMN
- INTERNAL REFERENCE
- FLUID TYPE:
  - T= TN
  - H= HIGH TEMP TN
  - S= SUPERTWIST
  - F= FSTN
- VIEW ANGLE:
  - 1= BOTTOM/GLARE
  - 2= BOTTOM/NON-GLARE
  - 3= TOP/GLARE
  - F= TOP/NON-GLARE
- VIEW MODE:
  - A= REFLECTIVE
  - B= TRANSFLECTIVE POSITIVE
  - C= TRANSMISSIVE POSITIVE
  - D= TRANSFLECTIVE NEGATIVE
  - E= TRANSMISSIVE NEGATIVE
- COLOR:
  - Y= YELLOW (STN)
  - B= BLUE (STN TRANSMISSIVE)
  - G= GREY (TN OR STN)
  - W= WHITE (FSTN)
- BACKLIGHT:
  - W= WHITE EL
  - E= GREEN EL
  - C= CFL
  - H= NONE

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SUPERTWIST LCD MODULES

SUPERTWIST LCD SELECTION CHART

PART NUMBER	LINE × COLUMN	OVERALL SIZE (MM)	VIEWING AREA (MM)	CHAR SIZE (MM)	DUTY CYCLE	POWER SUPPLY (1)	POLARIZER (3)	BACKLIGHT (4)	OPER TEMP (5)
SSM10801	1 × 8	(58 × 32)	(26.8 × 5.8)	(4.45)	1/8	H	GA/YA/GB/YB/BE	EL & LED	A
SSM11601	1 × 16	(85 × 36)	(59.4 × 8.7)	(7.96)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM11602	1 × 16	(80 × 36)	(58.7 × 6.3)	(5.5)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM11603	1 × 16	(80 × 36)	(58.7 × 8.7)	(5.5)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM11604	1 × 16	(80 × 36)	(58.7 × 5.8)	(4.45)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM11605	1 × 16	(80 × 36)	(59.6 × 6.6)	(5.73)	1/16	H/M	GA/YA/GB/YB/BE	EL	D
SSM11606	1 × 16	(115 × 35)	(94.9 × 7.9)	(7.95)	1/16	H/M	GA/YA/GB/YB/BE	EL	D
SSM11607	1 × 16	(151 × 40)	(114.0 × 14.5)	(12.71)	1/16	M/T	GA/GB	EL	B/C
SSM11612	1 × 16	(85 × 36)	(59.5 × 7.2)	(5.55)	1/16	M	YB/BE	EL & LED	B
SSM12001	1 × 20	(80 × 36)	(53.5 × 4.9)	(3.8)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM12002	1 × 20	(180 × 40)	(142.8 × 14.5)	(12.71)	1/16	M/T	GA/GB	EL	B/C
SSM12403	1 × 24	(208 × 40)	(171.6 × 14.5)	(12.71)	1/16	M/T	GA/GB	EL	B/C
SSM13202	1 × 32	(175 × 31)	(133.6 × 9.3)	(5.9)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM14001	1 × 40	(182 × 34)	(149.4 × 8.8)	(5.5)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM14003	1 × 40	(285 × 40)	(239.2 × 14.5)	(12.69)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM18001	1 × 80	(264 × 50)	(199.6 × 5.2)	(3.31)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM20801	2 × 8	(58 × 32)	(25.2 × 10.7)	(3.8)	1/16	M	YB/BE	EL & LED	B
SSM21601	2 × 16	(85 × 36)	(59.4 × 12.3)	(4.45)	1/16	M	YB/BE	EL & LED	B
SSM21602	2 × 16	(84 × 44)	(56.2 × 11.5)	(4.85)	1/16	H/M	GA/YA/GB/YB/BE	EL	D
SSM21603	2 × 16	(151 × 40)	(114.0 × 20.7)	(8.44)	1/16	M/T	GA/GB	EL	B/C
SSM22001	2 × 20	(116 × 37)	(83.0 × 11.5)	(4.85)	1/16	M	YB/BE	EL & LED	B
SSM22002	2 × 20	(180 × 40)	(142.8 × 20.7)	(8.44)	1/16	M/T	GA/GB	EL	B/C
SSM22401	2 × 24	(118 × 36)	(89.4 × 8.8)	(4.45)	1/16	M	YB/BE	EL & LED	B
SSM22402	2 × 24	(208 × 40)	(171.6 × 20.6)	(8.44)	1/16	M	GA/GB	EL	B
SSM22403	2 × 24	(118 × 36)	(88.3 × 11.5)	(4.85)	1/16	H	GA/GB/BE	EL & LED	A
SSM23202	2 × 32	(175 × 31)	(133.6 × 11.8)	(4.85)	1/16	H/M	GA/YA/GB/YB/BE	EL	D
SSM24001	2 × 40	(182 × 34)	(149.4 × 12.3)	(4.45)	1/16	M	YB/BE	EL & LED	B
SSM24002	2 × 40	(285 × 56)	(239.2 × 30.9)	(12.69)	1/16	M/T	GA/YA/GB/YB/BE	EL	B/C
SSM28001	2 × 80	(264 × 50)	(199.6 × 5.2)	(3.31)	1/16	M	GA/YA/GB/YB/BE	EL	B
SSM41601	4 × 16	(87 × 60)	(56.2 × 20.8)	(4.15)	1/16	H/M	GA/YA/GB/YB/BE	EL	D
SSM44001	4 × 40	(215 × 60)	(149.5 × 27.3)	(4.85)	1/16	M	GA/YA/GB/YB/BE	EL	B
SSM44002	4 × 40	(280 × 88)	(239.2 × 63.7)	(12.69)	1/16	M	GA/YA/GB/YB/BE	EL	B
SSM48001	4 × 80	(290 × 88)	(220.3 × 23.5)	(4.15)	1/16	M	GA/YA/GB/YB/BE	EL	B

*All parts are also available in Standard "TN" Fluids

DISPLAY ORDERING INFORMATION

SSM 0 00 00 X XX - X

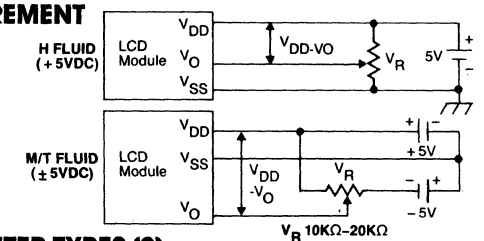
- Supertwist
- Lines
- Characters
- Type
- Voltage Required
  - H=5 VDC
  - M=±5 VDC
  - T=±5 VDC High Temperature
- Polarizer
- LED
  - R=Red
  - G=Green

TEMPERATURE RANGE: (4)

	"H"	"M"	"T"
Operating:	0°C +40°C	0°C +50°C	−20°C +70°C
Storage:	−20°C +70°C	−20°C +70°C	−40°C +90°C

"H/M" indicates that both are available

POWER SUPPLY REQUIREMENT



POLARIZER TYPES (3)

- **GA** = Reflective/Positive image, Dark Blue on Light Gray, No EL Lamp
- **YA** = Reflective/Positive image, Dark Blue on Yellow Green, No EL Lamp
- **GB** = Transflective/Positive image, Dark Blue on Light Gray, With EL Lamp
- **YB** = Transflective/Positive image, Dark Blue on Yellow Green, With EL Lamp
- **BE** = Transmissive/Negative image, White on Dark Blue, With EL Lamp

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LIQUID CRYSTAL DISPLAYS

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DIRECT DRIVE TN LCDs


MODEL 3900-365-X20


MODEL 3901-365-X20


MODEL 3902-365-X20


MODEL 3906-365-X20

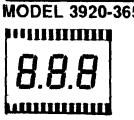

MODEL 3918-365-X20

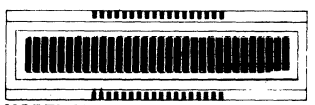

MODEL 3935-365-X20


MODEL 3919-365-X20


MODEL 3920-365-X20


MODEL 3922-365-X20

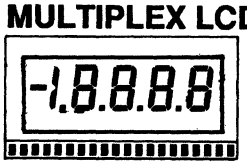

MODEL 3940-365-X20

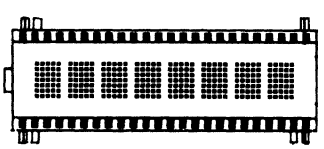

MODEL 3975-365-X20

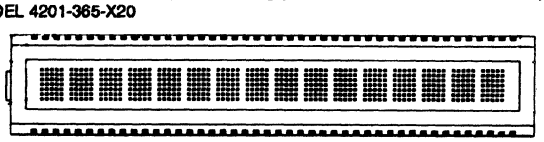
ORDERING INFORMATION

PART NUMBER	DESCRIPTION	GLASS SIZE
3900-365-X20	4.0 digit (.35") 40 contacts	2.00" x 0.90", 0.70"
3901-365-X20	3.5 digit (.5") 40 contacts	2.00" x 1.20", 0.90"
3902-365-X20	3.5 digit (.5") 40 contacts	2.00" x 1.20", 0.90"
3906-365-X20	4.0 digit (.5") 40 contacts	2.00" x 1.20", 0.90"
3918-365-X20	6.0 digit (.5") 50 contacts	2.75" x 1.20", 0.90"
3919-365-X20	6.0 digit (.7") 50 contacts	3.70" x 1.50", 1.20"
3920-365-X20	6.0 digit (1.0") 70 contacts	5.40" x 1.80", 1.50"
3922-365-X20	8.0 digit (.5") 68 contacts	3.70" x 1.20", 0.90"
3935-365-X20	2.0 digit (.5") 18 contacts	1.20" x 1.20", 0.90"
3940-365-X20	3.0 Digits (.35") 24 contacts	1.20" x 0.90", 0.70"
3975-365-X20	Single 32-Bar Graph 35 contacts	4.00" x 1.20", 0.90"

MULTIPLEX LCDs


MODEL 4201-365-X20




MODEL 4285-365-X20

ORDERING INFORMATION

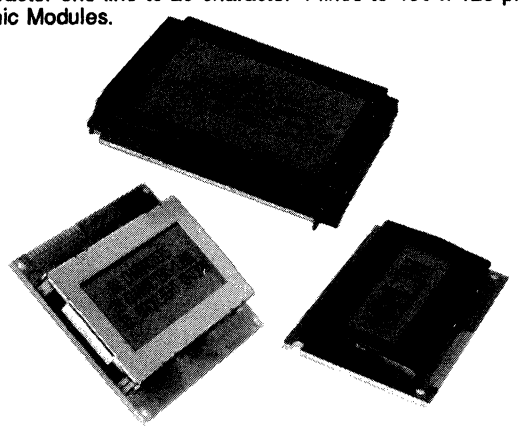
PART NUMBER	DESCRIPTION	GLASS SIZE
4201-365-X20	4.5 digit (.4") 44 contacts	2.0" x 1.050", 0.9"
4284-365-X20	8 Char., 5 x 7 dot matrix (.3") 48 contacts	2.5" x 0.8", 0.6"
4285-365-X20	16 Char., 5 x 7 dot matrix (.3") 88 contacts	4.7" x 0.9", 20.7"

For detailed product information contact your Standish LCD sales representative or authorized distributor. Individual catalogs are available that describe our standard and custom glass and module LCD product lines. The catalogs provide complete information plus application and design recommendations. Also included are examples of color and backlighted techniques, theory of operation, and quality assurance and test standards.



LCD MODULES

The Standish line of standard Liquid Crystal Display Modules offers stocked models for all applications. The line features Dot Matrix and Intelligent Graphic LCDs in TN or STN models. EL and LED backlighting optional, and modules with 8 character one line to 20 character 4 lines to 480 x 128 pixel Graphic Modules.



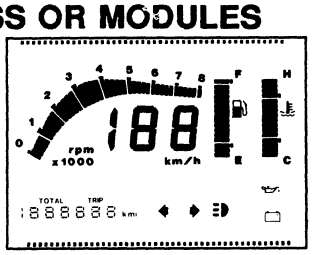
ORDERING INFORMATION

BASIC MODEL NUMBER*		LCD TYPE TLC=TN SLC=STN		BACKLIGHT EL=EL XX=NONE LE=LED	MODULE DESCRIPTION
SIM81XXXX	—	TLC	—	XX	8 Characters x 1 Line
SIM161XXX	—	TLC	—	XX	16 Characters x 1 Line
SIM161XXX	—	TLC	—	EL	16 Characters x 1 Line
SIM162XXX	—	TLC	—	XX	16 Characters x 2 Lines
SIM162XXX	—	SLC	—	XX	16 Characters x 2 Lines
SIM162XXX	—	TLC	—	EL	16 Characters x 2 Lines
SIM202XXX	—	TLC	—	XX	20 Characters x 2 Lines
SIM202XXX	—	SLC	—	XX	20 Characters x 2 Lines
SIM202XXX	—	TLC	—	LE	20 Characters x 2 Lines
SIM202XXX	—	SLC	—	LE	20 Characters x 2 Lines
SIM402XXX	—	TLC	—	XX	40 Characters x 2 Lines
SIM402XXX	—	SLC	—	XX	40 Characters x 2 Lines
SIM402XXX	—	TLC	—	EL	40 Characters x 2 Lines
SIM402XXX	—	SLC	—	EL	40 Characters x 2 Lines
SIM204XXX	—	SLC	—	XX	20 Characters x 4 Lines
SIM204XXX	—	SLC	—	EL	20 Characters x 4 Lines
SIM24064X	—	SLC	—	EL	240 x 64 Dots
SIM128128	—	SLC	—	EL	128 x 128 Dots
SIM16080X	—	SLC	—	EL	160 x 80 Dots
SIM480128	—	SLC	—	EL	480 x 128 Dots

NOTE: X in Model Number indicates not applicable to that model.
*NOTE: DC/AC Converter for EL backlight not supplied.

CUSTOM LCD GLASS OR MODULES

Standish technology offers flexibility of format design to compliment your requirements. We can provide Custom designed "glass only" or custom LCD modules, ready for convenient connection to Intelligence input source. Custom designs are relatively inexpensive to tool. Options include unique symbols, glass shapes, "MIL-SPEC" conditions, color options, etc. Consult Standish application specialists for design assistance.



eem MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

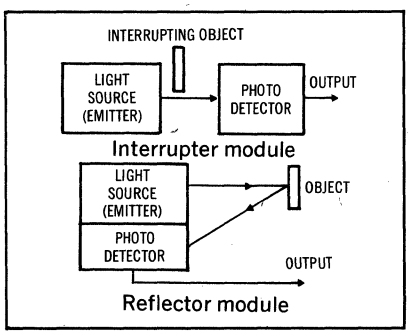
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

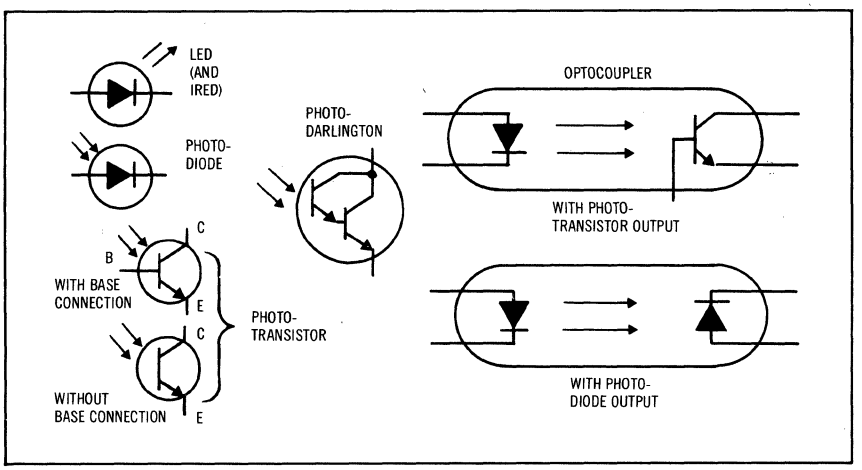
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

SIGNALEX®

HIGH VISIBILITY DISPLAYS

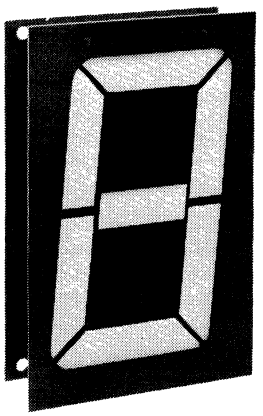
ENERGY-SAVING: Electromagnetically-operated Signalex displays require no power to maintain continuous indication. Inherently bi-stable, Signalex displays draw power only at the instant of change.

INHERENT MEMORY: Indication is maintained even with loss of power.

DIRECT ACCESS: Signalex displays can change from one number to any other—without a run-through of numbers. The unit immediately displays the transmitted number.

LOW MAINTENANCE: The rugged Signalex design assures long life and dependability. With no bulbs to replace, they are virtually maintenance-free.

HIGH-VISIBILITY: Signalex displays can be used indoors and out, in temperatures ranging from -40°C to +75°C. Their light-reflecting segments give high visibility in bright ambient light.



402L

7 SEGMENT MODELS

DISPLAY SIZES	1½"	4"	6"	9"	12"	18"	24"
SIGNALEX MODEL	152L	402L	602L	900L	1200L	1810L	2410L
Character Size H x W	1-9/16" x 15/16" (40 x 24 mm)	4-1/16" x 2-5/16" (103 x 59 mm)	6-1/16" x 3-9/16" (154 x 91 mm)	9" x 6" (228 x 152 mm)	12" x 8" (305 x 204 mm)	18" x 12" (46 x 30 cm)	24" x 16" (61 x 41 cm)
Vane Width	5/32" (4 mm)	7/16" (11 mm)	11/16" (17 mm)	1-1/8" (29 mm)	1-1/2" (38 mm)	2-1/4" (5.7 cm)	3" (7.6 cm)
Frame Size H x W	1-7/8" x 1-5/16" (49 x 33 mm)	5" x 3-1/4" (127 x 83 mm)	7-1/4" x 5-1/8" (184 x 130 mm)	11" x 8-1/4" (279 x 210 mm)	14" x 11" (356 x 279 mm)	21" x 16½" (533 x 419 mm)	28" x 22" (711 x 559 mm)
Pulse Length, min.	30 ms	50 ms	90 ms	150 ms	200 ms	300 ms	400 ms
Pulse Power, Each Vane	0.35 W	0.93 W	1.4 W	3.6 W	3.6 W	9.0 W	9.0 W
Viewing Dist., max.	50 Feet (15 Meters)	160 Feet (50 Meters)	240 Feet (75 Meters)	360 Feet (110 Meters)	480 Feet (150 Meters)	720 Feet (220 Meters)	960 Feet (300 Meters)
Weight	2-1/4 oz. 65 gm.	8-1/2 oz. 240 gm.	12-2/3 oz. 360 gm.	1-1/2 lbs. 680 gm.	2-1/4 lbs. 1020 gm.	4-1/2 lbs. 2. kg	6 lbs. 2.7 kg

U.S. Patent Nos. 3,886,545; 4,117,478; U.S. Design Patent 249,985 and Patents Pending

Operation: Individually controlled segments, pulse-operated through a bi-stable magnetic circuit.

Voltage: 12V. DC ±10% standard. Other voltages available.

Coils: Standard is bifilar wound with 3 leads per segment. Model 152L has terminal pins for direct PCB mounting.

Temperature: -40°C to +75°C.

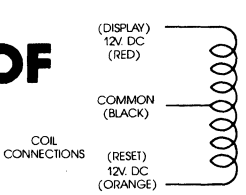
Relative Humidity: Up to 95% R.H. at any temperature in the range, provided no consideration present.

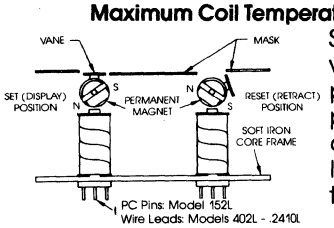
Power to Maintain Display: NONE

Vane Colors: White, Saturn-Yellow, Orange-Red Fluorescents. Black background standard. Other high-visibility colors available.

Maximum Coil Temperature: +105°C

PRINCIPLE OF OPERATION





Signalex® displays operate on a well-proven electromagnetic principle. A short pulse in a coil produces a magnetic field that acts upon a permanent magnet located in a rotor, part of which is the vane itself.

The magnet is either attracted or repelled, turning the rotor and vane with it. In either display or reset position the magnetic circuit is stable so that the vane can remain in either position with no power in the coil. The permanent magnet pole is attracted to the soft iron core which will hold the vane in position until a reverse pulse is passed.

The rotor and magnet assemblies are the only moving parts in the display. Their light weight and low inertia give fast response time. High lubricity plastic bearings are used.

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SIGNALEX

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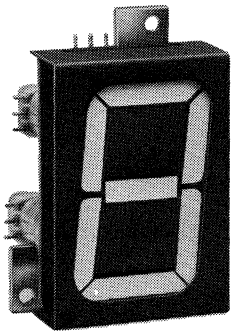
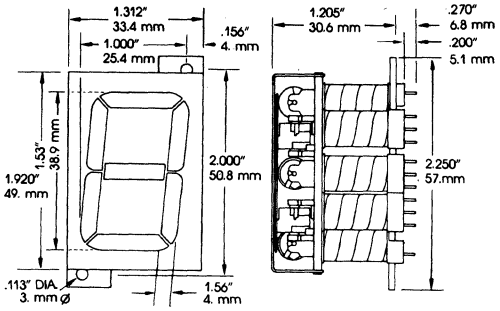
HIGH VISIBILITY 7-SEGMENT DISPLAYS

MODEL 152L

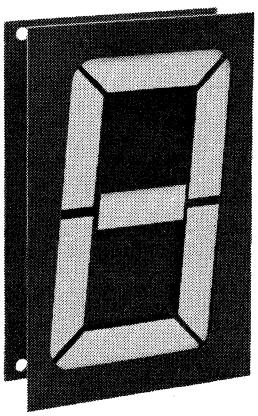


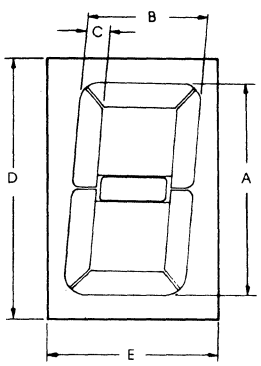


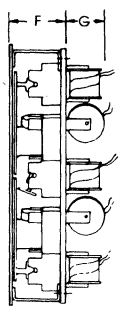
The Signalex 152L is used world-wide in readout applications for toll booths, clocks, gas pumps, arcade games, oil rig instrumentation, currency exchange panels, and industrial controls. Since Signalex readouts draw no power while maintaining position, they are ideal for battery-powered systems as well as AC.

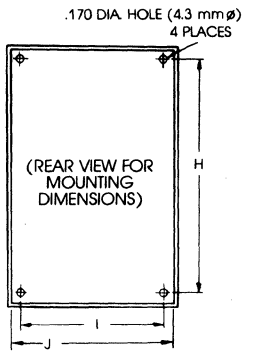
Connections: 3 per coil
(1 to display, 1 to reset, 1 common)
Pulse Power: 31ma at 12.V.
Pulse Length: 30ms min., display or reset
Character Slope: 5°
Visibility: Up to 70° either side of perpendicular to the front face.
Temperature Range: -40°C to + 75°C
Materials: Front Mask: Steel, Bearings: Polyester.
Hazardous Areas: Recognized by Underwriters Laboratories, Inc.,
No. MH10471. BASEEFA Class 2 No. 4054 J.

MODELS 402L & 602L

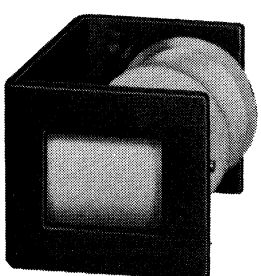








(in.) Dim.	A	B	C	D	E	F	G	H	I	J
Model 402L	4-1/16	2-5/16	7/16	5	3-1/4	1-1/16	3/4	4-1/2	2-5/8	3-1/8
Model 602L	6-1/16	3-9/16	11/16	7-1/4	5-1/8	1-5/16	3/4	6-1/2	4-1/2	5



SIGNALEX® TYPE A

The Type A Indicator is a bi-stable electromagnetic annunciator showing alternate display faces in its window. It may be mounted for operation in any position. It is driven in either direction by 1.1 watt pulses as short as 30 ms and remains in its last position without power input until pulsed to the opposite position.

Signalex Type A indicators are used in hospital, apartment house, and commercial call boards, as well as in circuit indicators, alarm systems, and a variety of other applications.

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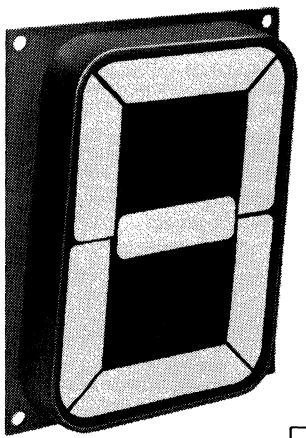
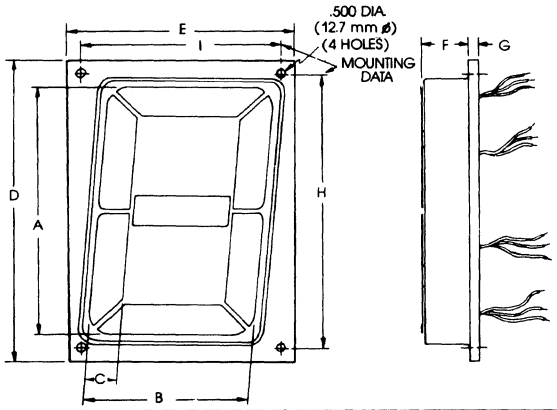
HIGH VISIBILITY 7-SEGMENT DISPLAYS

MODELS 900L & 1200L

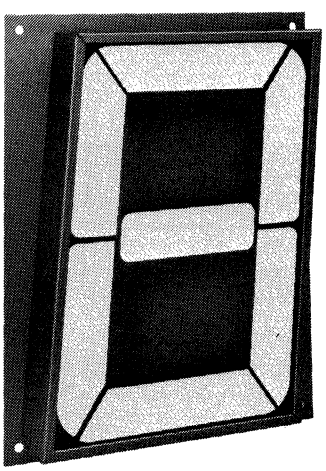


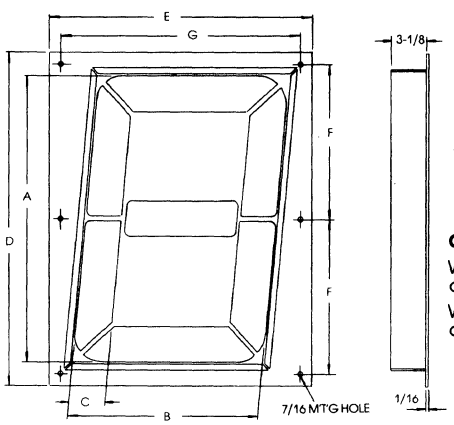


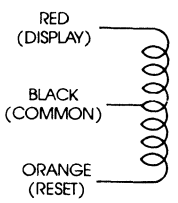
Length of Leads: 7" Min. for 402L & 602L.
30" Min. for 900L & 1200L
Bearings: High lubricity polyester, replaceable.
Vanes: Individually replaceable.
Visibility: 402L & 602L Series—To 60° either side.
900L & 1200L Series—To 75° either side.

(in.) Dim.	A	B	C	D	E	F	G	H	I
Model 900L	9	6	1-1/8	11	8-1/4	2-1/32	3/16	10*	7-1/4*
Model 1200L	12	8	1-1/2	14	11	2-1/16	3/16	13	10

MODELS 1810L & 2410L







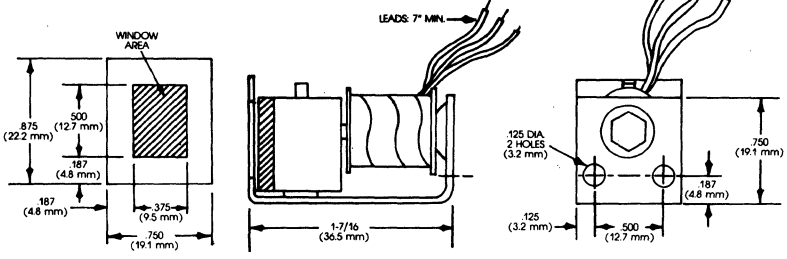
Coil Connection (402L & larger) (7 coils per digit)
With black lead connected to (-), (+) on red lead displays white. (+) on orange lead resets to black.
With black lead connected to (+), (-) on orange lead displays white. (-) on red lead resets to black.

(in.) Dim.	A	B	C	D	E	F	G
TYPE 1810L	18"	12	2 1/4	21	16 1/2	19 1/2*	15
TYPE 2410L	24"	16	3	28	22	13	20

*20" From Top to Bottom MT'G Hole. No Center Holes.

ANNUNCIATOR

Window Size: 3/8" H x 1/2" W (9.5 mm x 12.7 mm)
Displays per Window: 2
Operating Temp. Range: -40°C to +75°C
Operating Mode: Bi-stable, pulsed
Min. Pulse Length: 30ms. either display
Power/Pulse: 1.1W
Maximum Coil Temperature: +105°C
Coil Resistance: 125. Ω ± 10%
Standard Voltage: 12 V. DC*
Standard Colors: Black & White, Yellow, Red.*
Leads: 7" Min.:
*Others Available.



U.S. Patent No. 3,936,818

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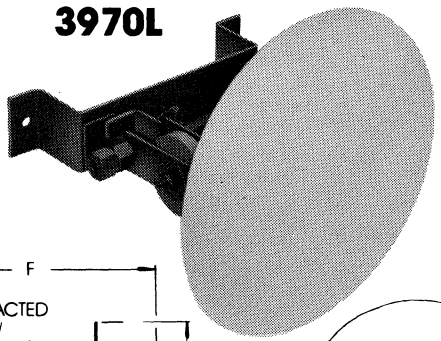
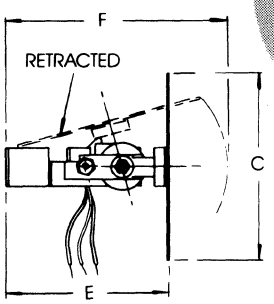
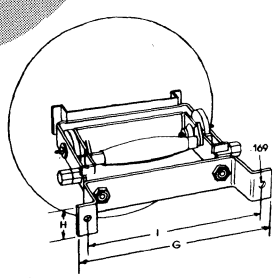
HIGH VISIBILITY ALPHANUMERIC DISPLAYS AND INDIVIDUAL GRAPHIC ELEMENTS

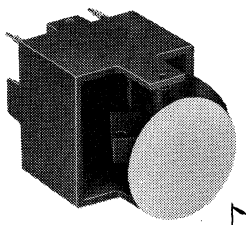
3970L

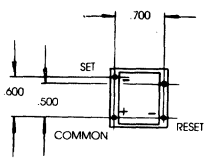


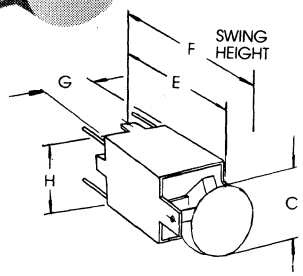




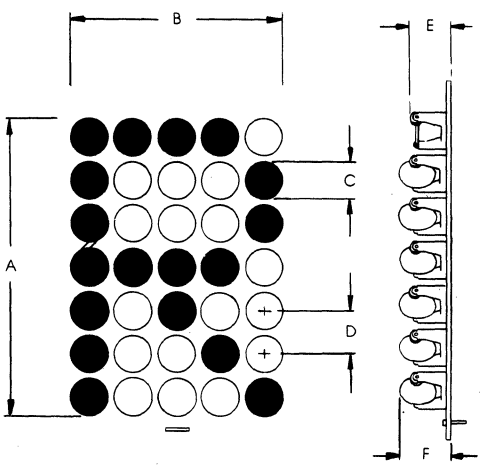
670RFR

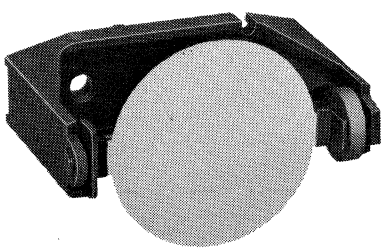


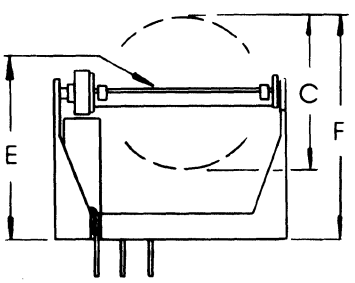


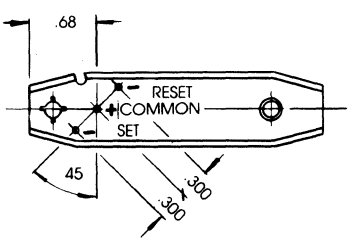


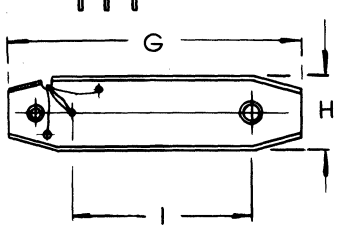
972-1872RFR











Model Number	Dim. A Char. Hgt. in.	mm.	Dim. B Char. Width in.	mm.	Dim. C Dot Dia. in.	mm.	Dim. D Dot Pitch in.	mm.	Dim. E Display Hgt. in.	mm.	Dim. F Swing Hght. in.	mm.	Dim. G Length in.	mm.	Dim. H Width in.	mm.	Dim. I Mounting in.	mm.
670RFR	6.00	152	4.25	108	.75	19.0	.875	22.2	1.33	33.8	1.57	39.7	.84	21.3	.84	21.3	—	—
972RFR	9.00	230	6.37	162	1.12	28.0	1.31	33.3	1.45	36.8	2.10	53.3	1.81	46.0	.75	19.0	.596	15.1
1272RFR	12.00	300	8.50	216	1.50	38.0	1.75	44.5	1.45	36.8	2.29	58.2	2.24	56.9	.75	19.0	1.026	26.1
1672RFR	16.00	406	11.37	289	2.00	51.0	2.34	59.5	1.45	36.8	2.54	64.5	2.74	69.6	.75	19.0	1.526	38.8
1872RFR	18.00	457	12.75	324	2.25	57.0	2.62	66.7	1.45	36.8	2.66	67.6	2.99	76.0	.75	19.0	1.776	45.1
3970L	39.50	1000	28.00	711	5.00	127.0	5.75	146.0	4.30	109.2	5.87	149.1	4.50	114	1.0	25.4	4.000	102.0

SIGNALEX®

THE STAVER COMPANY INCORPORATED

P.O. Box 220M, Bay Shore, NY 11706
(516) 666-8000 • FAX: (516) 666-8039

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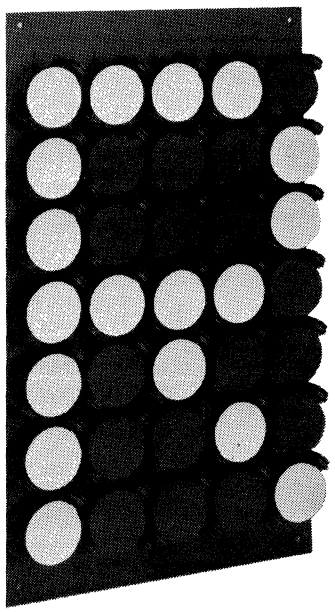
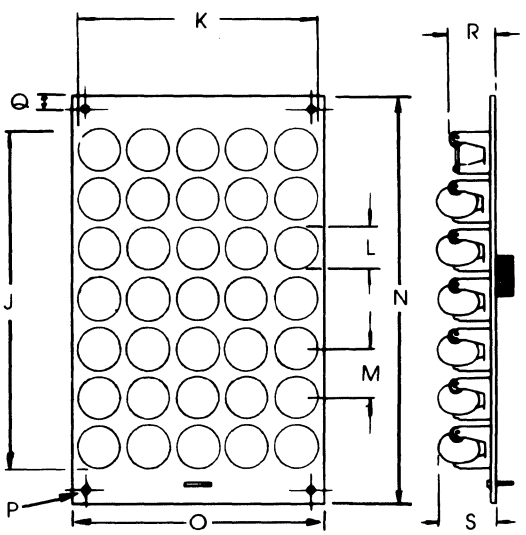
SIGNALEX®

HIGH VISIBILITY ALPHANUMERIC DISPLAYS AND INDIVIDUAL GRAPHIC ELEMENTS

Signalex Individual Alphanumerics are bi-stable electromagnetic displays which require only a very short pulse to change position. Inherent latching memory requires no power except during the moment of change. The magnetic design permits operation of most models using 12vdc with a 2 msec. pulse and, at higher voltages, at 1 msec. or less.

The standard 7 by 5 matrix of 35 dots gives full alphanumeric capability, and is available in sizes which can create characters 6", 9", 12", 16", 18" and 39" high. The flexibility of Signalex individual alphanumerics permits the creation of custom displays. In addition to the standard (7 x 5) format, the 28-dot (7 x 4) numeric format, a 23-dot (7-Bar) format, or other desired shapes may be used.





670-1872RFR-35BC

SPECIFICATIONS—ALL MODELS

	670RFR-35BC	972-1872RFR-35BC
Pulse Length, Min. @ 12V	2ms	2ms
Pulse Length, Min. @ 18V	1ms	1ms
Maximum Duty Cycle @ 12V	5%	5%
Current Each Dot @ 12V	680ma	580ma
Coil Res. Center to Each Side	17.5 ohms	20.5 ohms
Coil Winding	Center Tapped Coil	
Coil Addressing	All Models	X-Y Matrix
Ground Polarity	Negative	Negative
Diodes	1N4004	1N4004
PCB Material	FR-4 or Equivalent	
Maximum Coil Temperature	All Models: +105C	
Operating Temperature Range	All Models: -40 C to +90 C	
Operating Rel. Humidity	All Models: Up to 95% @ +90 C*	
Standard Colors	All Models: White, Yellow, Red	

*Provided No Condensation Present

35 DOT 7 BY 5 ALPHANUMERIC MATRICES

	Dim. J Char. Hgt		Dim. K Char. Width		Dim. L Dot Dia.		Dim. M Dot Pitch		Dim. N Matrix Hgt		Dim. O Matrix Wdth		Dim. P Mtg. Hole		Dim. Q Hole Offset		Dim. R Thickness		Dim. S Swing Hgt.	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
670RFR-35BC	6	152	4.25	108	.75	19	.875	22.2	7.75	197	4.25	114	.178	4	.25	6	1.35	34	1.57	39.7
972RFR-35BC	9	230	6.37	162	1.12	28	1.31	33.3	11.87	301	6.53	166	.195	5	.25	6	1.80	43	2.07	52.6
1272RFR-35BC	12	300	8.50	216	1.50	38	1.75	44.5	15.00	386	8.72	224	.195	5	.50	13	1.80	43	2.25	57.2
1672RFR-35BC	16	406	11.37	289	2.00	51	2.34	59.4	19.50	502	11.69	301	.195	5	.50	13	1.80	43	2.54	64.5
1872RFR-35BC	18	457	12.75	324	2.25	57	2.62	66.7	21.63	557	13.09	337	.195	5	.50	13	1.80	43	2.66	67.6

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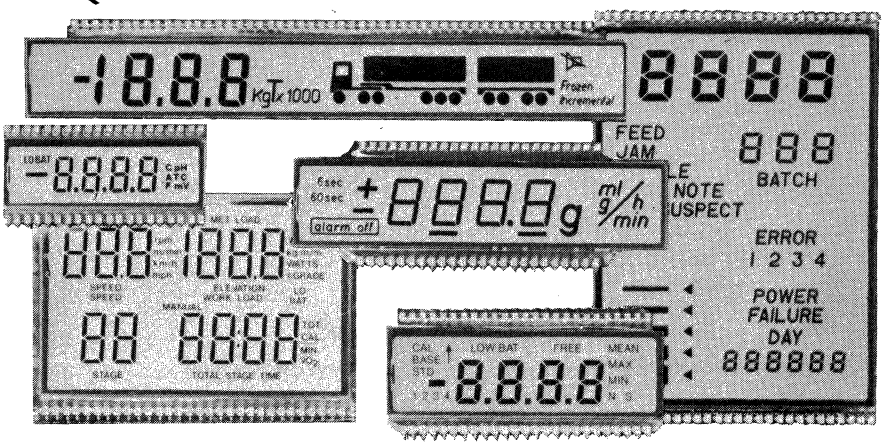
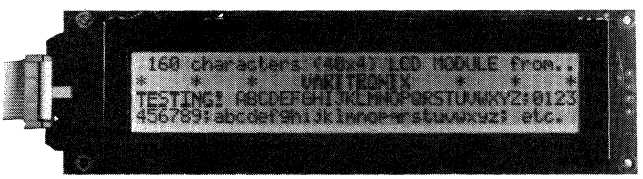




- Wide temperature supertwist (SBE) ***NEW***
- High contrast
- Wide viewing angle
- Internal character generator
- LED & EL backlighting
- Large ½″ character height

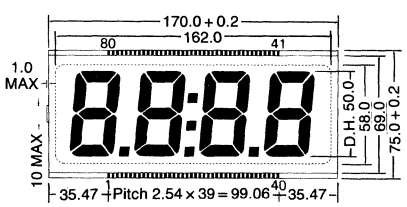
alpha-numeric modules

Model Number	Characters x Lines	Digit Size	Module Size (WxH)
MDL-16166	16x1	6.3	80x36
MDL-16188	16x1	9.2	122x33
MDL-16265	16x2	5.6	84x44
MDL-201612	20x1	12.7	180x48
MDL-20188	20x1	9.2	146x33
MDL-202612	20x2	12.7	182x60
MDL-20265	20x2	5.6	116x37
MDL-20268	20x2	9.2	146x43
MDL-204612	20x4	12.7	182x90
MDL-20464	20x4	4.8	98x60
MDL-20464B	20x4	4.03	77x47
MDL-20468	20x4	9.2	146x63
MDL-24166	24x1	6.3	126x36
MDL-24265	24x2	5.2	118x36
MDL-40266	40x2	5.5	182x34
MDL-40466	40x4	5.5	196x56
MDL-81809	8x1	10.75	84x44
MDL-161615	16x1	14.54	151x40

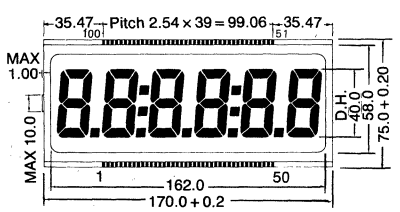
partial list

numeric lcd

VI-50402-DP Large 2-inch digit



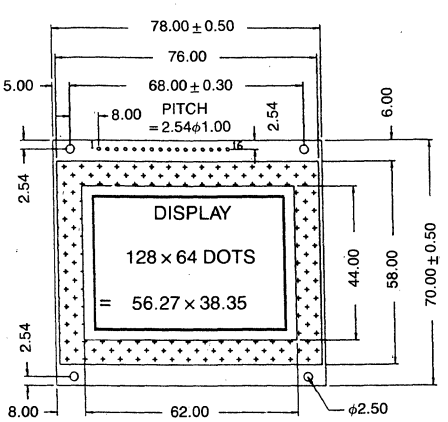
VI-40602-DP Large 1.6 inch digit



graphic lcd modules

Pixel Format	Overall Size
80 × 32	84 × 44
84 × 64	90 × 60
100 × 32	75 × 54
100 × 32	98 × 50
128 × 64	78 × 70
192 × 64	100 × 60
240 × 64	176 × 65
240 × 128	144 × 104

MGLS-12864 128 × 64 DOTS



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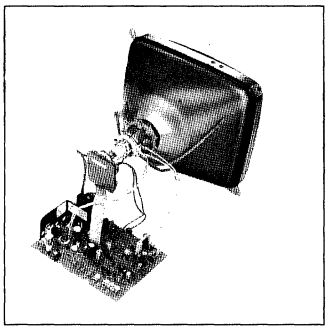
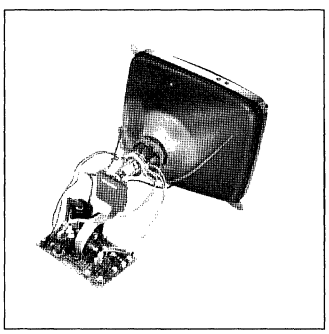
Monochrome and Color Monitors



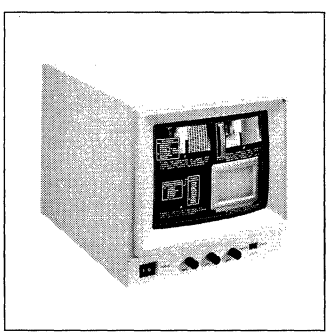
Customiser III™ & Customiser™ VGA Series B/W Monitors

- Monochrome monitors with P4 phosphor provide a resolution of 900 lines (center), 750 lines (corners). Other phosphors are available as an option.
- Both are available in CRT sizes 7, 9, 12, or 14" (diagonal measure).
- Various faceplate finishings are available.
- VGA Customiser III horizontal frequency is 31.5 kHz (standard); vertical frequency is 60 to 70 Hz. Non-linearity is less than 10%.
- This Series is ideal for applications where low power consumption is required.



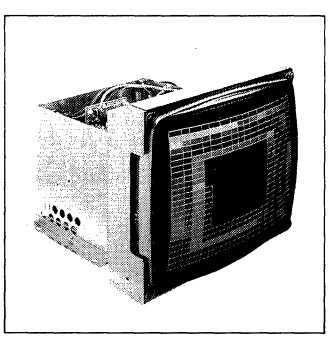
Compact Customiser IV™ Monitor

- Monochrome monitor with P4 phosphor provides a resolution of 900 lines (center), 750 lines (corners). Other phosphors are available as an option.
- CRT sizes are 5, 7, 9, 12, or 14" (diagonal measure).
- Various faceplates finishings are offered.
- The Customiser IV is ideal for applications requiring low power consumption and compact mechanical configurations.



Compact Multi-Scan Color Monitor

- 9" Multi-Scan monitor with an active view area of approximately 160 x 115 mm.
- Automatically adjust scan rate. Video input is TTL level and it can be set to automatically switch to analog. Sync is TTL level with auto polarity.
- Horizontal frequency ranges from 15 to 35 kHz and vertical from 50 to 110 Hz with automatic size control for both axis.
- The monitor is ideal for financial, instrumentation and medical electronic applications.



Prismatic™ VGA Color Monitor

- Color monitor with P22 phosphor and polished faceplate (standard). Variety of optional faceplates and transmittance available.
- Resolution set up for VGA mode 1 (640 x 350), mode 2 (640 x 200) and mode 3 (640 x 480).
- CRT sizes are 9" to 19" (diagonal measure).
- User controls contrast, brightness, horizontal position, on demand degauss, horizontal frequency, horizontal size, focus, vertical frequency, vertical size, vertical linearity, and vertical position.

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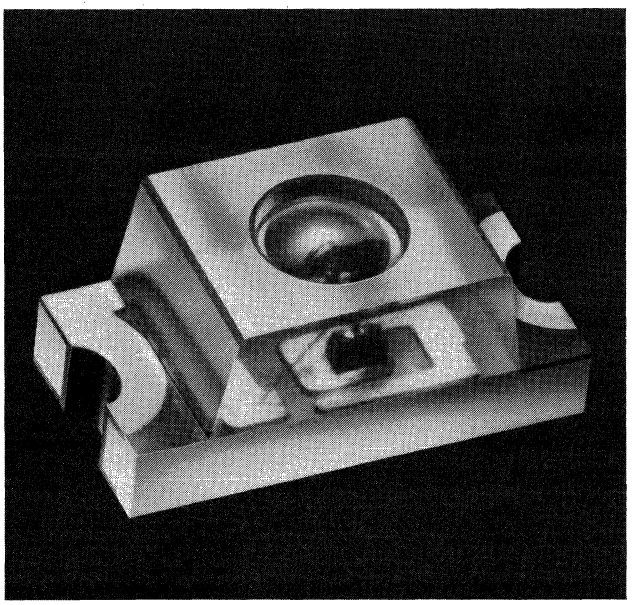
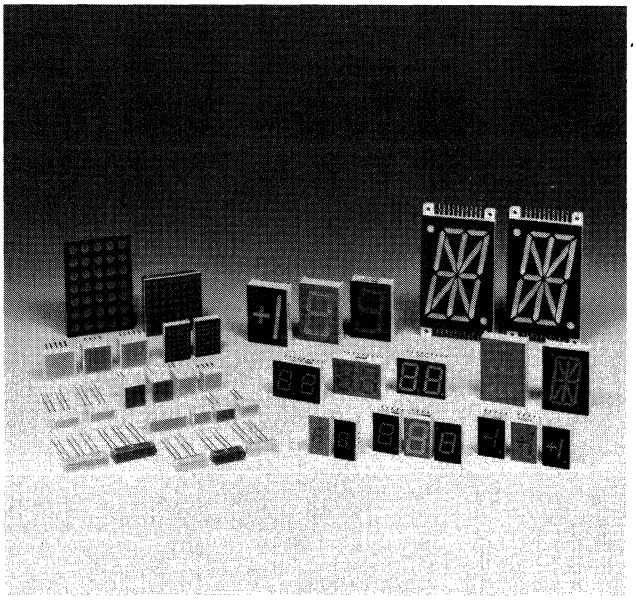
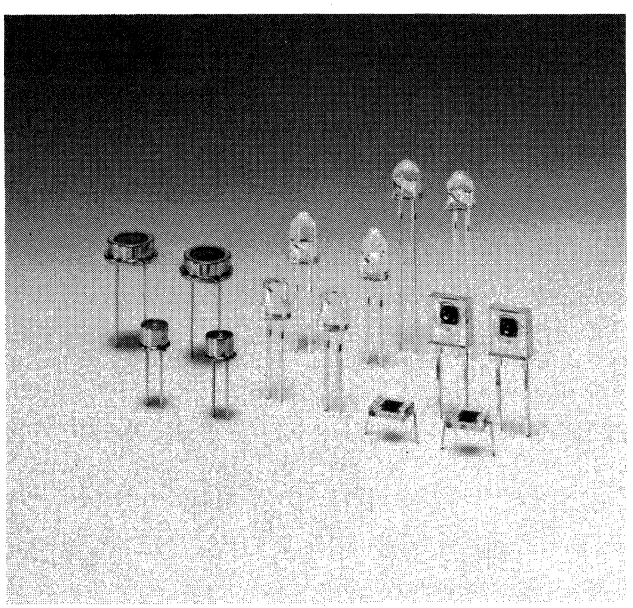
Your Number One Choice For Display Technology









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LAMPS AND INDICATOR LIGHTS

Manufacturer	Starting EEM Page No.	Light Type									Accessories/Hardware			Features				
		Incandescent	LED	Neon	Fluorescent	Electro luminescent	Infrared	Krypton	Ultra violet	Xenon	Sockets/ Holders/ Clips	Caps & Lenses	Inverters	Panel Mount	Relampable PC Mount	Assemblies	Rectangular	Waterproof
AND	B•1137		√															
Arcolectric Corp.	B•1141	√	√	√							√	√		√	√		√	√
Data Display Products	B•1142		√											√	√			
Dialight Corp.	B•1145		√								√	√		√			√	
Endicott Research Grp.	B•1151												√					
Genisco Elect. Corp.	B•1153	√		√							√	√		√	√	√		
Gilway Technical Lamp	B•1155	√	√	√			√				√			√	√			
Glolite	B•1154	√	√	√								√				√		
IDEA Inc.	B•1164		√								√	√		√		√	√	
Industrial Devices	B•1166	√	√	√							√	√		√	√	√	√	√
JKL Components	B•1169	√	√	√	√						√			√	√	√		
Kingbright	B•1170		√															
Lamptronix Co. Ltd.	B•1173	√		√							√			√	√	√		
Ledtronics	B•1174		√				√				√	√		√		√		√
Minelco/Tally Inc.	B•1178	√	√											√		√	√	√
Oshino Electric Lamp Works	B•1180	√									√			√	√			
Oxley	B•1179		√											√		√		
Rodale Tech. Sales	B•1182	√		√										√	√	√		
Rohm Electronics	B•1183		√											√		√	√	
Sharp Electronics Corp.	B•1184		√													√		
Shelly Associates	B•1185	√	√	√										√	√		√	
Shogyo Int'l Corp.	B•1186	√	√	√	√	√	√	√	√	√	√			√	√	√	√	
Shokai Far East Ltd.	B•1187	√	√	√	√		√	√	√	√				√			√	
Sloan Co.	B•1188	√	√	√							√	√		√	√	√		√
II Stanley Co. Inc.	B•1196		√		√		√										√	
Sylvania	B•1202	√		√							√	√		√	√	√		
Visual Comm. Co.	B•1208	√	√								√	√		√	√		√	
Wilbrecht	B•1211	√	√	√							√			√	√	√	√	√

MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

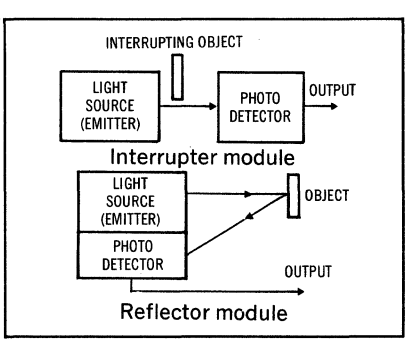
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

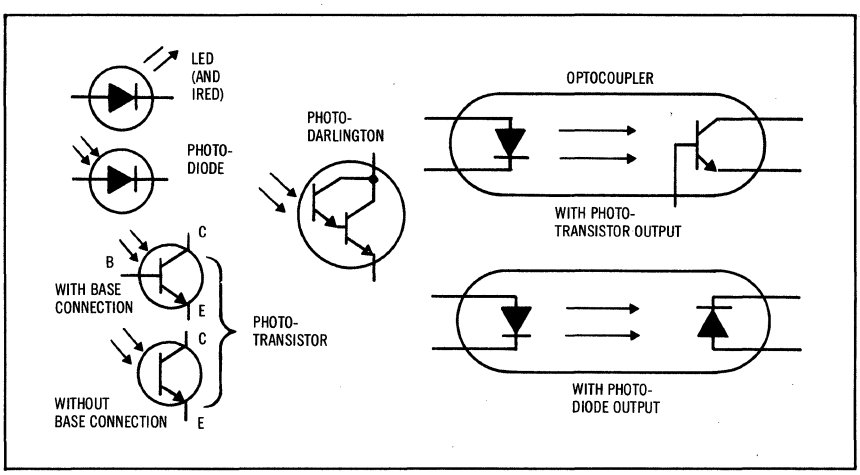
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

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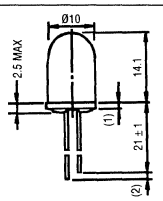
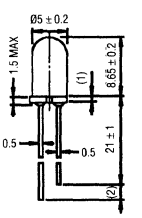
AND 190, 191 Series - 10 mm Package Kilo Bright

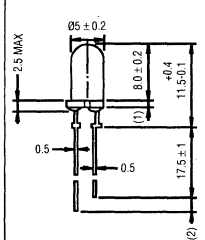
Part Number	Color		Lens Description	Axial Luminous intensity (mod)		Test Condition (I_f = mA)	Viewing Angle 2ϕ1/2(deg.)
	Led	Lens		Min.	Typ.		
AND190CRP	Red	Clear	Clear	5,600	13,000	20	4
AND190BRP	Red	Clear	Clear	3,200	10,200	20	4
AND191CRP	Red	Milky	Diffused	320	720	20	16
AND191BRP	Red	Milky	Diffused	180	530	20	16



AND 120, 130, 180, 134, and 116 Series - T1 3/4 Package Kilo Bright

Part Number	Color		Lens Description	Axial Luminous intensity (mod)		Test Condition (I_f = mA)	Viewing Angle 2ϕ1/2(deg.)
	Led	Lens		Min.	Typ.		
AND180CRP	Red	Clear	Clear	1,800	4,100	20	8
AND180BRP	Red	Clear	Clear	1,000	3,000	20	8
AND180ASP	Red	Clear	Clear	320	1,000	20	8
AND130CR	Red	Clear	Clear	1,000	2,300	20	15
AND130BR	Red	Clear	Clear	560	1,680	20	15
AND155CRP	Red	Clear	Clear	560	1,280	20	24
AND155BRP	Red	Clear	Clear	320	1,000	20	24
AND155ASP	Red	Clear	Clear	153	300	20	24
AND120CR	Red	Clear	Clear	560	1,280	20	35
AND120BR	Red	Clear	Clear	320	900	20	35
AND134CR	Red	Red	Diffused	100	230	20	35
AND134BR	Red	Red	Diffused	56	208	20	35
AND116CR	Red	Milky	Diffused	56	208	20	60
AND116BR	Red	Milky	Diffused	32	72	20	60





AND 125 and 126 Series - T1 Package Kilo Bright

Part Number	Color		Lens Description	Axial Luminous intensity (mod)		Test Condition (I_f = mA)	Viewing Angle 2ϕ1/2(deg.)
	Led	Lens		Min.	Typ.		
AND125CR	Red	Clear	Clear	160	400	20	60
AND126CR	Red	Milky	Diffused	63	150	20	70

Absolute Maximum Ratings (T_A = 25°C)

Characteristics	Symbol	Rating Red	Unit
Forward Current (DC)	I_F	50	mA
Reverse Voltage	V_R	4	V
Power Dissipation	P_D	125	mW
Operating Temperature Range	T_{OPR}	−20 to +85	°C
Storage Temperature Range	T_{STG}	−30 to +100	°C

Electro-Optical Characteristics (T_A = 25°C)

Characteristics	Symbol	Test Condition	Red Min.	Red Typ.	Red Max.	Units
Forward Voltage	V_F	I_F = 20mA		1.75	2.2	V
Reverse Current	I_R	V_R = 4V			100	μA
Peak Emission Wavelength	λ_P	I_F = 20mA		660		nm
Spectral Line Half Width	$\Delta\lambda$	I_F = 20mA		25		nm

AND 180ASP/AND155ASP Absolute Maximum Ratings) (T_A = 25°C)

Characteristics	Symbol	Rating Red	Unit
Forward Current (DC)	I_F	50	mA
Reverse Voltage	V_R	4	V
Power Dissipation	P_D	125	mW
Operating Temperature Range	T_{OPR}	−20 to +85	°C
Storage Temperature Range	T_{STG}	−30 to +100	°C

AND180ASP/AND155ASP Electro-Optical Characteristics (T_A = 25°C)

Characteristics	Symbol	Test Condition	Red Min.	Red Typ.	Red Max.	Units
Forward Voltage	V_F	I_F = 20mA		1.9	2.4	V
Reverse Current	I_R	V_R = 4V			100	μA
Peak Emission Wavelength	λ_P	I_F = 20mA		630		nm
Spectral Line Half Width	$\Delta\lambda$	I_F = 20mA		25		nm

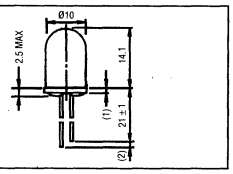
AND
ONE OF THE PURDY GROUP OF COMPANIES

Light Emitting Diode Lamps

770 AIRPORT BLVD., BURLINGAME, CA 94010 • TEL (415) 347-9916 • FAX (415) 340-1670 • MCI/TLX 677-1439 (PURDY UW)

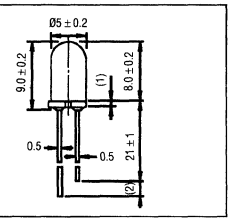
AND 190 and 191 Series - 8mm/10 mm Package - Striking Bright

Part Number	Color		Lens Description	Axial Luminous intensity (mod)		Test Condition (I_f = mA)	Viewing Angle 2ϕ1/2(deg.)
	Led	Lens		Min.	Typ.		
AND190GCP	Green	Clear	Clear	560	2,000	20	4
AND191GCP	Green	Milky	Diffused	56	200	20	16



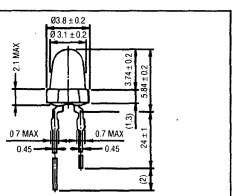
AND 180, 135, 134, and 114 Series - T1 3/4 Package - Striking Bright

Part Number	Color		Lens Description	Axial Luminous intensity (mod)		Test Condition (I_f = mA)	Viewing Angle 2ϕ1/2(deg.)
	Led	Lens		Min.	Typ.		
AND180QRP	Red	Clear	Clear	320	720	20	15
AND135NR	Red	Clear	Clear	100	230	20	25
AND134MR	Red	Red	Diffused	56	128	20	30
AND114KR	Red	Clear	Diffused	18	41	20	80
AND180PGP	Green	Clear	Clear	180	410	20	15
AND135NGP	Green	Clear	Clear	100	230	20	25



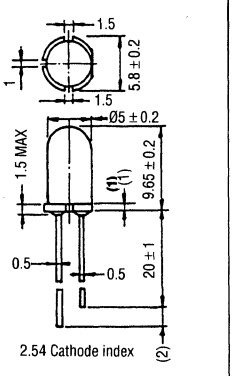
AND 163, 124, 160, and 125 Series - T1 Package - Striking Bright

Part Number	Color		Lens Description	Axial Luminous intensity (mod)		Test Condition (I_f = mA)	Viewing Angle 2ϕ1/2(deg.)
	Led	Lens		Min.	Typ.		
AND163QR	Red	Lt. Red	Clear	320	720	20	10
AND160RC	Red	Clear	Clear	200	200	20	10
AND125RC	Red	Clear	Clear	25	50	20	60
AND124KR	Red	Red	Diffused	18	41	20	70
AND160NG	Green	Clear	Clear	100	230	20	10



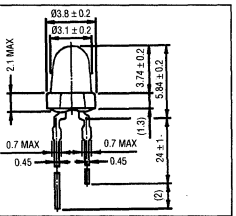
AND 181P and 182P Series - T1 3/4 Package - Ultra Bright

Part Number	Color		Lens Description	Axial Luminous intensity (mod)		Test Condition (I_f = mA)	Viewing Angle 2ϕ1/2(deg.)
	Led	Lens		Min.	Typ.		
AND181RCP	Red	Red	Clear	250	500	20	15
AND182RCP	Red	Red	Diffused	150	300	20	25
AND181URP	Red	Lt. Red	Clear	125	250	20	15
AND182URP	Red	Lt. Red	Diffused	75	150	20	25
AND181SP	Red	Lt. Red	Clear	75	150	20	15
AND182SP	Red	Lt. Red	Diffused	45	90	20	25
AND181RP	Red	Lt. Red	Clear	25	50	20	15
AND182RP	Red	Lt. Red	Diffused	13	25	20	25
AND181GP	Green	Lt. Green	Clear	100	200	20	15
AND182GP	Green	Lt. Green	Diffused	60	120	20	25
AND181YP	Yellow	Lt. Yellow	Clear	70	150	20	15
AND182YP	Yellow	Lt. Yellow	Diffused	45	90	20	25
AND181OP	Orange	Lt. Orange	Clear	75	150	20	15
AND182OP	Orange	Lt. Orange	Diffused	45	90	20	25



AND 163U and 164U Series - T1 Package - Ultra Bright

Part Number	Color		Lens Description	Axial Luminous intensity (mod)		Test Condition (I_f = mA)	Viewing Angle 2ϕ1/2(deg.)
	Led	Lens		Min.	Typ.		
AND163UR	Red	Lt. Red	Clear	50	100	20	10
AND164UR	Red	Lt. Red	Diffused	20	40	20	25
AND163UG	Green	Lt. Green	Clear	35	70	20	10
AND164UG	Green	Lt. Green	Diffused	15	30	20	25
AND163UY	Yellow	Lt. Yellow	Clear	20	40	20	10
AND164UY	Yellow	Lt. Yellow	Diffused	10	20	20	25



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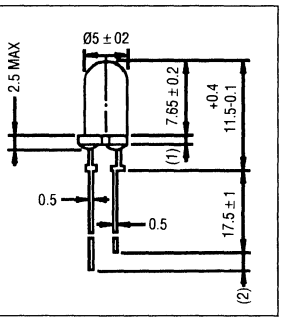
Light Emitting Diode Lamps and Displays

770 AIRPORT BLVD., BURLINGAME, CA 94010 • TEL (415) 347-9916 • FAX (415) 340-1670 • MCI/TLX 677-1439 (PURDY UW)

STANDARD BRIGHTNESS LEDS

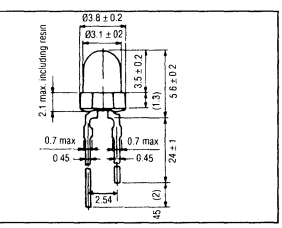
AND 113 and 114 Series - T1 3/4 Package - Standard Bright - P denotes no standoffs

Part Number	Color		Lens Description	Axial Luminous Intensity (mod)		Test Condition (I_f = mA)	Viewing Angle 2φ1/2(deg.)
	Led	Lens		Min.	Typ.		
AND113R(P)	Red	Red	Clear	3.5	7	15	50
AND114R(P)	Red	Red	Diffused	1.5	3	15	80
AND113S	Red	Red	Clear	12	25	15	50
AND114S	Red	Red	Diffused	4	8	15	80
AND113G(P)	Green	Green	Clear	15	30	15	50
AND114G(P)	Green	Green	Diffused	4	8	15	80
AND113Y(P)	Yellow	Yellow	Clear	40	20	15	50
AND114Y(P)	Yellow	Yellow	Diffused	3	6	15	80
AND113O(P)	Orange	Orange	Clear	10	20	15	50
AND114O(P)	Orange	Orange	Diffused	3	6	15	80



AND 123 and 124 Series - T1 Package - Standard Bright

Part Number	Color		Lens Description	Axial Luminous Intensity (mod)		Test Condition (I_f = mA)	Viewing Angle 2φ1/2(deg.)
	Led	Lens		Min.	Typ.		
AND123R	Red	Red	Clear	1.5	3.5	10	60
AND124R	Red	Red	Diffused	1	2.5	10	70
AND123G	Green	Green	Clear	5	10	10	60
AND124R	Green	Green	Diffused	2.5	5	10	70
AND123Y	Yellow	Yellow	Clear	2.5	5	10	60
AND124R	Yellow	Yellow	Diffused	2	4	10	70



7 Segment Displays

Size of Digits	Common		Color		Number of Pins
	Cathod	Anode	Display	Face	
.5 inch	AND370R	AND371R	Red	Red	18
.5 inch	AND370G	AND371G	Green	Green	18
.54 inch	AND5420OCLB	AND5420OALB	Red	Red	18
.8 inch	AND8010SCLB	AND8010SALB	Red	Gray	18
.8 inch	AND8010GCLB	AND8010GALB	Green	Gray	18
2.3 inch	AND2316SCLB	AND2316SALB	Red	Red	20
2.3 inch	AND2316GCLB	AND2316GALB	Green	Black	20



16 Segment Displays

Size	Number of Digits	Common		Color		Number of Pins
		Cathod	Anode	Display	Face	
.8 inch	1	AND8010SCL	AND8010SAL	Red	Red	16
.8 inch	1	AND8010GCL	AND8010GAL	Green	Gray	16
2.3 inch	1	AND2307SCL	AND2307SAL	Red	Red	10
2.3 inch	1	AND2307GCL	AND2307GAL	Green	Gray	10
4.0 inch	1	AND4107SCL	AND4107SAL	Red	Red	10
4.0 inch	1	AND4107GCL	AND4107GAL	Green	Gray	10



Dot Matrix Displays

Size of Digits	Common		Format	Color		Number of Pins
	Cathode Column	Cathode Row		Display	Face	
2.0	AND2570S	AND2571S	5 x 7	Red	Gray	14
2.0	AND2570G	AND2571G	5 x 7	Green	Gray	14

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

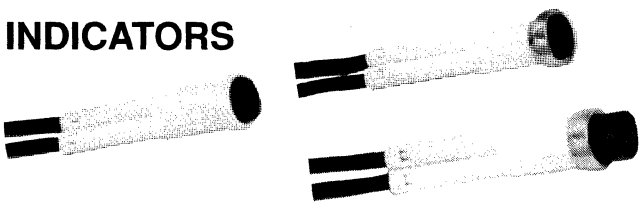
WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
Microwave Components, Product Selection Guide **A**•1746
Military Qualified Products List **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide **B**•1233
Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
Relays, Product Selection Guide **B**•1397
Resistor Color Codes **A**•1924
Resistors, Product Selection Guide **A**•1835
Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
Solenoids, Product Selection Guide **B**•1614
Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

Arcolectric

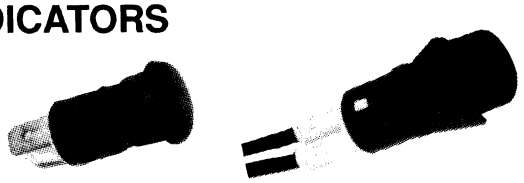
NEON-INCANDESCENT–LAMP HOLDERS and LED INDICATOR LIGHTS

INDICATORS



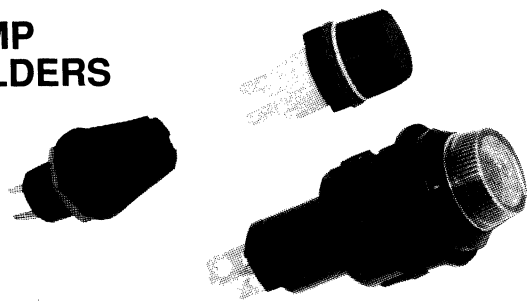
Standard 5/16" snap-in mounting dia 6-250 volt UL and CSA approved. Available in Neon, Incandescent and LED

INDICATORS



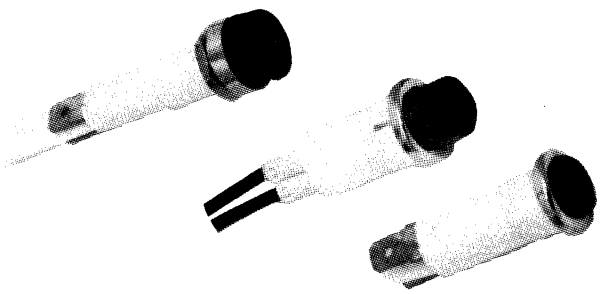
Standard 1/2" snap-in mounting dia. 6-250 volt. UL, CSA and VDE approved. Available in Neon, Incandescent and LED

LAMP HOLDERS



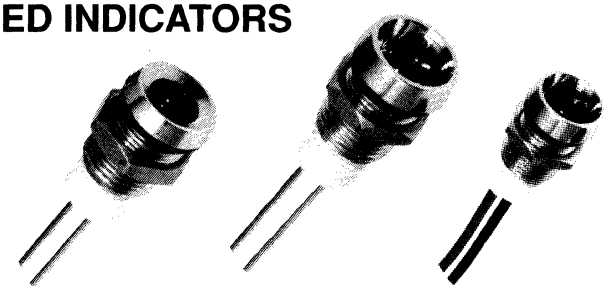
Supplied with or without replacable lamps 6-28 volt. Mounting sizes 3/8" to 1.0" dia. Polycarbonate lenses. Several other options available.

INDICATORS



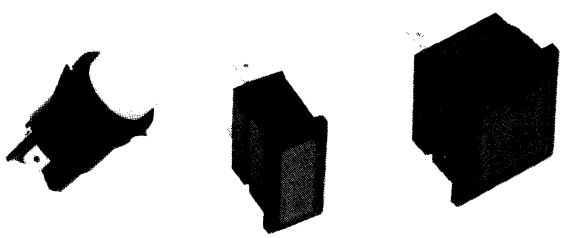
Standard 1/2" dia. mounting. 6-250 volt UL, CSA and VDE versions. Chrome finish bezels.

LED INDICATORS



- Sealed version to IP66 with internal and external O'rings
- Brass with Chrome finish and Aluminum with Black anodized finish.
- All versions can be supplied with or without LED lamps.
- Standard 5/16" dia. mounting hole
- Extended PVC wire leads option.
- InLine resistor options for voltage range 6-28vdc.

INDICATORS



Additional round, square and oblong shapes in many cut-out sizes are available. These styles match the appearance of our rocker and push-button range of switches. Various voltages and colors to select from.

Most products are UL, CSA and VDE etc approved.
Complete details supplied on request.

SEE PAGE B • 1648, SECTION 5100 FOR SWITCHES.

A FULL LINE CATALOG OF DRAWINGS AND SPECIFICATIONS AVAILABLE FREE OF CHARGE

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El Segundo, California 90245-4630
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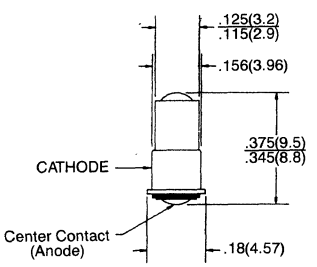
Full line catalog available

T-1 Sub-Midget LED Lamp

LED Colors Available: Bright Red, Red, Orange, Amber, Green, Pure Green
Standard Voltages: 2, 4, 5, 6, 12, 15, 24, 28, AC or DC

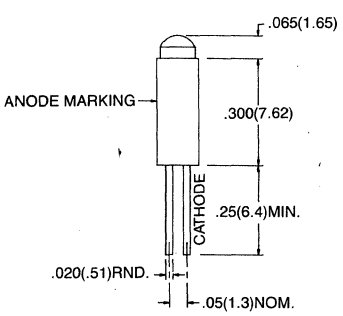
MF125

T-1 Flange LED, Dual-Chip
Replaces Incandescent#: 682, 685, 714, 718, 6839, 7240, 7241, 8022



BP125

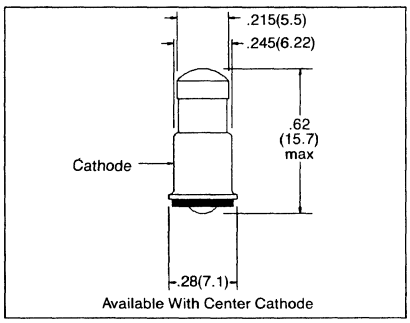
T-1 Bi-Pin LED, Dual-Chip
Replaces Incandescent#: 7265, 7680, 7683, 7714, 7715, 7839, 8099



T-1 3/4 MIDGET LED LAMP

LED Colors Available: Bright Red, Ultra Red, Red, Orange, Amber, Green, Pure Green, Blue, Red/Green
Standard Voltages: 5, 6, 12, 15, 24, 28, 60, & 110 AC or DC

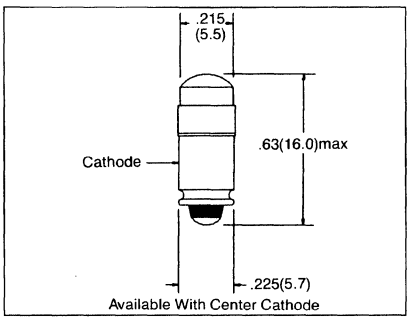
MF200



T-1 3/4 Flange LED, 6-Chip

Replaces Incandescent #: 327, 328, 330, 345, 349, 350, 370, 376, 377, 380, 381, 382, 385, 387, 394, 459, 7332, 7333, 7335, 7341, 8918

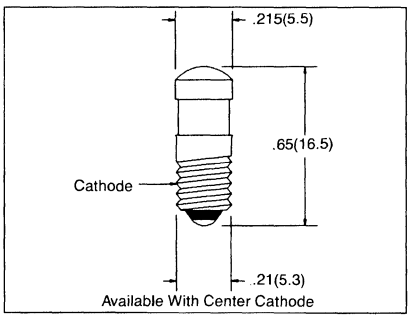
MG200



T-1 3/4 Groove LED, 6-Chip

Replaces Incandescent #: 334, 336, 337, 379, 386, 388, 398

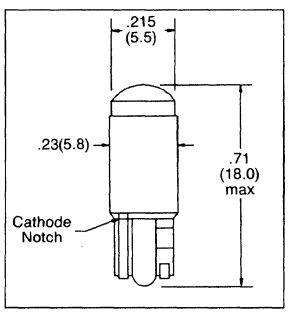
MS200



T-1 3/4 Screw LED, 6-Chip

Replaces Incandescent #: 335, 342, 369, 373, 378, 383, 399, 1768, 1775, 8362, 8369, 8384

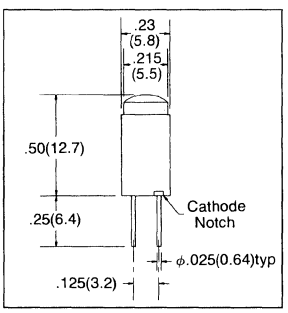
WB200



T-1 3/4 Wedge LED, 6-Chip

Replaces Incandescent #: 17, 18, 37, 56, 70, 73, 74, 79, 84, 85, 86

BP202



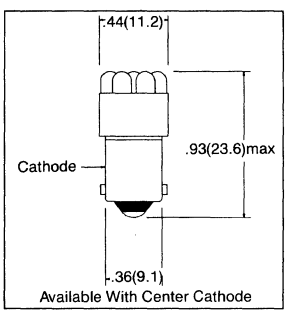
T-1 3/4 Bi-Pin LED, 6-Chip

Replaces Incandescent #: 2314, 2324, 2325, 2335, 2337, 2341, 2342, 3149, 7001, 7003, 7327, 7328, 7330, 7349, 7361, 7371, 7373, 7376, 7377, 7380, 7381, 7382, 7387, 7876, 7945

T-3 1/4 Miniature LED LAMP

LED Colors Available: Red, Amber, Amber/Yellow, Yellow, Green, Blue
Standard Voltages: 6, 12, 24, 28, 48, 60, 110 AC or DC

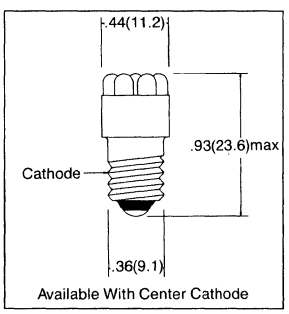
MB400



T-3 1/4 Bayonet LED, 7-Cluster

Replaces Incandescent #: 12MB, 12RB, 24MB, 24RB, 28MB, 28RB, 44, 47, 48MB, 48RB, 53, 57, 60MB, 60RB, 120MB, 120RB, 216, 239, 240, 256, 313, 316, 356, 363, 755, 756, 757, 1302, 1437, 1445, 1488, 1495, 1810, 1813, 1815, 1818, 1819, 1820, 1829, 1835, 1847, 1850, 1855, 1864, 1866, 1873, 1889, 1891, 1892, 1893, 1895

MS400

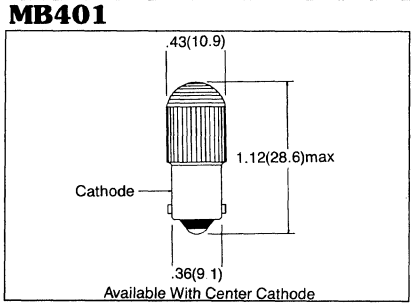


T-3 1/4 Screw LED, 7-Cluster

Replaces Incandescent #: 46, 52, 1446, 1449, 1483, 1487, 1821

LED Colors Available: Bright Red, Ultra Red, Red, Orange, Amber, Green, Pure Green, Blue, Red/Green
Standard Voltages: 5, 6, 12, 15, 24, 28, 60, 110, AC or DC

MB401



T-3 1/4 Bayonet LED, 6-Chip

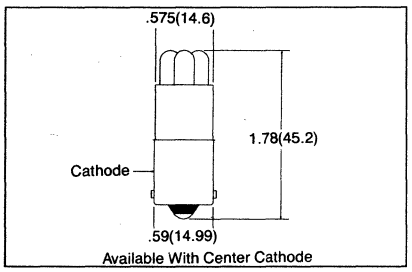
Replaces Incandescent #: Same as MB400

Data Display Products • 445 So. Douglas Street, El Segundo, CA 90245-4630 • (800) 421-6815 • (213) 640-0442 • FAX (213) 640-7639

T-4 1/2 CANDELABRA LED LAMP

LED Colors Available: Red, Orange, Amber, Green **Standard Voltages:** 12, 15, 24, 28, 48, 60 & 110 AC or DC

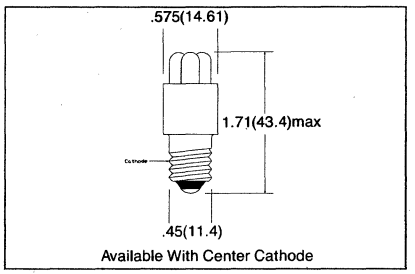
MB500



T-4 1/2 Bayonet LED, 4-Cluster

Replaces Incandescent #: 301, 303, 309, 311, 623, 1251, 1495, 1723, 1855

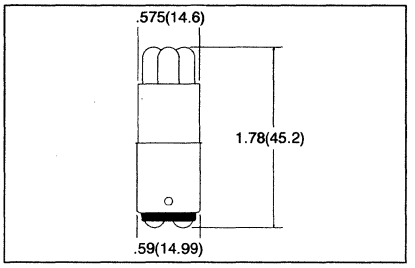
MS500



T-4 1/2 Screw LED, 4-Cluster

Replaces Incandescent #: 3S6/5, 6S6, 12RC, 24RC, 28RC, 48RC, 60RC, 120RC

DCB500



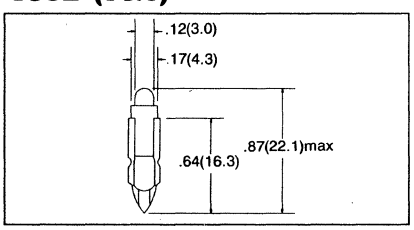
T-4 1/2 Double Contact Bayonet LED, 4 -Cluster

Replaces Incandescent #: 302, 304, 306, 308, 1204, 1252, 1638, 1692

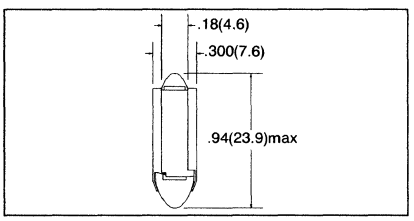
TELEPHONE SLIDE BASED LEDs

LED Colors Available: Bright Red, Ultra Red, Red, Orange, Amber, Amber/Yellow, Yellow, Green, Pure Green, Blue, Red/Green
Voltage Range: 2-110V AC or DC

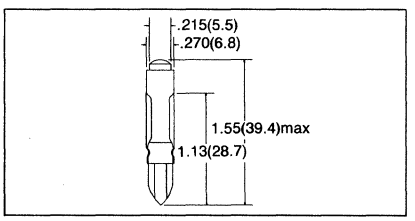
46SB (T4.6)



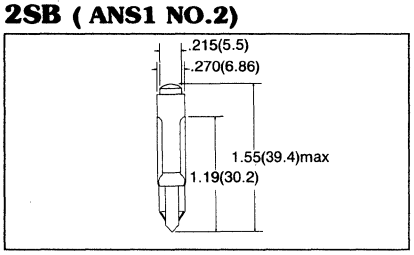
5TSB (T5)



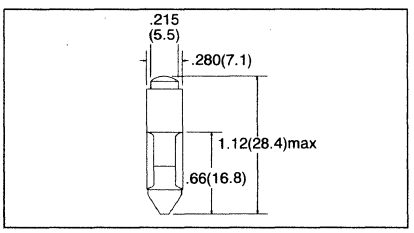
1SB (T6.8, ANS1 NO.1)



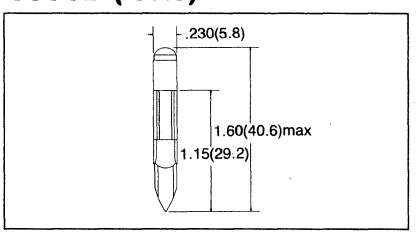
2SB (ANS1 NO.2)



5SB (ANS1 NO.5)

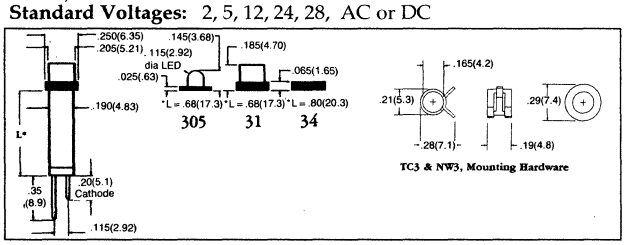


55SSB (T5.5)



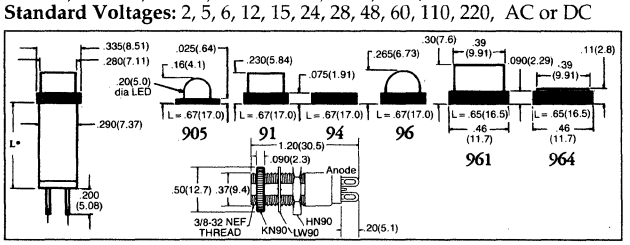
.190" PANEL MOUNT LEDs

LED Colors Available: Red, Amber, Amber/Yellow, Yellow, Green, Blue
Standard Voltages: 2, 5, 12, 24, 28, AC or DC



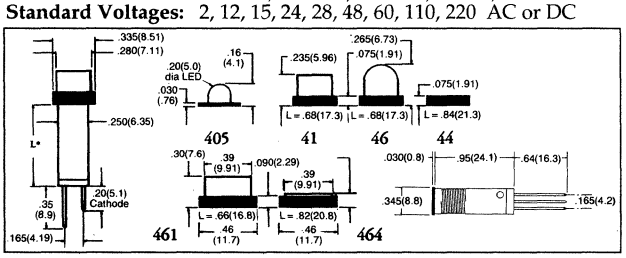
.290" PANEL MOUNT LEDs

LED Colors Available: Bright Red, Ultra Red, Red, Orange, Amber, Yellow, Green, Pure Green, Blue, Red/Green
Standard Voltages: 2, 5, 6, 12, 15, 24, 28, 48, 60, 110, 220, AC or DC



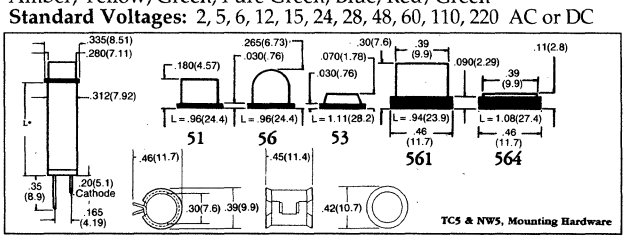
.250" PANEL MOUNT LEDs

LED Colors Available: Red, Amber, Yellow, Green, Blue
Standard Voltages: 2, 12, 15, 24, 28, 48, 60, 110, 220 AC or DC



.312" PANEL MOUNT LEDs

LED Colors Available: Bright Red, Ultra Red, Red, Orange, Amber, Yellow, Green, Pure Green, Blue, Red/Green
Standard Voltages: 2, 5, 6, 12, 15, 24, 28, 48, 60, 110, 220 AC or DC



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LED LAMPS & CIRCUIT BOARD INDICATORS (CBI)™

T-1 3/4, T-1, T-3/4 Discrete LED Lamps-521 SERIES

Discrete LED lamps available in T-3/4, T-1 & T-1 3/4 red, green, yellow and 3 leaded bi-color. The lens can be diffused or non-diffused with or without integral resistors.

PART NO.	COLOR LED/LENS	VF	mA	MCD	SNAP-IN MOUNT	FIG
521-9165	R/DIFF	2.3	20	2.0	B	1
521-9173	G/DIFF	2.3	20	3.2	B	1
521-9174	Y/DIFF	2.3	20	3.2	B	1
521-9177	R-G/DIFF	2.3	20	6.0	A	2
521-9178	R-G/DIF	2.1/2.3	10	5.0/8.0		3
521-9183	R/DIFF	5.0	12	0.8	A	4
521-9185	R/ND	1.6	20	0.8		5
521-9186	R/DIFF	1.6	20	0.8		5
521-9195	R/DIFF	1.6	3	0.4		6
521-9200	R/DIFF	1.7	20	2.0	A	7
521-9210	G/DIFF	2.4	10	2.0	C	8
521-9211	Y/DIFF	2.2	10	2.5	C	8
521-9215	R/DIFF	5.0	12	0.8	C	9
521-9216	R/DIFF	1.7	20	2.4	C	8
521-9240	R/DIFF	1.7	20	2.0	A	10
521-9246	R/DIFF	2.2	10	7.0	A	11
521-9247	R/ND	2.2	10	30.0	A	11
521-9248	Y/DIFF	2.2	10	8.0	A	11
521-9249	Y/ND	2.2	10	30.0	A	11
521-9250	G/DIFF	2.4	20	3.0	A	11
521-9251	G/ND	2.4	20	50.0	A	11
521-9264	R/DIFF	2.5	25	6.5		12
521-9265	Y/DIFF	2.5	20	2.5		12
521-9266	G/DIFF	2.5	25	2.5		12
521-9270	G/DIFF	2.4	20	8.0	A	2
521-9271	Y/DIFF	2.4	10	6.0	A	2
521-9320	R/DIFF	1.8	2	2.0	A	2

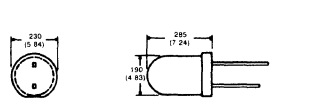

FIGURE 1

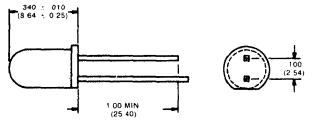

FIGURE 2

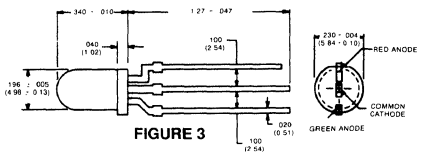

FIGURE 3

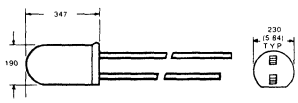

FIGURE 4

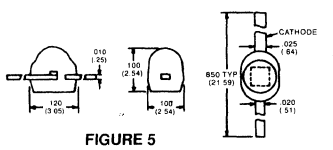

FIGURE 5

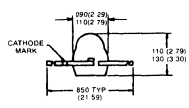

FIGURE 6

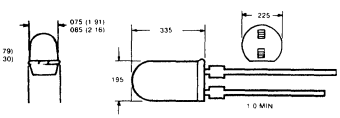

FIGURE 7

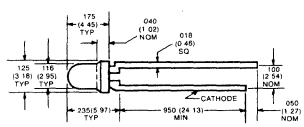

FIGURE 8

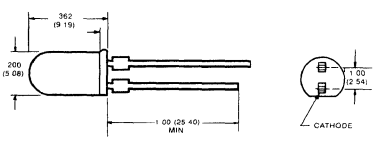

FIGURE 9

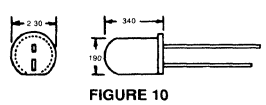

FIGURE 10

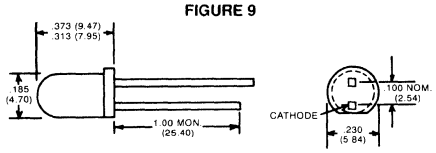

FIGURE 11

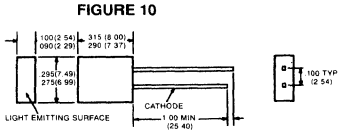

FIGURE 12

Snap-In Mounting Hardware

Mounting hardware for rear mounting of 521 series LEDs. Check chart below for correct product. Note recommended mounting hole and panel thickness below.

PART NO.	LED USED WITH	RECOM MTG HOLE	MAX PANEL THICKNESS	FIG.
515-0004	A	.265 (6.73)	7/64 (2.78)	13
515-0005	B	.265 (6.73)	7/64 (2.78)	13
515-0006	C	.165 (4.19)	.100 (2.54)	13

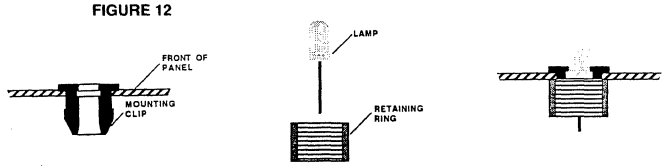

FIGURE 13

T-1 3/4 (5mm) Variable Height - 561 SERIES

Variable height CBIs available in 3 heights .5, .7, and 1 inch when mounting above the PC board. Available in red, green or yellow, high or super effiecient versions. Integral resistors are also available. Flat denotes cathode. Check the chart below for the product you require.

PART NO.	HEIGHT	COLOR	VF	mA	MCD	FIG.
561-0104-050	.500	R	5	13	2	14
561-0104-070	.700	R	5	13	2	15
561-0104-100	1.00	R	5	13	2	16
561-1101-050	.500	R	1.8	2	2	14
561-1101-070	.700	R	1.8	2	2	15
561-1101-100	1.00	R	1.8	2	2	16
561-1201-050	.500	Y	1.9	2	2	14
561-1201-070	.700	Y	1.9	2	2	15
561-1201-100	1.00	Y	1.9	2	2	16
561-1301-050	.500	G	1.8	2	2	14
561-1301-070	.700	G	1.8	2	2	15
561-1301-100	1.00	G	1.8	2	2	16
561-2101-050	.500	R	2.2	10	4	14
561-2101-070	.700	R	2.2	10	4	15
561-2101-100	1.00	R	2.2	10	4	16
561-2201-050	.500	G	2.2	20	3	14
561-2201-070	.700	G	2.2	20	3	15
561-2201-100	1.00	G	2.2	20	3	16
561-2301-050	.500	Y	2.2	10	3	14
561-2301-070	.700	Y	2.2	10	3	15
561-2301-100	1.00	Y	2.2	10	3	16

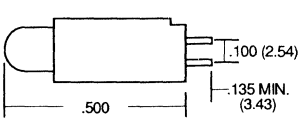

FIGURE 14

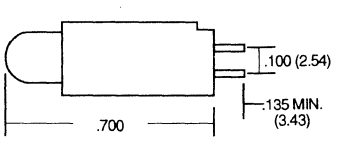

FIGURE 15

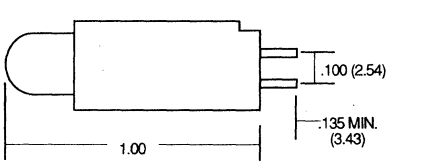

FIGURE 16

ALL INDICATIONS ARE DIALIGHT

DIALIGHT 1913 Atlantic Avenue, Manasquan, NJ 08736 (908) 223-9400 Fax: (908) 223-8788

Dialight's circuit board indicators (CBI) offer you a variety of different LEDs assembled in either right angle or top view packages, all products are manufactured in our state of the art facility in Roxboro, NC.

CIRCUIT BOARD INDICATORS (CBI)™

T-1 3/4 (5mm) Single-550 SERIES

High luminous intensity solid state light source available in red, green, or yellow and 2 & 3 leaded bi-color, standard, high and super efficient LEDs; some with intergal resistors. Right angle housing offers ease of assembly and pretrimmed leads compatable with Dual or Quad 550 Series.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
550-0204	TOP	GREEN	2.3	20	3.2	17
550-0205	RIGHT	GREEN	2.3	20	3.2	18
550-0207	RIGHT	GREEN	2.3	20	3.2	19
550-0304	TOP	YELLOW	2.3	20	3.2	17
550-0305	RIGHT	YELLOW	2.3	20	3.2	18
550-0307	RIGHT	YELLOW	2.3	20	3.2	19
550-0404	TOP	RED	1.7	20	2.0	17
550-0405	RIGHT	RED	1.7	20	2.0	18
550-0407	RIGHT	RED	1.7	20	2.0	19
550-0504	TOP	RED	5	13	1.5	17
550-0505	RIGHT	RED	5	13	1.5	18
550-0507	RIGHT	RED	5	13	1.5	19
550-1107	RIGHT	RED	1.8	2	2.0	19
550-1207	RIGHT	YELLOW	1.9	2	1.8	19
550-1307	RIGHT	GREEN	1.8	2	1.8	19
550-2205	RIGHT	GREEN	2.2	10	3	18
550-2207	RIGHT	GREEN	2.2	10	3	19
550-2305	RIGHT	YELLOW	2.2	10	3	18
550-2307	RIGHT	YELLOW	2.2	10	3	19
550-2405	RIGHT	RED	2.2	10	4	18
550-2407	RIGHT	RED	2.2	10	4	19
550-3007	RIGHT	R/G	2.3	20	6	19
550-3505	RIGHT	R/G	2.1/2.3	10	5/8	20

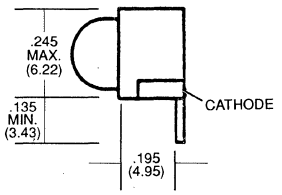

FIGURE 17

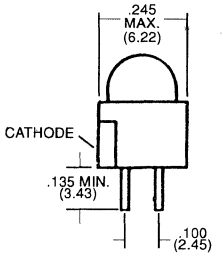

FIGURE 18

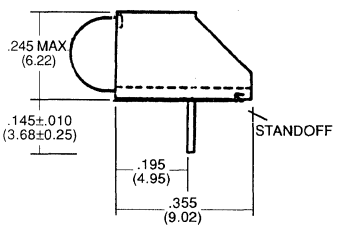

FIGURE 19

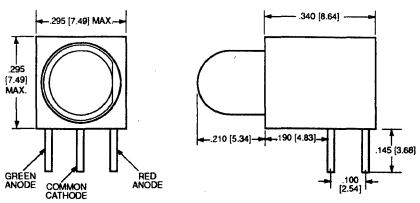

FIGURE 20

T-1 3/4 (5mm) Dual-550 SERIES

High luminous intensity solid state light source available in red, green or yellow some with intergal resistors can be ordered with same variety of LEDs as in 550 Series. Right angle housing offers ease of assembly and pretrimmed leads compatable with Single or Quad 550 Series.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
550-0207-002	RIGHT	GREEN	2.3	20	3.2	21
550-0307-002	RIGHT	YELLOW	2.3	20	3.2	21
550-0407-002	RIGHT	RED	1.7	20	2.0	21
550-0507-002	RIGHT	RED	5	13	1.5	21

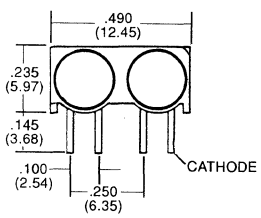

FIGURE 21

T-1 3/4 (5mm) Quad-550 SERIES

Four high luminous intensity solid state light source in a single package available in red, green or yellow; some with integral resistors can be ordered with same variety of LEDs as in 550 Series. Right angle housing offers ease of assembly and pretrimmed leads compatable.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
550-0206-004	RIGHT	GREEN	2.3	20	3.2	22
550-0306-004	RIGHT	YELLOW	2.3	20	3.2	22
550-0406-004	RIGHT	RED	1.7	20	2.0	22
550-0506-004	RIGHT	RED	5	13	1.5	22
550-3006-004	RIGHT	R/G	2.3	20	6	22

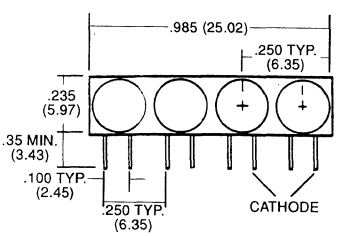

FIGURE 22

T-1 3/4 (5mm) Bilevel-552 SERIES

Bi-level solid state light source available in red, green or yellow with or without intergal resistors, also available in high and super efficient versions. The bi-level design conserves PC board space and right angle housing offers ease of assembly, leads are pretrimmed.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
552-0111	RIGHT	R/R	1.7	20	3.2	23
552-0122	RIGHT	G/G	2.3	20	3.2	23
552-0211	RIGHT	R/R	2.2	10	4.0	23
552-0222	RIGHT	G/G	2.2	10	3.0	23
552-0311	RIGHT	R/R	5	13	1.5	23
552-0911	RIGHT	R/R	1.8	2	2.0	23
552-0922	RIGHT	G/G	1.8	2	1.8	23

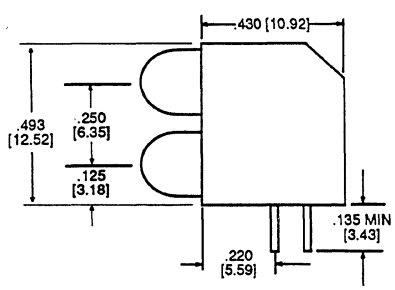

FIGURE 23

ALL INDICATIONS ARE DIALIGHT

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CIRCUIT BOARD INDICATORS (CBI)™

2mm X 5mm Rectangular-566 SERIES

NEW - Rectangular right angle CBIs available in high efficiency red, green, yellow and 3 leaded bi-color unique snap-in retention feature allows for positive placement on PC board prior to wave soldering.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
566-0207	RIGHT	GREEN	2.3	20	4	24
566-0307	RIGHT	YELLOW	2.2	20	3.5	24
566-0407	RIGHT	RED	2.2	20	4.8	24
556-3507	RIGHT	R/G	2.1/2.3	20	3.5/4.0	25

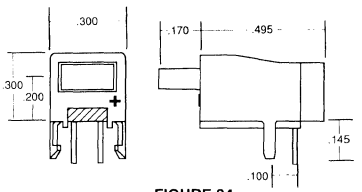

FIGURE 24

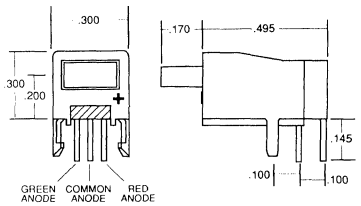

FIGURE 25

T-1 (3mm) Single - 551 SERIES

High luminous intensity solid state light source available in red, green or yellow standard and super efficient LEDs; some with integral resistors. Right angle housing offers ease of assemble compatable with Quad 551 series.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
551-0207	RIGHT	GREEN	2.1	10	1.6	26
551-0307	RIGHT	YELLOW	2.1	10	6.3	26
551-0407	RIGHT	RED	2	10	10	26
551-0507	RIGHT	RED	5	13	2.5	26
551-1107	RIGHT	RED	1.8	2	1.8	26
551-1207	RIGHT	YELLOW	1.9	2	1.6	26
551-1307	RIGHT	GREEN	1.8	2	1.6	26

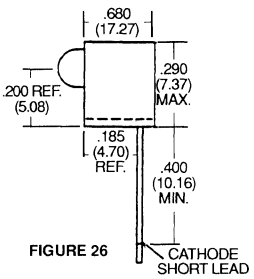

FIGURE 26

T-1 (3mm) Quad - 551 SERIES

Four high luminous intensity solid state light source in a single package available in red, green, and yellow standard and super efficient LEDs; some with intergal resistors.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
551-0207-004	RIGHT	GREEN	2.1	20	16	27
551-0307-004	RIGHT	YELLOW	2.1	20	6.3	27
551-0407-004	RIGHT	RED	1.7	20	10	27
551-0507-004	RIGHT	RED	5	13	2.5	27

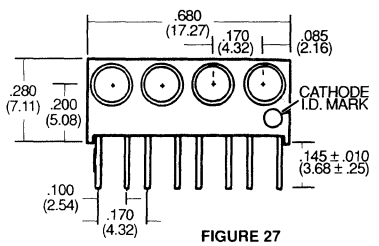

FIGURE 27

SURFACE MOUNT CIRCUIT BOARD INDICATORS (CBI)™

Dialight introduces the first truly surface mountable CBI with a newly patented lens design that is compatable with the harsh processing environment and automatic placement equipment.

T-1 3/4 (5mm) Surface Mount -590 SERIES

NEW - Surface mountable CBI available in high efficiency red, green, and yellow.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
590-2001	RIGHT	RED	2.5	10	8	28
590-2101	RIGHT	GREEN	2.5	10	6.5	28
590-2301	RIGHT	YELLOW	2.5	10	5	28
590-2401	RIGHT	RED	2.2	10	29	28

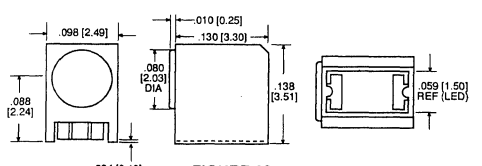

FIGURE 28

T-1 (3mm) Surface Mount -591 SERIES

NEW - Surface mountable CBI available in high efficiency red, green, and yellow.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
591-2001	RIGHT	RED	2.5	10	8	29
591-2301	RIGHT	GREEN	2.5	10	6.5	29
591-2401	RIGHT	YELLOW	2.5	10	5	29
591-2101	RIGHT	RED	2.2	10	29	29

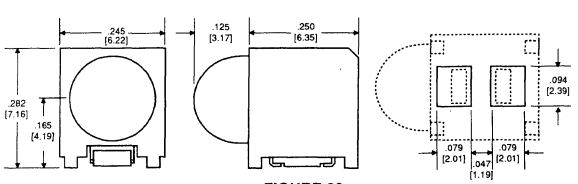

FIGURE 29

T-3/4 (Subminiature) Surface Mount -595 SERIES

NEW - Surface mountable CBI available in high efficiency red, green and yellow.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
595-2101	RIGHT	RED	1.7	20	9.5	30
595-2301	RIGHT	GREEN	2.1	20	5.6	30
595-2401	RIGHT	YELLOW	2.2	20	5.6	30

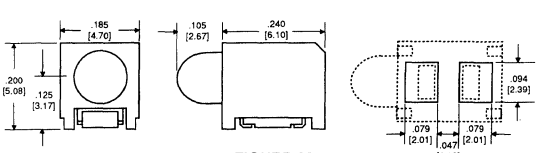

FIGURE 30

ALL INDICATIONS ARE DIALIGHT

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SURFACE MOUNT CIRCUIT BOARD INDICATORS (CBI)™

T-1 (3mm) Bilevel - 553 SERIES

Bi-level solid state light source available in red, green or yellow with or without integral resistors. Available in standard and super efficient versions, the bilevel design conserves PC board space and right angle housing offers ease of assembly; leads are pretrimmed.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
553-0111	RIGHT	RED/RED	2.0	10	1.6	31
553-0122	RIGHT	GRN/GRN	2.1	10	2.6	31
553-0211	RIGHT	RED/RED	1.8	2	1.8	31
553-0222	RIGHT	GRN/GRN	1.8	2	1.6	31
553-0311	RIGHT	RED/RED	5	13	1.5	31

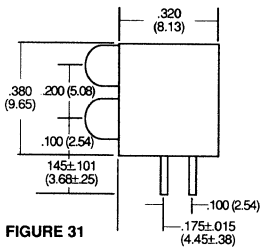

FIGURE 31

T-1 (3mm) Trilevel - 564 SERIES

NEW - Tri-level solid state state light source available in red, green or yellow with or without intergal resistors. Available in standard and super efficient versions, the unique trilevel design conserves PC board space and right angle housing offers ease of assembly; leads are pretrimmed.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
564-0100-111	RIGHT	RD/RD/RD	2.2	10	1.6	32
564-0100-222	RIGHT	GR/GR/GR	2.3	10	2.6	32
564-0100-132	RIGHT	RD/YL/GR	2.2/2.2/2.3	10	5.5/6/5	32
564-0200-111	RIGHT	RD/RD/RD	1.8	2	1.8	32
564-0200-222	RIGHT	GR/GR/GR	1.8	2	1.6	32
564-0200-132	RIGHT	RD/YL/GR	1.8/1.9/1.8	2	1.8/1.6/1.6	32
564-0300-111	RIGHT	RD/RD/RD	5	13	8	32

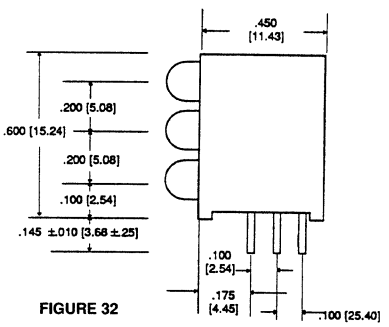

FIGURE 32

T-3/4 (Subminiature) Single - 555 SERIES

Incorporates a T-3/4 LED in either a right angle or top view package in red, green or yellow integral resistors are available for a wide variety of voltages compatable with our 555 quad series.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
555-2001	RIGHT	RED	1.6	20	3	33
555-2003	RIGHT	RED	5	6	1.2	33
555-2004	RIGHT	RED	5	16	2	33
555-2006	RIGHT	RED	14	10	1.5	33
555-2007	RIGHT	RED	5	3	0.6	33
555-2008	RIGHT	RED	24	3	2	33
555-2301	RIGHT	GREEN	2.4	20	1	33
555-2303	RIGHT	GREEN	5	4.7	0.5	33
555-2401	RIGHT	YELLOW	2.2	20	2	33
555-2403	RIGHT	YELLOW	5	4.7	0.6	33
555-3001	TOP	RED	1.6	20	3	34
555-3003	TOP	RED	5	6	1.2	34
555-3004	TOP	RED	5	16	2	34
555-3006	TOP	RED	14	10	1.5	34
555-3007	TOP	RED	5	3	0.6	34
555-3008	TOP	RED	24	3	2	34

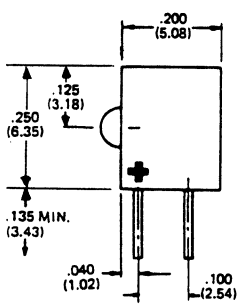

FIGURE 33

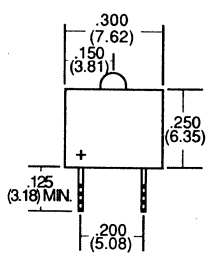

FIGURE 34

T-3/4 (Subminiature) Quad - 555 SERIES

Incorporates a T-3/4 LED in a right angle package in red, green or yellow. Integral resistors are available for a wide variety of voltages compatable with our 555 single series.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
555-4001	RIGHT	RED	1.6	20	3	35
555-4003	RIGHT	RED	5	6	1.2	35
555-4007	RIGHT	RED	5	3	0.6	35
555-4301	RIGHT	GREEN	2.4	20	1	35
555-4303	RIGHT	GREEN	5	4.7	0.5	35
555-4401	RIGHT	YELLOW	2.2	20	2	35
555-4403	RIGHT	YELLOW	5	4.7	0.6	35

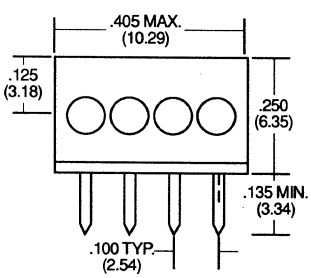

FIGURE 35

ALL INDICATIONS ARE DIALIGHT

DIALIGHT

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Part numbers for red lens only, amber & green also available. They are also listed for 2V or 6V operation. Other voltages are available. Internal current limiting resistor can be furnished on request.

PANEL MOUNT LED INDICATORS

605 SERIES for 5mm mounting hole

PART NO.	COLOR	VF	mA	mcd*	FIG.
605-1111-110	RED	2	10	1.2	36
605-2111-110	RED	2	10	1.2	37

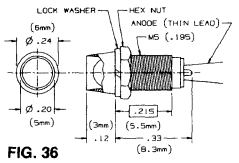

FIG. 36

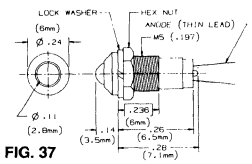

FIG. 37

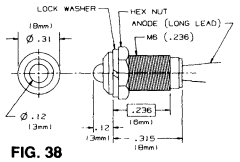

FIG. 38

606 SERIES for 6mm mounting hole

606-1111-110	RED	2	5	2.4	38
606-2111-110	RED	2	5	2.4	39
606-1415-110	R/G	2	5/20	.6/1.0	40
606-2415-110	R/G	2	5/20	.6/1.0	41

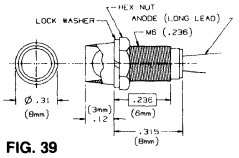

FIG. 39

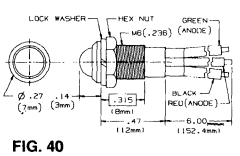

FIG. 40

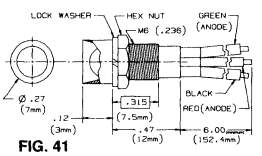

FIG. 41

607 SERIES for 7mm mounting hole

607-1112-110	RED	2	15	8.0	42
607-2112-110	RED	2	15	8.0	43
607-3132-120	RED	6	15	8.0	44

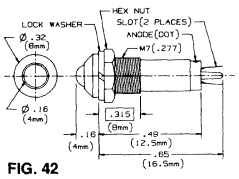

FIG. 42

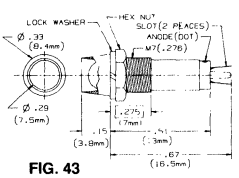

FIG. 43

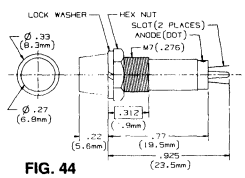

FIG. 44

608 SERIES for 8mm mounting hole

608-1131-110	RED	2	15	20	45
608-3131-110	RED	2	15	20	46

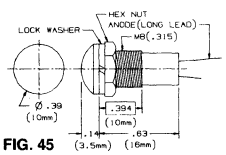

FIG. 45

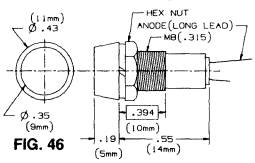

FIG. 46

609 SERIES for 9mm mounting hole

609-1112-110	RED	6	15	20	47
609-2112-110	RED	6	15	20	48

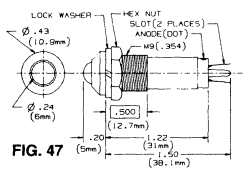

FIG. 47

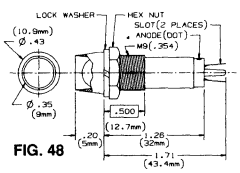

FIG. 48

610 SERIES for 10mm mounting hole

610-3132-120	RED	6	10	250	49
610-4232-120	RED	6	10	250	50

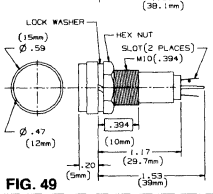

FIG. 49

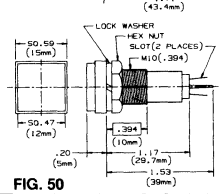

FIG. 50

SNAP-IN PANEL MOUNT LED INDICATORS

558 SERIES for .156" mounting hole

558-0101-001	RED	2	20	2.8	51

Mounting hole - .155 (394) to .158 (4.01) Diameter

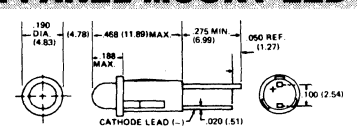

FIG. 51

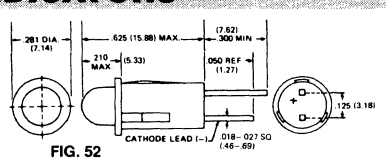

FIG. 52

559 SERIES for .250" mounting hole

559-0101-001	RED	2	5	2.7	52
559-3001-001	R/G	2	20	6	53
559-3501-003	R/G	2	5	1.2	54
559-4101-001	RED	1.9	5	1.4	55
559-5101-001	RED	1.7	20	30	52

Mounting hole - .249 (6.32) to (6.40) diameter

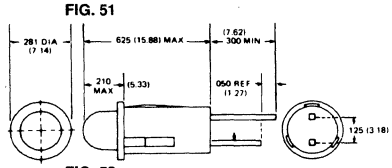

FIG. 53

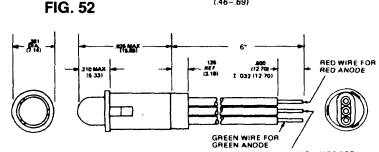

FIG. 54

608 SERIES for 8mm mounting hole

608-1132-220	RED	6	15	20	56
608-2132-220	RED	6	15	20	57

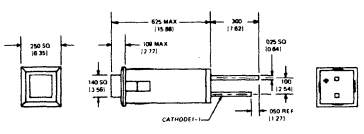

FIG. 55

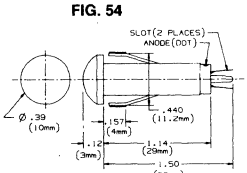

FIG. 56

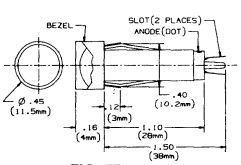

FIG. 57

* mcd intensity of LED

Figures 44,45,46 & 49-57 have polycarbonate housing. all others are chrome plated brass.

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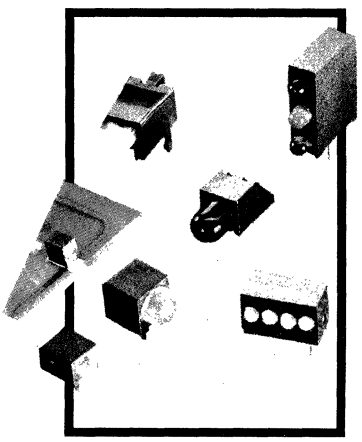

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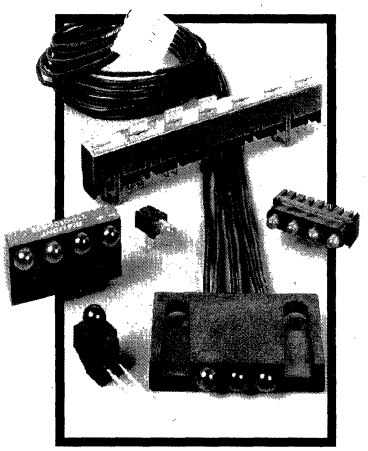

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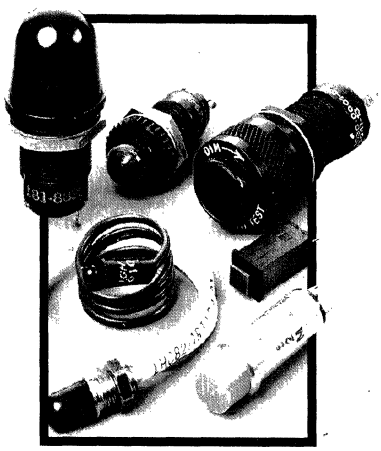

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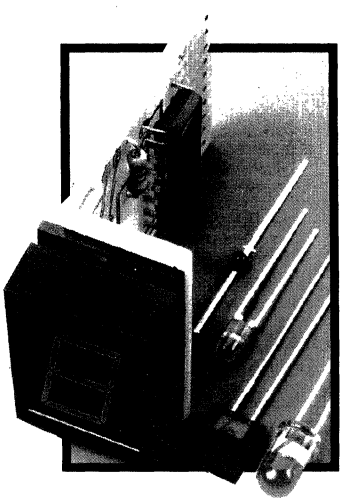

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FLUORESCENT TUBE INVERTERS FOR LCD DISPLAYS

The ERG E200II dc to ac inverters are a unique series of dc to ac power supplies designed and processed to power the cold-cathode fluorescent tube(s) contained in different LCD display assemblies. Each E200II part number is tailored to the specifications of the individual LCD display assembly. This insures complete system compatibility, maximum LCD display life and reliability.

Every ERG E200II part number is designed, validated and 100% tested using the actual LCD display assembly. A complete data sheet is produced for each unit outlining performance characteristics at various operating points and provides guaranteed performance specifications.

The E200II inverters are "vacuum" encapsulated to insure proper dielectric integrity, protection from the environment and handling during manufacturing.

Each E200II inverter is offered in a "C" or "E" configuration. These configurations provide "extra pin" control, allowing the inverter to be disabled and/or dimmed without adding series input components. The data sheet for each "C" or "E" unit contains specific component values and application information which makes system interfacing with the ERG E200II Series simple.

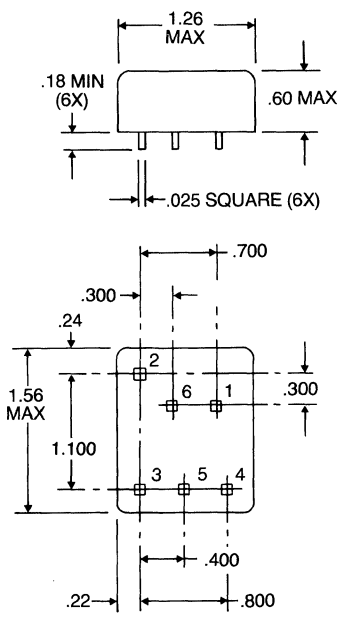
Some of the distinguishing features of the ERG E200II series are:

- ❑ High Efficiencies (80% to 85%)
- ❑ Small printed circuit mountable package
- ❑ Guaranteed performance
- ❑ "Vacuum" encapsulated construction
- ❑ Designed and manufactured in the USA with local support
- ❑ Standard designs are cross referenced to LCD part numbers
- ❑ Tailored designs to meet special requirements

LCD to ERG INVERTER CROSS REFERENCE

MANUFACTURER	LCD DISPLAY PART NUMBER	ERG Part Number 5 Volt Input	12 Volt Input	24 Volt Input
Epson	EG2405B-LS	E1050	E1051	
Epson	EG7500B-LS	E1026	E1042	
Epson	EG7501B-LS	E1113	E1041	
Epson	EG8003N-NS		E1058	
Epson	EG9005G-NS	E1074		
Epson	EG9006D-NS	E1076	E1098	
Epson	EG9007F-NS	E1015		
Hitachi	LMG5040XUFC	E1022		
Hitachi	LMG5042XUFC	E1057		
Hitachi	LMG6121XUFC	E1067		
Kyocera	KL6440ASHT-FW	E1127		
Kyocera	KL6448ASTT-FW		E1019	
Optrex	DMF5010NBU-FW		E1097	
Optrex	DMF6104NB-FW	E1084	E1082	E1083
Optrex	DMF651AN-FW		E1013	
Optrex	DMF666NB-FW	E1120		
Seiko	G643GX5S100		E1049	
Sharp	LM10P10		E1119	
Sharp	LM24010Z	E1099		
Sharp	LM32004T	E1126		E1114
Sharp	LM64014C			E1017
Sharp	LM64P60	E1043	E1024	
Sharp	LM64P62	E1066	E1065	
Sharp	LM64P64	E1039	E1040	
Sharp	LM64P70	E1001		
Sharp	LM64P722	E1131	E1132	
Sharp	LQ424A01		E1002	
Sharp	LQ6NC01		E1018	
Sharp	LQ6NC02		E1018	
Toshiba	TLX-1341-C3B	E1075		
Toshiba	TLX-1501-C3M	E1135	E1136	
Toshiba	TLX-1551-C3M	E1103		
Toshiba	TLX-1702S-C3M	E1137	E1138	
Toshiba	TLX-1721-A3	E1133	E1134	
Toshiba	TLX-1741-C3M	E1118		

E200II Package Configurations



1. Vin(+)
2. Vin(−)
3. Vout (common)
4. Vout(AC) tube 1
5. Vout(AC) tube 2 (on two tube inverters)
6. Disable/Control ("C" and "E" type)

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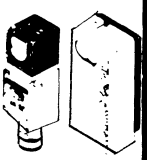
PHOTOELECTRICS


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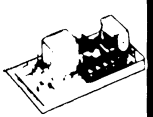
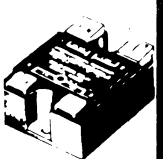
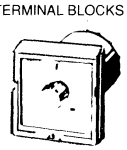

LIQUID LEVEL CONTROLS

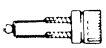

SOLID STATE RELAYS


TERMINAL BLOCKS


TEMPERATURE CONTROLS


TIMERS

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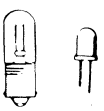
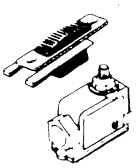
KNOBS


LAMPS & LEDS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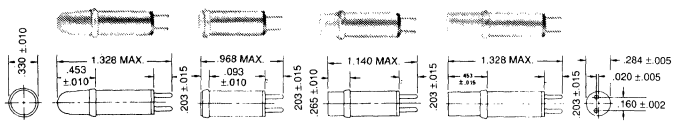
ELDEMA INDICATOR LITES

INCANDESCENT C-LITES CF SERIES

Eldema CF Series incandescent C-lites have an unbased lamp packaged inside the cartridge, with connections made to the two pins. The lamps used are the standard T-1-3/4 bulb size or smaller with ratings from 1.35 to 28 volts available. Lens colors in both clear and translucent shades are all standard. The short flat lens style cartridge–Cf03–conforms to MS18235.

MATE WITH DH SERIES LAMPHOLDERS

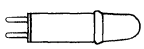
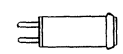
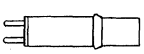


CF01 DOME LENS STYLE | **CF02** FLUSH LENS STYLE | **CF03 & CF93** SHORT FLAT LENS STYLE | **CF04** LONG FLAT LENS STYLE

ORDERING INFORMATION– To order Eldema incandescent C-lites refer to the table below and specify Style–Lens, Color–Cartridge, Finish–and Lamp Number.
EXAMPLE PART NUMBER: **CF03-RTS-2187**

CHOICE OF LENS SHAPE AND COLOR–The CF03, short flat lens, is the style used in most applications.The long flat lens–CF04– and the dome lens–CF01– are used where wide side visibility is important. The lens colors for CF incandescent C-Lites are usually the translucent shades except for the lower brilliance lamps which should be used with the clear colors. The translucent lens colors give an even, diffused light over the lens surface. The transparent lens color(WC-water clear) should be used with the lampholders and screw-on D Series lens caps.

LAMP SPECIFICATIONS–The lamp specifications shown are the lamp manufacturer's ratings and are based on average performance under laboratory conditions. The milli ampere ratings are nominal values with 10% tolerances at rated voltage operation.

SERIES CF STYLE	LENS COLOR	FINISH	LAMP Number	Volts	MA	Life(hrs.)
 CF01 Dome	Translucent		1728*	1.35	60	5,000
	AT-Amber	S	1738*	2.7	60	6,000
	BT-Blue	-	2158*	3.0	15	10,000
	GT-Green	Clear	680	5.0	60	60,000
	RT-Red	Anodize	1730	6.0	40	1,000
	WT-White	(Standard)	2114	6.0	60	3,000
	YT-Yellow		1784	6.0	200	1,000
 CF02 Flush	Clear	B	2180	6.3	40	20,000
	AC-Amber	Black	2112	6.3	200	5,000
	BC-Blue	Anodize	2181	6.3	200	20,000
	CC-Cloudy	(Special)	1869*	10.0	14	100,000
	GC-Green		2107*	10.0	40	10,000
 CF03 & CF93 Short Flat	RC-Red		2174	12.0	40	10,000
	WC-Water		1705	14.0	80	1,500
	Clear		2182	14.0	80	15,000
	YC-Yellow		4814*	14.0	17	50,000
 CF04 Long Flat			4818*	18.0	20	20,000
			2102	18.0	40	10,000
			1762	28.0	40	4,000
			2185	28.0	40	20,000
			2187	28.0	40	7,000

*These lamps should be used with the clear lens colors only because of their relatively lower light output.

TYPE CF93 - LENS STYLE

Now available - fluted lens cap for improved lite dispersion on low power lamps and elimination of "hot spots" on high power lamps.



Dimensionally same as **CF03** above.

HOW TO SPECIFY

Standard		Fluted
CF03	becomes	**CF93**
CG03	becomes	**CG93**
CR03	becomes	**CR93**

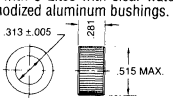
D HOLDER ASSEMBLY

MATE WITH SINGLE LAMPHOLDERS

These lens caps and collars mate with the single lamp holders. The collars may be used with C-Lites that have colored lenses. The lens caps should be used with C-Lites with clear water (transparent) lenses. The lens caps are high temperature plastic with anodized aluminum bushings.

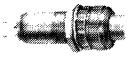


DHO-10 -D14B WITH CF03

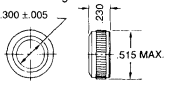


D14 COLLAR

The **D14** knurled collar is designed for use on the **DHO** holder only. The collar securely retains the C-Lite cartridge. It may be used with any of the **CF, CG,** or **CR** cartridges.



DHN-10B-D15B WITH CF03

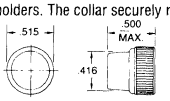


D15 COLLAR

The **D15** is a new trim style collar for the **DHN** or **DHO** holders. The collar securely retains any of the **CF, CG,** or **CR** Series C-Lite cartridges.



DHN- B-D06BRT

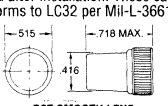


D06 SMOOTH LENS

The **D06** lens caps rotate so lens marking may be aligned after installation. These caps mate with the **CF03, CG03, CR03,** and **CF24** style C-Lite. The **D06** conforms to LC32 per Mil-L-3661.



DHN -10B-D07BRC

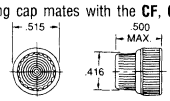


D07 SMOOTH LENS

The **D07** lens will rotate to align lens marking. The long cap mates with the **CF, CG,** and **CR** cartridges with the dome and long flat shapes.

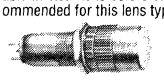


DHO-30B-D09WC

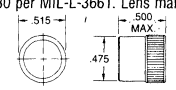


D09 FLUTED LENS Clear colors only

The **D09** fluted lens caps mate with **CF03, CG03, CR03** and **CF24** style C-Lites. These caps are available in clear lens colors only. The **D09** conforms to LC30 per MIL-L-3661. Lens marking is not recommended for this lens type.



DHN-60B-D25BWT



D25 SHROUD LENS Translucent colors only

The **D25** is a full shroud lens with end on viewing only. The **D25** comes in translucent colors and mates with the **CF03** and **CF24** C-Lite incandescent cartridges.



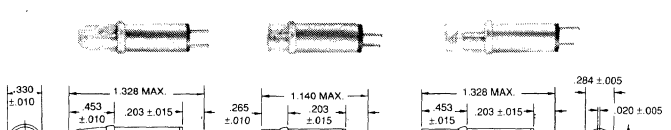
DHO-10B Holder only with CF03 C-Lite for Flush Panel Mounting

Holder	Lens Cap	O.A.L	Max. Panel
DHO or DHN	D06 or D09	1.573 Max.	1/4"
DHO or DHN	D07	1.781 Max.	1/4"
DHO	D14 or D15	1.281 Max.	3/16"
DHN	D15	1.296 Max.	1/4"
DHO or DHN	D25	1.573 Max.	1/4"
DHO	None	1.203 Max.	9/32"

NEON C-LITES CR SERIES - NEON LAMP WITH BUILT-IN RESISTOR / CG SERIES - NEON LAMP ONLY

Eldema neon C-Lites come in two basic types–CG Series with the neon lamp built into the cartridge but requiring an external resistor–CR Series, with the lamp and current limiting resistor built into the cartridge. Neon C-Lites only come in clear (transparent) lens colors due to their low light output–note neons are not effective with blue or green lenses. The water clear lens color should be specified when the neon C-Lite is used with a DH lampholder and lens cap. The CR01 conforms to MS18236 and the CR04 to MS18237

MATE WITH DH SERIES LAMPHOLDERS

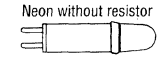
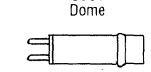
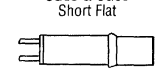


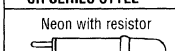
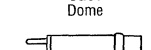
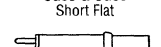
CG 01 AND CR01 DOME LENS STYLE | **CG93 AND CR93 CG03 AND CR03** SHORT FLAT LENS STYLE | **CG04 AND CR04** LONG FLAT LENS STYLE

ORDERING INFORMATION–To order Eldema neon C-Lites refer to the table at right and specify the Style–Lens, Color–Cartridge, Finish and Lamp or Lamp/Resistor Number.
EXAMPLE PART NUMBER: **CG03-RCS-N120**
CR03-WCS-N117

CHOICE OF LAMP–High brightness lamps offer the best indication and require 110 Volts AC or 150 Volts DC for their operation–the current is less than 1.5 ma with a 33K resistor in series with the lamp.
The standard brightness lamps require less than 0.6 ma current and operate on 90 Volts DC or 65 Volts AC with a 100K resistor in series with the lamp.
The circuit component lamps are comparable to the standard brightness lamps–selected for the firing voltages listed.

RECOMMENDED RESISTOR VALUES–The lower the resistor value, the greater the light output, but the life rating decreases. The standard life ratings are the best compromise for most applications. Listed below are the approximate life ratings for operation on 110-125 Volts AC and the recommended resistor.
HIGH BRIGHTNESS LAMPS
Standard life–25,000 hours–33K, Medium life–3,000 hours–22K
STANDARD BRIGHTNESS LAMPS
Standard life–15,000 hours–100K, Medium life–5,000 hours–56K
Long Life–25,000 hours–150K
The last digit in the lamp/resistor number designates the resistor value as follows: (CG type)–none; (CR type) 1-22K, 3-33K, 4-56K, 7-100K, 8-150K. Other resistor values on special order.

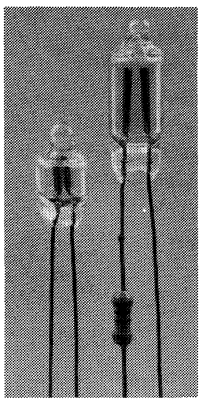
CG SERIES STYLE	LENS COLORS	FINISH	LAMP NUMBER
Neon without resistor  CG01 Dome	Clear Colors Only	S - Clear Anodize (Standard)	STANDARD NEON LAMPS N110 - Standard brightness N120 - High Brightness
 CG93 & CG03 Short Flat	AC - Amber CC - Cloudy RC - Red WC - Water Clear YC - Yellow	B - Black Anodize (Special)	SPECIAL COMPONENT LAMPS (Available in CG01 and CG04 only) N210* - Firing Voltage 72±8 Volts DC N220* - Firing Voltage 72±4 Volts DC N230* - Firing Voltage 80 Volts DC Maximum
 CG04 Long Flat	Cloudy Clear (CC) is the shade of white most suitable for neon lamps		

CR SERIES STYLE	LENS COLORS	FINISH	LAMP/RESISTOR NUMBER
Neon with resistor  CG01 Dome	Same as Above	Same as Above	STANDARD NEON LAMPS N114 - Standard brightness Medium Life (56K) N117 - High Brightness Standard Life (100K) N118 - Standard Brightness Long Life (150K) N121 - High Brightness Medium Life (22K) N123 - High Brightness Standard Life (33K)
 CG93 & CG03 Short Flat			
 CG04 Long Flat			

* The special circuit component lamps are longer than the indicator type lamps and require the long CG01 and CG04 lens shape. These lamps are available with a built-in resistor in the long CN Series cartridges.

FOR MORE INFORMATION PLEASE CONSULT FACTORY. SEE OUR PAGES IN SECTION 2700 & 2750

NEON LAMPS



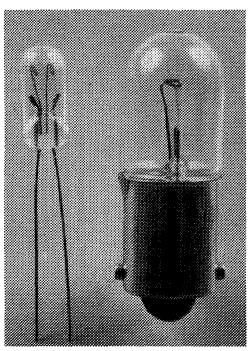
A neon lamp is a cold cathode electric discharge device which generates light close to the electrodes. The lamp is constructed of lead-glass tubing containing two nickel-iron electrodes and filled with a proprietary mixture of neon, argon, and krypton gases.

All of Glowlite's neon lamps can be made with radioactive gas blends to reduce "dark effect."

Glowlite product offerings include:

- Standard Brightness Lamps
- Semi-High Brightness Lamps
- High Brightness Lamps
- Colored Lamps
- Specialty Neon Lamps
- Circuit Component Lamps

INCANDESCENT LAMPS



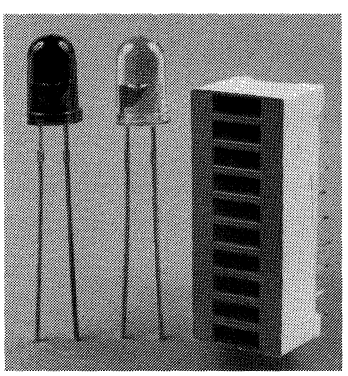
Glowlite can supply nearly 500 industry standard miniature Incandescent Lamp part numbers. Ther term "miniature lamp" is a generic term that has evolved over time to encompass all lamps of small size and low operating voltage.

Miniature lamps are generally constructed using a vacuum or gas-sealed hard glass bulb, molybdenum wire anchor, coiled tungsten wire filiament and copper coated Fe-Ni alloy lead wire. Glowlite currently stocks many of the most popular lamp types and can quickly supply special or custom lamps if necessary.

Glowlite product offerings include:

- Wire Terminal Lamps
- S.C. and D.C. Bayonet Lamps
- Midget Flange Lamps
- Disc Base Lamps
- Wedge Base Lamps
- Axial Lamps
- Line Voltage Lamps

OPTOELECTRONICS



Glowlite optoelectronic components are manufactured with particular care and emphasis placed on realizing established industry standards and improving customer satisfaction.

Total quality control, exhaustive research and development, and full automation allow Glowlite to supply the market place with a superior product at economical cost. Glowlite LED's can be sorted for brightness as well as color uniformity if required.

Glowlite product offerings include:

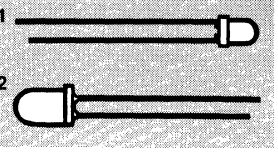
- 3.0 and 5.0mm LEDs (colored/diffused)
- Special Shape LEDs
- Super High Bright LEDs
- Tape and Reel LEDs
- LEDs with Internal Resistors
- Blinking LEDs
- Right Angle LEDs
- Seven Segment Displays

Glowlite

P.O. Box 688 • Hwy 77 South • Pauls Valley, Oklahoma 73075 • (405) 238-5541 • (800) 654-3662 FAX (405) 238-3029

Super Bright Green LEDs: T-1 and T-1 3/4

	LED No.	Size	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
GREEN	E166	T-1	Clear	200mcd	**300mcd**	30°	2.2V	2.5V	565nm	1
GREEN	E167	T-1 3/4	Clear	100mcd	**200mcd**	30°	2.2V	2.5V	565nm	2
GREEN	E168	T-1 3/4	Clear	200mcd	**300mcd**	30°	2.2V	2.5V	565nm	2



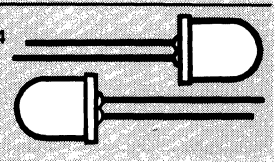
T-1 Ultra Bright LEDs

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E169	Clear	360mcd	**500mcd**	30°	1.85V	2.5V	660nm	3
RED	E170	Clear	500mcd	**700mcd**	30°	1.85V	2.5V	660nm	3
RED	E171	Clear	700mcd	**1000mcd**	30°	1.85V	2.5V	660nm	3



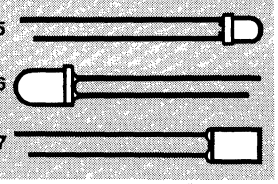
Jumbo LEDs: T-3 1/4, T-10mm (Very Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E176	Diffused	12.5mcd	**40.0mcd**	100°	2.0V	2.5V	625nm	4
YELLOW	E177	Diffused	8.0mcd	**40.0mcd**	100°	2.1V	2.5V	590nm	4
GREEN	E178	Diffused	8.0mcd	**40.0mcd**	100°	2.2V	2.5V	565nm	4



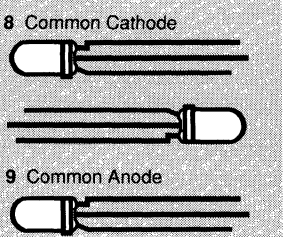
Blue LEDs: T-1, T-1 3/4 and Rectangular

	LED No.	Size	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
BLUE	E172	T-1	Clear	7.0mcd	**14.0mcd**	30°	3.0V	3.2V	470nm	5
BLUE	E173	T-1	Diffused	.4mcd	**1.0mcd**	60°	3.0V	3.2V	470nm	5
BLUE	E174	T-1 3/4	Diffused	.4mcd	**1.0mcd**	60°	3.0V	3.2V	470nm	6
BLUE	E175	Rect.	Diffused	.4mcd	**1.0mcd**	120°	3.0V	3.2V	470nm	7



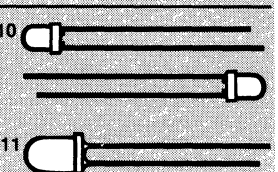
T-1 3/4 Bi-Color LEDs (Very Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED & GREEN	E203	Milky White	12.5mcd 12.5mcd	**40.0mcd** **40.0mcd**	100° 100°	2.0V 2.2V	2.5V 2.5V	625nm 565nm	8 8
RED & GREEN	E204	Milky White	12.5mcd 12.5mcd	**40.0mcd** **40.0mcd**	100° 100°	2.0V 2.2V	2.5V 2.5V	625nm 565nm	9 9
RED & YELLOW	E205	Milky White	8.0mcd 8.0mcd	**20.0mcd** **20.0mcd**	100° 100°	2.0V 2.1V	2.5V 2.5V	625nm 590nm	8 8
GREEN & YELLOW	E206	Milky White	8.0mcd 8.0mcd	**20.0mcd** **20.0mcd**	100° 100°	2.2V 2.1V	2.5V 2.5V	565nm 590nm	8 8



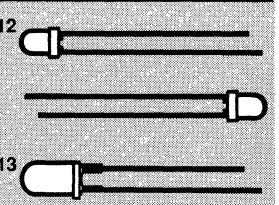
T-1 and T-1 3/4 Infrared LEDs: 940nm, 880nm

	IRLED No.	Size	Lens	Radient Intensity at 100mA Minimum	Radient Intensity at 100mA Typical	Viewing Angle	Forward Voltage at 100mA Typical	Forward Voltage at 100mA Maximum	Peak Wave Length at 100mA	Drawing
Infrared	E21	T-1	Clear	6mW	**10mW**	25°	1.3V	1.7V	940nm	10
Infrared	E22	T-1	Trans. Blue	21mW	**35mW**	26°	1.3V	1.7V	880nm	10
Infrared	E23	T-1 3/4	Clear	6mW	**10mW**	25°	1.3V	1.7V	940nm	11
Infrared	E24	T-1 3/4	Trans. Blue	21mW	**35mW**	26°	1.3V	1.7V	880nm	11



Phototransistors

Photo-transistor No.	Size	Light current I_L		Dark current I_D	Collector to Emitter Sustaining Voltage V_{CE}	Emitter to Collector Breakdown Voltage BV_{ECO}	Collector to Emitter Saturation Voltage V_{CE} (sat)	Drawing
		V_{CE}=5V H=20mW/cm²		H=0 V_{CE}=15	I_C=100µA H=0	I_C=100µA H=0	I_C=0.5mA H=20mW/cm²	
		Minimum	Typical	Maximum	Minimum	Minimum	Typical	
D40	T-1	1.0mA	20.0mA	100nA	30.0V	5.0V	0.4V	12
D41	T-1 3/4	1.0mA	20.0mA	100nA	30.0V	5.0V	0.4V	13



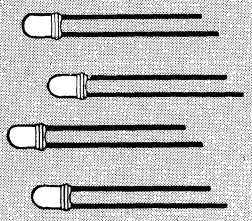
Please request Engineering Catalog 165
800 West Cummings Park, Woburn, Massachusetts 01801
Telephone us directly: 617 935-4442
Fax: 617 938-5867

Gilway Technical Lamp

T-1 Visible LEDs (Very Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E100	Clear	90mcd	**200mcd**	32°	2.1V	3.0V	650nm	1
ORANGE	E102	Clear	90mcd	**200mcd**	32°	2.1V	3.0V	610nm	1
YELLOW	E104	Clear	90mcd	**200mcd**	32°	2.2V	3.0V	585nm	1
GREEN	E106	Clear	90mcd	**200mcd**	32°	2.2V	3.0V	563nm	1
RED	E112	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	650nm	1
ORANGE	E113	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	610nm	1
YELLOW	E114	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	585nm	1
GREEN	E116	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	563nm	1

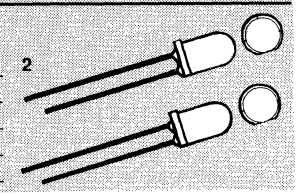
1



T-1¾ Diffused LEDs (Very Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E118	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	650nm	2
ORANGE	E119	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	610nm	2
YELLOW	E120	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	585nm	2
GREEN	E121	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	563nm	2

2

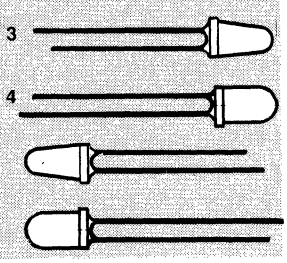


T-1¾ LEDs (Ultra Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E280	Clear	300mcd	**500mcd**	25°	1.8V	2.5V	660nm	3
RED	E282	Clear	700mcd	**1000mcd**	25°	1.8V	2.5V	660nm	3
RED	E284	Clear	2000mcd	**3000mcd**	25°	1.8V	2.5V	660nm	3
RED	E180	Clear	300mcd	**500mcd**	40°	1.8V	2.2V	660nm	4
RED	E181	Clear	500mcd	**1000mcd**	40°	1.8V	2.2V	660nm	4
RED	E183	Clear	1000mcd	**2000mcd**	40°	1.8V	2.2V	660nm	4
RED	E184	Clear	2000mcd	**3000mcd**	40°	1.8V	2.2V	660nm	4

3

4

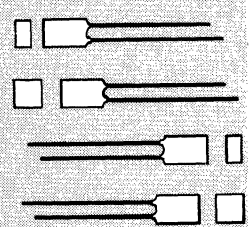


Rectangular and Square LEDs

	LED No.	Lens	Luminous Intensity at 10mA Min.	Luminous Intensity at 10mA Typical	Luminous Intensity at 10mA Max.	Forward Voltage at 10mA Typical	Forward Voltage at 10mA Maximum	Peak Wave Length at 10mA	Drawing
RED	E122	Diffused	.40mcd	**.80mcd**		2.0V	3.0V	650nm	5
ORANGE	E123	Diffused	.40mcd	**.80mcd**		2.0V	3.0V	610nm	5
YELLOW	E124	Diffused	.40mcd	**.80mcd**		2.1V	3.0V	585nm	5
GREEN	E125	Diffused	.40mcd	**1.0mcd**		2.1V	3.0V	562nm	5
RED	E126	Diffused	.40mcd	**1.0mcd**		2.0V	3.0V	650nm	6
ORANGE	E127	Diffused	.40mcd	**1.0mcd**		2.0V	3.0V	610nm	6
YELLOW	E128	Diffused	.40mcd	**1.0mcd**		2.1V	3.0V	585nm	6
GREEN	E129	Diffused	.40mcd	**1.0mcd**		2.1V	3.0V	562nm	6

5

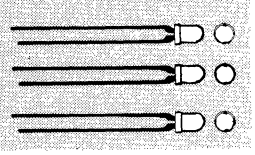
6



T-1 Low Current LEDs (2mA)

	LED No.	Lens	Luminous Intensity at 2mA Minimum	Luminous Intensity at 2mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E130	Diffused	1.0mcd	**2.0mcd**	40°	2.1V	2.8V	697nm	7
YELLOW	E131	Diffused	1.0mcd	**2.0mcd**	40°	2.0V	2.8V	570nm	7
GREEN	E132	Diffused	1.0mcd	**2.0mcd**	40°	2.1V	2.8V	565nm	7

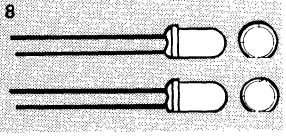
7



T-1¾ Low Current LEDs (2mA)

	LED No.	Lens	Luminous Intensity at 2mA Minimum	Luminous Intensity at 2mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E133	Diffused	1.0mcd	**2.0mcd**	38°	2.1V	2.8V	697nm	8
YELLOW	E134	Diffused	1.0mcd	**2.0mcd**	38°	2.0V	2.8V	570nm	8
GREEN	E135	Diffused	1.0mcd	**2.0mcd**	38°	2.1V	2.8V	565nm	8

8



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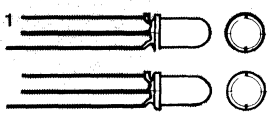
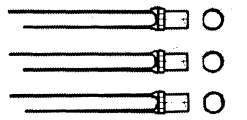
T-1¾ Bi-Color LED (Very Bright)

	LED No.	Lens	Luminous Intensity at 10mA Minimum	Luminous Intensity at 10mA Typical	Viewing Angle	Forward Voltage at 10mA Typical	Forward Voltage at 10mA Maximum	Peak Wave Length at 20mA	Drawing
RED &	E202	Milky White	3.6mcd	**10mcd**	50°	2.0V	3.0V	650nm	1
GREEN			3.6mcd	**10mcd**	50°	2.1V	3.0V	563nm	



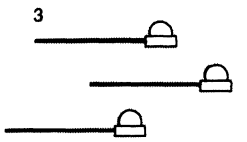
T-1 Wide Angle LEDs

	LED No.	Lens	Luminous Intensity at 10mA Minimum	Luminous Intensity at 10mA Typical	Viewing Angle	Forward Voltage at 10mA Typical	Forward Voltage at 10mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E136	Transparent	.6mcd	**1.6mcd**	140°	2.0V	3.0V	650nm	2
YELLOW	E137	Transparent	.9mcd	**2.5mcd**	140°	2.1V	3.0V	585nm	2
GREEN	E138	Transparent	1.4mcd	**4.0mcd**	140°	2.1V	3.0V	563nm	2



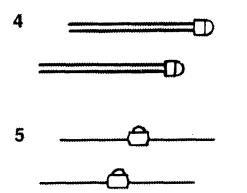
Right Angle LEDs

	LED No.	Lens	Luminous Intensity at 15mA Min.	Luminous Intensity at 15mA Typical	Luminous Intensity at 15mA Max.	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 15mA	Drawing
RED	E108	Transparent	—	**2.5mcd**	—	60°	2.1V	2.8V	700nm	3
ORANGE	E109	Transparent	—	**4.0mcd**	—	60°	2.1V	2.8V	610nm	3
YELLOW	E110	Transparent	—	**4.0mcd**	—	60°	2.1V	2.8V	585nm	3
GREEN	E111	Transparent	—	**4.0mcd**	—	60°	2.1V	2.8V	565nm	3



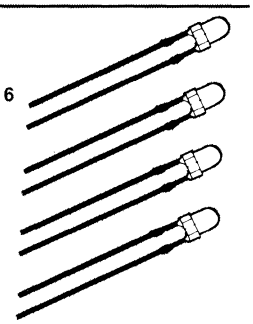
Micro Miniature LEDs (2.0mm Diameter)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E3	Transparent	1.5mcd	**3.0mcd**	45°	2.1V	2.7V	630nm	4
YELLOW	E4	Transparent	1.5mcd	**3.0mcd**	45°	2.1V	2.7V	585nm	4
GREEN	E5	Transparent	.6mcd	**1.2mcd**	45°	2.1V	2.7V	560nm	4
RED	E6	Transparent	1.4mcd	**4.0mcd**	40°	2.0V	2.8V	650nm	5
YELLOW	E7	Transparent	1.4mcd	**4.0mcd**	40°	2.1V	2.8V	585nm	5
GREEN	E8	Transparent	2.2mcd	**6.3mcd**	40°	2.1V	2.8V	560nm	5



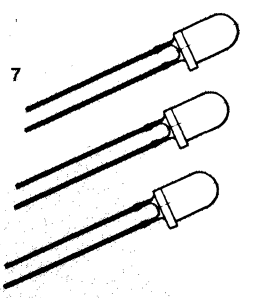
T-1 LEDs (Operate on 5VDC, 12VDC or 24VDC)

	LED No.	Lens	Foward Voltage Operating	Foward Voltage Max.	Foward Current (mA) Typical	Luminous Intensity at Oper. Voltage Min.	Luminous Intensity at Oper. Voltage Typical	Viewing Angle	Peak Wave Length	Dwg
RED	E139	Diffused	5.0VDC	6.0VDC	12	3.5mcd	6.0mcd	55°	630nm	6
RED	E142	Diffused	12.0VDC	13.2VDC	9	2.5mcd	4.0mcd	55°	630nm	6
RED	E145	Diffused	24.0VDC	26.4VDC	4	1.0mcd	1.5mcd	55°	630nm	6
YELLOW	E140	Diffused	5.0VDC	6.0VDC	12	4.5mcd	7.5mcd	55°	585nm	6
YELLOW	E143	Diffused	12.0VDC	13.2VDC	9	3.5mcd	5.5mcd	55°	585nm	6
YELLOW	E146	Diffused	24.0VDC	26.4VDC	4	1.2mcd	2.0mcd	55°	585nm	6
GREEN	E141	Diffused	5.0VDC	6.0VDC	12	6.0mcd	9.5mcd	55°	568nm	6
GREEN	E144	Diffused	12.0VDC	13.2VDC	9	4.0mcd	6.5mcd	55°	568nm	6
GREEN	E147	Diffused	24.0VDC	26.4VDC	4	1.5mcd	2.5mcd	55°	568nm	6



T-1¾ LEDs (Operate on 5VDC, 12VDC or 24VDC)

	LED No.	Lens	Foward Voltage Operating	Foward Voltage Max.	Foward Current (mA) Typical	Luminous Intensity at Oper. Voltage Min.	Luminous Intensity at Oper. Voltage Typical	Viewing Angle	Peak Wave Length	Dwg
RED	E148	Diffused	5.0VDC	6.0VDC	12	5.0mcd	8.5mcd	55°	630nm	7
RED	E151	Diffused	12.0VDC	13.2VDC	9	3.5mcd	5.5mcd	55°	630nm	7
RED	E154	Diffused	24.0VDC	26.4VDC	4	1.4mcd	2.0mcd	55°	630nm	7
YELLOW	E149	Diffused	5.0VDC	6.0VDC	12	5.0mcd	8.5mcd	55°	585nm	7
YELLOW	E152	Diffused	12.0VDC	13.2VDC	9	3.5mcd	5.5mcd	55°	585nm	7
YELLOW	E155	Diffused	24.0VDC	26.4VDC	4	1.4mcd	2.0mcd	55°	585nm	7
GREEN	E150	Diffused	5.0VDC	6.0VDC	12	6.0mcd	10.0mcd	55°	568nm	7
GREEN	E153	Diffused	12.0VDC	13.2VDC	9	4.5mcd	7.0mcd	55°	568nm	7
GREEN	E156	Diffused	24.0VDC	26.4VDC	4	1.6mcd	2.5mcd	55°	568nm	7



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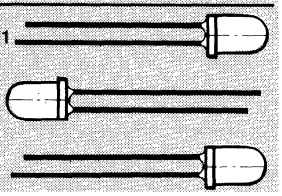
T-1¾ Flashing LEDs

	LED No.	Lens	Foward DC Voltage Min.	Foward DC Voltage Max.	Foward Current (mA) Min.	Foward Current (mA) Typ.	Foward Current (mA) Max.	Luminous Intensity at 9.0 VDC Typical	Viewing Angle	Freq. (Hz)	Peak Wave Length	Dwg
RED	E157	Diffused	3.5	13.0	38	56	70	70.0mcd	120°	2.5	660nm	1
RED	E159	Diffused	3.5	13.0	38	56	70	12.5mcd	120°	2.5	625nm	1
YELLOW	E160	Diffused	3.5	13.0	38	56	70	12.5mcd	120°	2.5	595nm	1
GREEN	E161	Diffused	3.5	13.0	38	56	70	8.0mcd	120°	2.5	565nm	1

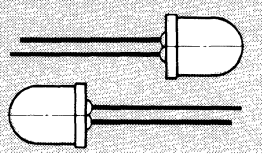
1



Large T-3¼ Flashing LEDs

	LED No.	Lens	Foward DC Voltage Min.	Foward DC Voltage Max.	Foward Current (mA) Min.	Foward Current (mA) Typ.	Foward Current (mA) Max.	Luminous Intensity at 9.0 VDC Typical	Viewing Angle	Freq. (Hz)	Peak Wave Length	Dwg
RED	E162	Diffused	3.5	13.0	38	56	70	120.0mcd	140°	2.5	660nm	2
YELLOW	E163	Diffused	3.5	13.0	38	56	70	12.5mcd	140°	2.5	595nm	2
GREEN	E164	Diffused	3.5	13.0	38	56	70	8.0mcd	140°	2.5	565nm	2

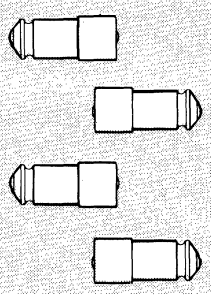
2



T-1¾ Miniature Grooved 6 Chip LED Lamps

	LED No.	Foward Voltage Operating	Foward Voltage Maximum	Foward Current (mA) Typical	Luminous Intensity at Foward Voltage Min.	Luminous Intensity at Foward Voltage Typical	Peak Wave Length	Dwg
RED	E372	6.0VDC	6.3VDC	50	42mcd	60mcd	630nm	3
RED	E375	12.0VDC	12.6VDC	36	42mcd	60mcd	630nm	3
RED	E378	28.0VDC	29.4VDC	17	42mcd	60mcd	630nm	3
YELLOW	E373	6.0VDC	6.3VDC	50	60mcd	85mcd	585nm	3
YELLOW	E376	12.0VDC	12.6VDC	36	60mcd	85mcd	585nm	3
YELLOW	E379	28.0VDC	29.4VDC	17	60mcd	85mcd	585nm	3
GREEN	E374	6.0VDC	6.3VDC	50	105mcd	150mcd	568nm	3
GREEN	E377	12.0VDC	12.6VDC	36	105mcd	150mcd	568nm	3
GREEN	E380	28.0VDC	29.4VDC	17	105mcd	150mcd	568nm	3

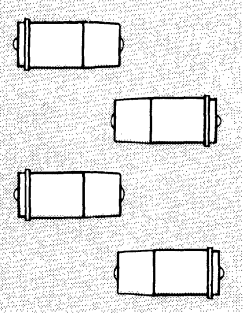
3



T-1¾ Miniature Flanged 6 Chip LED Lamps

	LED No.	Foward Voltage Operating	Foward Voltage Maximum	Foward Current (mA) Typical	Luminous Intensity at Foward Voltage Min.	Luminous Intensity at Foward Voltage Typical	Peak Wave Length	Dwg
RED	E381	6.0VDC	6.3VDC	50	42mcd	60mcd	630nm	4
RED	E384	12.0VDC	12.6VDC	36	42mcd	60mcd	630nm	4
RED	E387	28.0VDC	29.4VDC	17	42mcd	60mcd	630nm	4
YELLOW	E382	6.0VDC	6.3VDC	50	60mcd	85mcd	585nm	4
YELLOW	E385	12.0VDC	12.6VDC	36	60mcd	85mcd	585nm	4
YELLOW	E388	28.0VDC	29.4VDC	17	60mcd	85mcd	585nm	4
GREEN	E383	6.0VDC	6.3VDC	50	105mcd	150mcd	568nm	4
GREEN	E386	12.0VDC	12.6VDC	36	105mcd	150mcd	568nm	4
GREEN	E389	28.0VDC	29.4VDC	17	105mcd	150mcd	568nm	4

4



Spacers for T-1, T-1¾, Right Angle, Square & Rectangular LEDs

Spacer No. (1)	Spacer No. (2)	Length	Material	Drawing
SP3T	SP3L	3 mm (.118)	Black PVC	5
SP4T	SP4L	4 mm (.157)	Black PVC	5
SP5T	SP5L	5 mm (.197)	Black PVC	5
SP6T	SP6L	6 mm (.236)	Black PVC	5
SP7T	SP7L	7 mm (.276)	Black PVC	5
SP9T	SP9L	9 mm (.354)	Black PVC	5
SP12T	SP12L	12 mm (.472)	Black PVC	5
SP15T	SP15L	15 mm (.590)	Black PVC	5

(1) Spacer numbers ending in "T" provide a tight fit on the LED leads.
(2) Spacer numbers ending in "L" provide a loose fit on the LED leads.

5



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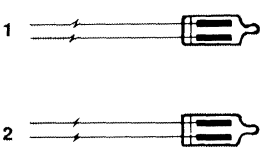
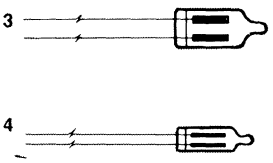
Neon Glow Lamps (Standard Brightness)

Lamp No.	Color Off	Color On	Circuit Voltage	Starting V Maximum AC	Starting V Maximum DC	Current mA	Series Resistor 115V	Series Resistor 220V	Average Life (hours)	mcd	Drawing
N514	Clear	Orange	90-115/220	65	90	.3	150KΩ	360KΩ	15,000	2.2	1
N515	Clear	Orange	90-115/220	65	90	.3	150KΩ	360KΩ	20,000	2.2	2
N516	Clear	Orange	90-115/220	65	90	.3	150KΩ	360KΩ	25,000	2.2	3



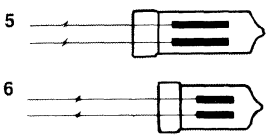
Neon Glow Lamps (High Brightness)

Lamp No.	Color Off	Color On	Circuit Voltage	Starting V Maximum AC	Starting V Maximum DC	Current mA	Series Resistor 115V	Series Resistor 220V	Average Life (hours)	mcd	Drawing
N517	Clear	Red	90-115/220	95	135	1.0	47KΩ	120KΩ	15,000	3.8	4
N518	Clear	Red	90-115/220	95	135	1.0	47KΩ	120KΩ	15,000	3.8	1
N519	Clear	Red	90-115/220	95	135	1.2	33KΩ	100KΩ	20,000	3.8	2
N520	Clear	Red	90-115/220	95	135	1.2	33KΩ	100KΩ	25,000	3.8	3



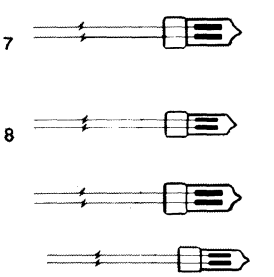
Neon Glow Lamps (Maximum Brightness)

Lamp No.	Color Off	Color On	Circuit Voltage	Starting Max. VAC	Current mA	Series Resistor 115V	Series Resistor 220V	Average Life (hours)	mcd	Drawing
N512	Clear	Red	90-115/220	85	5.0	8.2KΩ	33KΩ	10,000	40.0	5
N501	Clear	Red	90-115/220	85	1.1	33KΩ	150KΩ	20,000	8.0	6
N502	Clear	Red	85-115/220	65	.9	47KΩ	180KΩ	20,000	4.0	7
N503	Clear	Red	85-115/220	75	1.4	33KΩ	120KΩ	20,000	4.0	8



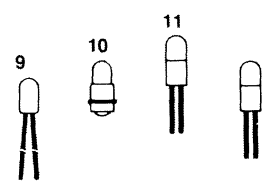
Fluorescent Glow Lamps (Green, Yellow, Blue)

Lamp No.	Color Off	Color On	Circuit Voltage	Starting Max. VAC	Current mA	Series Resistor 115V	Series Resistor 220V	Average Life (hours)	mcd	Drawing
N504	White	Green	90-115/220	80	.8	51KΩ	200KΩ	20,000	4.0	6
N505	White	Green	90-115/220	80	1.4	33KΩ	120KΩ	20,000	6.0	6
N506	White	Green	90-115/220	80	.6	75KΩ	220KΩ	20,000	1.1	7
N507	White	Green	90-115/220	80	.6	75KΩ	270KΩ	20,000	.8	8
N508	White	Yellow	90-115/220	80	.8	51KΩ	200KΩ	20,000	4.0	6
N509	White	Yellow	90-115/220	80	1.4	33KΩ	120KΩ	20,000	6.0	6
N510	White	Blue	90-115/220	80	.8	51KΩ	200KΩ	20,000	1.5	6
N511	White	Blue	90-115/220	80	1.4	33KΩ	120KΩ	20,000	3.2	6



T-3/4 Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 9	Flanged 10	Bi-Pin 11
5.0	.060	.05	100,000	6833	8913	7114
5.0	.060	.15	3,000	6153	6183	7115
5.0	.075	.09	25,000	7133	8828	7116
5.0	.115	.15	40,000	7153	8270	7118
5.0	.115	.20	5,000	7102	7123	7119
12.0	.060	.15	16,000	L51	L52	L53
14.0	.050	.13	16,000	L54	L55	L56
28.0	.024	.15	16,000	L57	L58	L59



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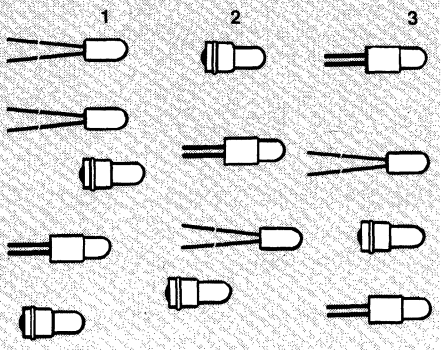
Gilway Technical Lamp

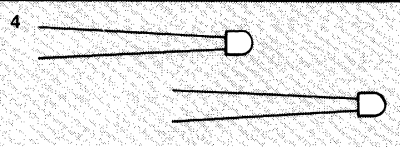
T-1 Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 1	Flanged 2	Bi-Pin 3
5.0	.021	.034	10,000	6022	8022	7022
5.0	.060	.15	5,000	6150	6180	7265
5.0	.075	.09	25,000	713	714	7714
5.0	.115	.15	40,000	715	718	7715
5.0	.115	.20	5,000	7213	7236	7267
5.0	.125	.22	5,000	7216	7239	7268
5.0	.145	.16	10,000	8096	7251	7269
10.0	.027	.10	10,000	7218	7240	8095
12.0	.060	.15	16,000	7219	32	8097
14.0	.065	.15	16,000	8111	8112	8098
18.0	.026	.15	16,000	7220	7241	8099
28.0	.024	.15	16,000	6838	6839	7839



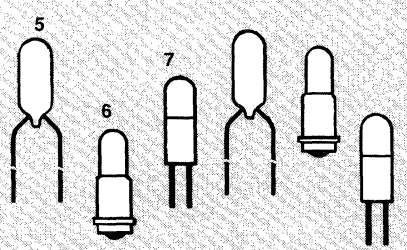
T-1 Subminiature Short Type Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 4
5.0	.06	.05	100,000	6832AS15
5.0	.075	.09	40,000	7132AS15
5.0	.115	.15	40,000	7152AS15
28.0	.024	.15	16,000	7009



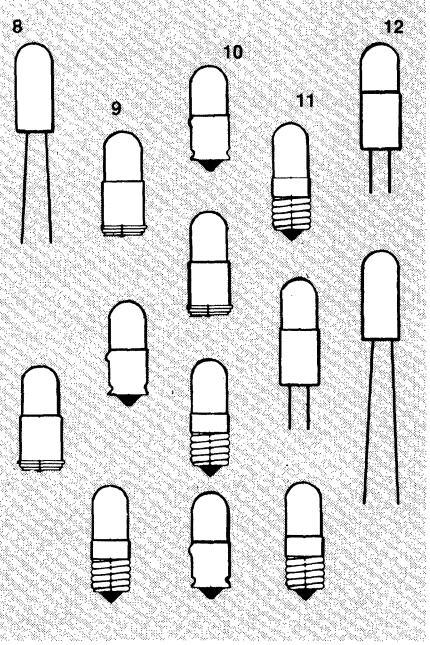
T-1¼ Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 5	Flanged 6	Bi-Pin 7
2.5	.40	.55	30	8655	8656	7307
3.0	.19	.25	350	324	8637	7637
5.0	.06	.03	100,000	580	3582	7580
5.0	.06	.05	100,000	583	3585	7583
5.0	.115	.15	40,000	515	3518	7515
6.0	.06	.13	3,000	2114	8541	7309
6.0	.20	.63	1,000	634	8628	7628
6.3	.20	.55	5,000	8610	8551	7310
14.0	.08	.50	1,000	8640	8646	7646
28.0	.04	.32	1,000	8627	8632	7632



T-1¾ Subminiature Lamps

Volts	Amps	M.S.C.P	Hours	Wire 8	Flanged 9	Grooved 10	Screw 11	Bi-Pin 12
3.0	.03	.02	1,800	2156	7329	7343	7314	7358
5.0	.06	.15	5,000	3151	3150	3152	3153	3149
5.0	.115	.15	40,000	2203	7335	7348	7319	7362
5.0	.19	.45	1,000	8784	7334	7350	7317	7363
6.0	.04	.03	10,000	1730	345	8705	342	7945
6.0	.20	.60	1,000	1784	328	337	1768	7328
6.0	.22	.63	3,000	1784L	7337	337L	1768L	7365
6.3	.04	.02	50,000	2180	380	7351	7320	7380
6.3	.20	.40	50,000	2181	381	379	378	7381
6.3	.20	.55	3,000	2112	349	398	7323	7349
10.0	.014	.002	10,000	1869	344	709	8691	7344
10.0	.04	.08	5,000	2107	367	397	389	7367
11.0	.022	.03	10,000	8946	7338	7353	7325	7369
12.0	.04	.12	10,000	2174	394	7354	7326	7394
14.0	.08	.30	50,000	2182	382	386	8362	7382
14.0	.08	.50	750	1705	330	336	373	7330
14.0	.100	.50	10,000	2162	8918	393	8162	7373
18.0	.04	.15	10,000	2102	370	346	8536	7370
22.0	.04	.30	2,000	8425	459	457	8437	7459
28.0	.04	.20	50,000	2185	385	7355	8384	7374
28.0	.04	.30	25,000	2187	387	388	399	7387
28.0	.04	.34	7,000	1764	327	334	335	7327
28.0	.065	.65	5,000	8361	7341	7356	8369	7376



Gilway Technical Lamp

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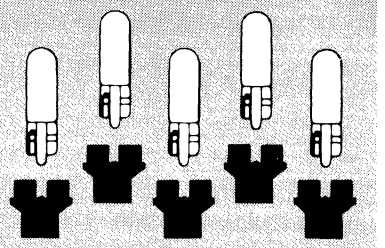
T-5mm Wedge Base Lamps

Lamp No.	Volts	Amps	M.S.C.P.	Hours	FilamentType	Base Type	Drawing
86	6.3	.200	40	50,000	C-2F	Wedge	1
73	14.0	.080	30	25,000	C-2F	Wedge	1
74	14.0	.100	70	500	C-2F	Wedge	1
85	28.0	.040	30	7,000	C-2F	Wedge	1
17	28.0	.065	65	5,000	C-2F	Wedge	1

T-5mm Wedge Base Holders

Holder No.	Lamp Type	Lamp Base Type	Drawing
H710	T-5mm	Wedge Base	2

1



2



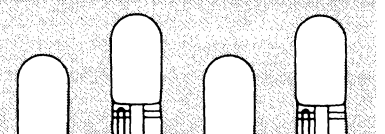
T-10mm Wedge Base Lamps

Lamp No.	Volts	Amps	M.S.C.P.	Hours	Filament Type	Base Type	Drawing
159	6.3	.150	38	5,000	C-2V	Wedge	3
259	6.3	.250	50	5,000	C-2V	Wedge	3
555	6.3	.250	90	3,000	C-2R	Wedge	3
161	14.0	.090	1.00	1,500	C-2F	Wedge	3
194	14.0	.270	2.00	1,500	C-2F	Wedge	3

T-10mm Wedge Base Holders

Holder No.	Lamp Type	Lamp BaseType	Drawing
H711	T-10mm	Wedge Base	4

3



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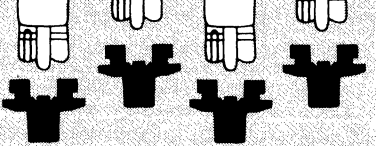
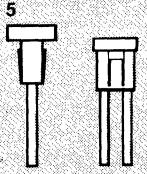


Holders for Miniature Bi-Pin Lamps

Holder No.	Lamp Type	Lamp BaseType	Specifications	Drawing
H712	T-1 T-1¼	Bi-Pin	2.54mm on center bi-pin	5
H713	T-1 T-1¾	Bi-Pin	3.17mm on center bi-pin	5
H714	T-1 T-1¼	Bi-Pin	2.54mm on center bi-pin	6
H715	T-1 T-1¾	Bi-Pin	3.17mm on center bi-pin	6
H716	T-¾ T-1	Bi-Pin	1.27mm on center bi-pin	6
H717	---	Bi-Pin	Printed Circuit Plan	7
H719	T-1¼ T-1¾	Bi-Pin	3.1mm or 2.54mm on center bi-pin	8

5



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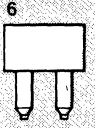

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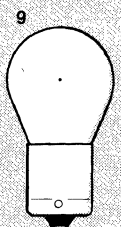
8



S-8 Miniature Lamps

Lamp No.	Volts	Amps	M.S.C.P.	Hours	Vacuum or Gas	Base Type	Drawing
6	6.4	3.0	23	500	G	D.C. Bayonet	10
6IF	6.4	3.0	23	500	G	D.C. Bayonet	10
8	8.0	2.2	20	500	G	D.C. Bayonet	10
88	6.8	1.91	15	300	G	D.C. Bayonet	10
94	12.8	1.04	15	700	G	D.C. Bayonet	10
1073	12.8	1.80	32	200	G	S.C. Bayonet	9
1142	12.8	1.44	21	1,000	G	D.C. Bayonet	10
305	28.0	.51	15	300	G	S.C. Bayonet	9
307	28.0	.67	21	300	G	S.C. Bayonet	9

9



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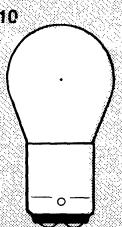

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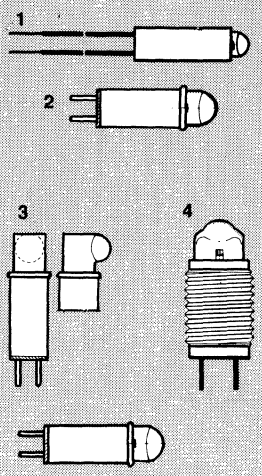
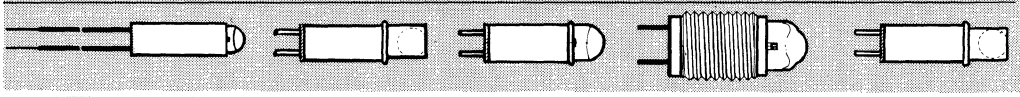
Gilway Technical Lamp

Focused Lens-End Lamps

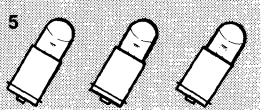
Lamp No.	Volts	Amps	Lux	Color Temp. (° Kelvin)	Hours	Vacuum or Gas	Filament Type	Base Type	Drawing
L1005	2.5	.350	1,200	2,170	30,000	V	C-6	Brass	1
L1005A	2.5	.350	1,550	2,170	30,000	V	C-6	Brass	1
L1026A	2.5	.350	2,000	2,250	10,000	V	C-2R	Brass	1
L1023	2.5	.350	2,100	2,240	15,000	V	C-6	Brass	1
L4038	2.5	.350	2,100	2,250	10,000	V	C-6	Cartridge	2
L4040	3.5	.370	4,000	2,550	1,000	V	C-2R	Cartridge	3
L1006	3.5	.450	1,600	2,230	30,000	G	C-6	Brass	1
L1024	3.5	.560	3,800	2,490	5,000	G	C-6	Brass	1
L1024A	3.5	.560	3,800	2,490	5,000	G	C-6	Brass	1
L1021	3.5	.600	12,000	2,930	100	Krypton	C-6	Brass	1
L1007	5.0	.160	800	2,300	15,000	V	C-2R	Brass	1
L1025	5.0	.240	1,200	2,450	10,000	V	C-2R	Brass	1
L8006	5.0	.775	7,000	2,370	30,000	G	C-6	½-20UNF-2A	4
L8008	5.0	.725	12,000	2,400	10,000	G	C-6	½-20UNF-2A	4





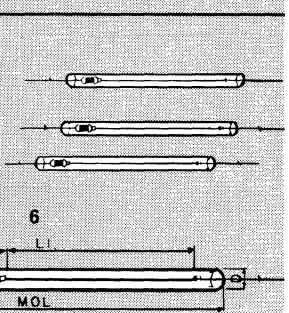
Midget Flanged Base Lens-End Lamps

Lamp No.	Volts	Amps	Lux	Color Temp. (° Kelvin)	Hours	Vacuum or Gas	Filament Type	Drawing
169-14	2.5	.340	1,000	2,170	30,000	V	C-6	5
180-14	2.5	.350	2,100	2,240	15,000	V	C-6	5
172-14	3.5	.450	1,600	2,230	30,000	G	C-6	5
173-14	3.5	.600	12,000	2,930	100	G	C-6	5
174-14	5.0	.170	880	2,300	15,000	V	C-2R	5



Line Filament Lamps

Lamp No.	Volts	Amps	Watts	Hours	Vacuum or Gas	Filament Type	Filament Length, L1	L2	Dimensions MOL	D Max	Drawing
L9050	3.0	.360	1.10	2,000	V	S-8	16±1	9±.5	36	3.5	6
L9001	4.5	.360	1.65	2,000	V	S-8	23±1	9±.5	43	3.5	6
L9013	6.0	.370	2.22	1,500	V	S-8	30±1	9±.5	50	3.5	6
L9003	12.0	.320	3.60	2,000	V	S-8	75±1	9±.5	92	3.5	6
L9014	12.0	.370	4.45	1,500	V	S-8	60±1	9±.5	77	3.5	6
L9028	12.0	.760	9.00	2,500	V	S-8	100±1	9±.5	121	3.5	6



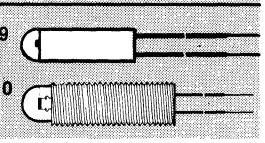
Lens-End Halogen Lamps

Lamp No.	Volts	Amps	Lux	Color Temp. (° Kelvin)	Hours	Filament Type	Base Type	Drawing
L1030	3.5	1.200	18,000	2,950	150	C-6	¼" Sleeve	7
L1041	5.0	1.430	30,000	2,800	3,000	C-6	¼" Sleeve	7
L1051	6.0	1.920	75,000	2,920	500	C-6	⅜" 24 UNF-2A	8



Clear-End Halogen Lamps

Lamp No.	Volts	Amps	Lumens	Color Temp. (° Kelvin)	Hours	Filament Type	Base Type	Drawing
L1031	3.5	1.200	40	2,950	150	C-6	¼" Sleeve	9
L1040	5.0	1.430	70	2,800	3,000	C-6	¼" Sleeve	9
L1050	6.0	1.920	170	2,920	500	C-6	⅜" 24 UNF-2A	10



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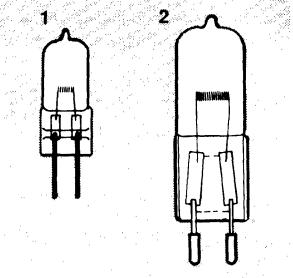
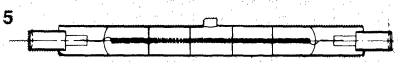
Quartz Halogen Lamps

Lamp No.	Volts	Watts	Lumens	Color Temp. (°Kelvin)	Hours	Filament Type	Dimensions D	Dimensions MOL	Dimensions LCL	Base Type	Drawing
L7387	6.0	10	200	3,200	100	C-6	8.5	30.0	19.5 ± .25	G-4	1
L6402	6.0	10	150	2,900	2,000	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7388	6.0	20	420	3,200	100	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7394	6.0	20	350	3,000	2,000	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7401	12.0	20	420	3,150	250	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7404	12.0	20	350	3,000	2,000	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7389	12.0	50	900	3,000	2,500	C-6	12.0	44.0	30.0 ± .25	GY6.35	2
L7390	12.0	100	2,400	3,000	2,000	C-Bar	11.0	44.0	30.0 ± .25	GY6.35	2
L7407	12.0	100	3,000	3,400	50	C-Bar	11.0	44.0	30.0 ± .25	G6.35	2
L6405	24.0	150	4,700	3,400	50	C-Bar	13.5	50.0	32.0 ± .50	G6.35	2
L7391	24.0	250	5,750	3,000	2,000	C-Bar	15.0	58.0	37.0	GY6.35	2
L9404	12.0	20	350	3,000	2,000	C-6	10.0	55.0	30.3 ± .25	*Snaplock*	3
L9389	12.0	50	900	3,000	2,500	C-6	12.0	60.0	33.3 ± .25	*Snaplock*	3
L9390	12.0	100	2,400	3,000	2,000	C-Bar	11.0	60.0	33.3 ± .25	*Snaplock*	3
L7409	12.0	20	300	3,000	2,000	C-8I	12.0	42.0	28.5 ± .25	GY6.35	4
L7410	12.0	35	600	3,000	3,000	C-8I	12.0	42.0	28.5 ± .25	GY6.35	4
L7411	12.0	50	900	3,000	3,000	C-8I	12.0	42.0	28.5 ± .25	GY6.35	4
L9110	120.0	150	2,400	2,900	1,500	C-8	12.0	78.0	—	R7s	5
L9111	120.0	150	3,600	2,900	2,000	C-8	9.4	114.2	—	R7s	5
L9112	120.0	250	4,000	2,900	2,000	C-8	9.4	114.2	—	R7s	5

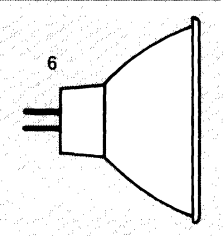






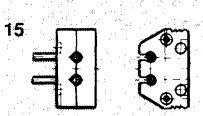
Dichroic Reflector Halogen Lamps

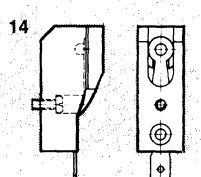
Lamp No.	Volts	Watts	Color Temp. (°Kelvin)	Hours	Dimensions MD	Dimensions MOL	Base	Drawing
L510	12.0	28	3,050	1,000	36.0	35.0	GZ4	6
L512	13.8	25	3,125	500	36.0	35.0	GZ4	6
L513	12.0	20	2,900	2,000	36.0	35.0	GZ4	6
L514	12.0	35	2,900	2,000	36.0	35.0	GZ4	6
L6408	12.0	75	3,000	1,500	50.0	42.0	GZ6.35	6
L7405	12.0	100	3,400	50	50.0	42.0	GZ6.35	6
L7406	21.0	150	3,350	40	50.5	45.0	GX5.3	6

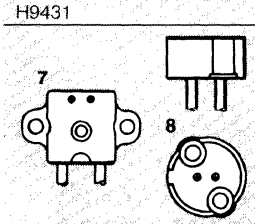


Halogen Lamp Holders

Holder No.	Halogen Lamp Base Types	Drawing
H9901	G-4, GZ4, MR-11	7
H9941	G-4, GZ4, MR-11	8
H997	G-4	9
H912	GY6.35, G6.35, MR-16	8
H701	GY6.35, G6.35, MR-16	10
H910	G6.35	11
H881	G6.35, GZ6.35	15
H9971	GY9.5, *Snaplock*	12
H705	GZ6.35, MR-16	13
H706	GX5.3, MR-16	13
H867	GY5.3, MR-16	13
H989	GX5.3, MR-16	8
H9431	R7s	14







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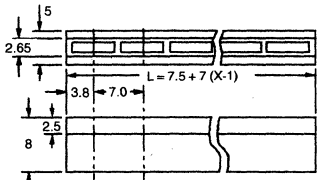
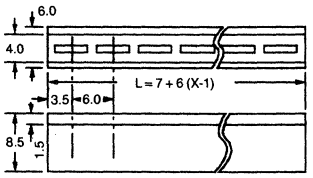
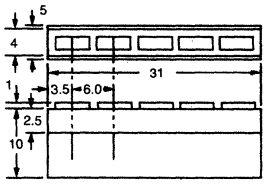


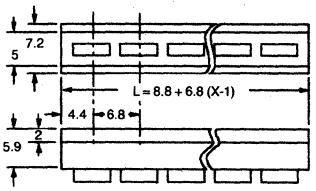
G20B (1.3 x 6.1 mm Lamp)



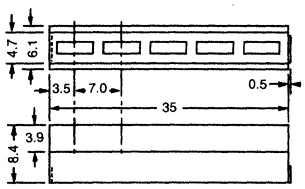
G22B (1 x 4.8 mm Lamp)



G24B (2 x 5 mm Lamp)



G26B (1.8 x 5.3 mm Lamp)



G28B (1.8 x 5.3 mm Lamp)

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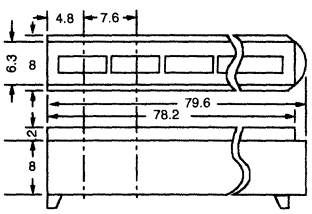
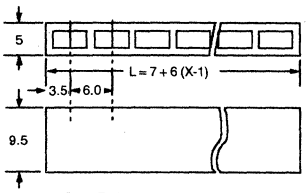
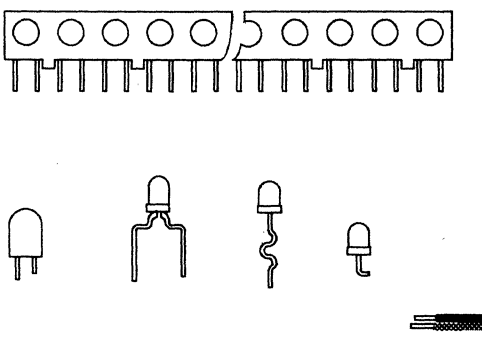
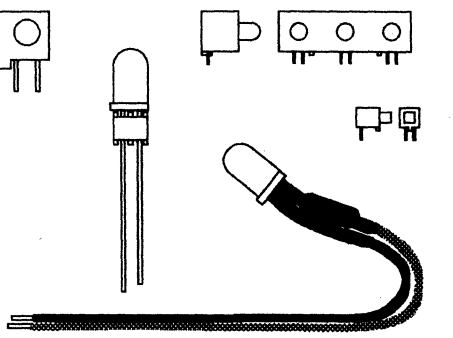


G30B (2.4 x 7.1 mm Lamp)



G32B (2.5 x 5 mm Lamp)





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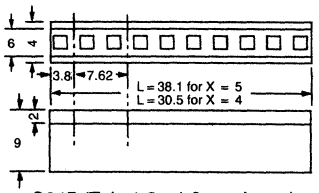
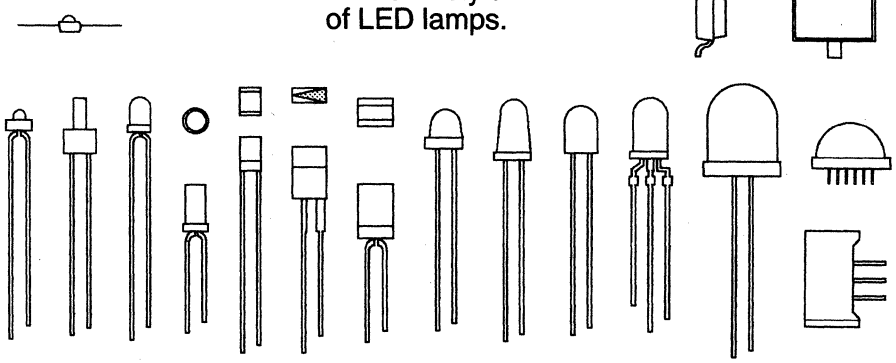
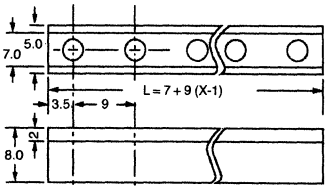
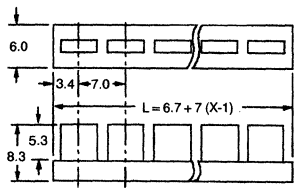


G34B (Twin 1.9 x 1.9 mm Lamp)

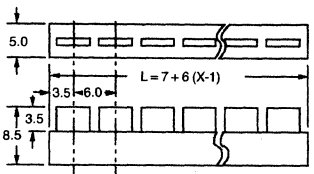




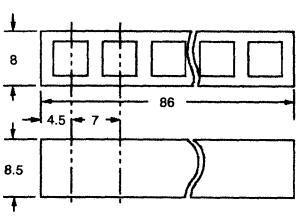
G36B (3 mm ϕ Lamp)



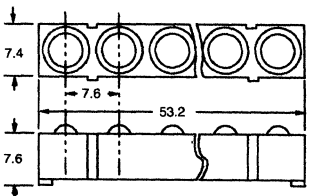
G38B (1.8 x 5.3 mm Lamp)



G42B (1 x 4.8 mm Lamp)



G52W (5 x 5 mm Lamp)



G57W (5 mm ϕ Lamp)

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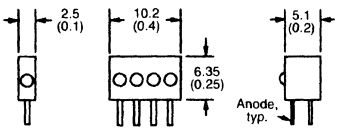

G170B & G174B

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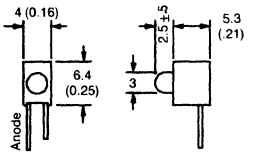
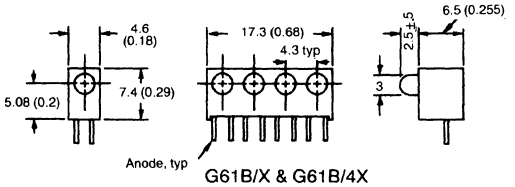
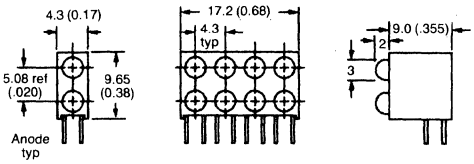


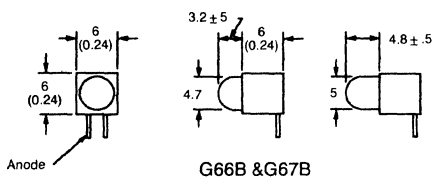
G60B



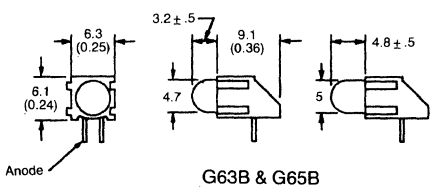
G61B/X & G61B/4X



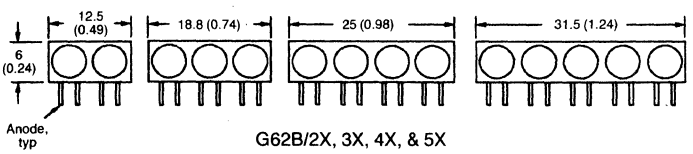
G78B & G784B



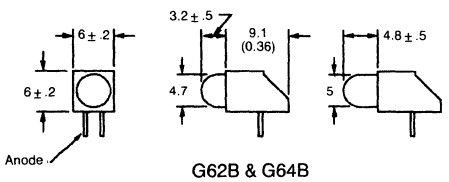
G66B &G67B



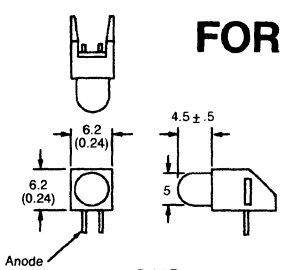
G63B & G65B



G62B/2X, 3X, 4X, & 5X



G62B & G64B



G69B

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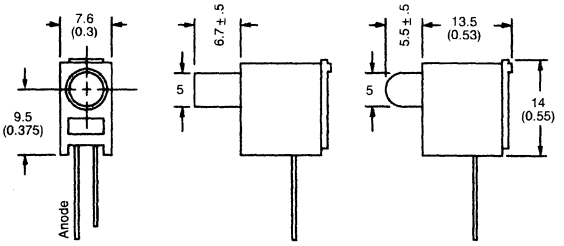
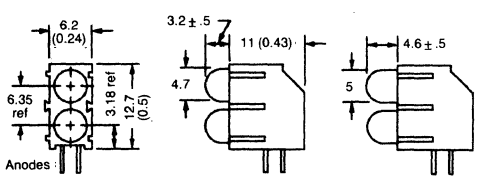
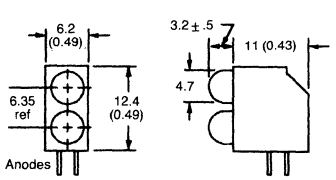


G48B G68B

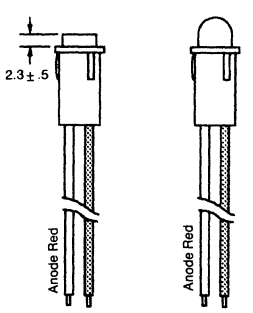


G73B &G75B

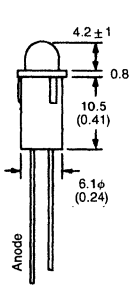


G72B

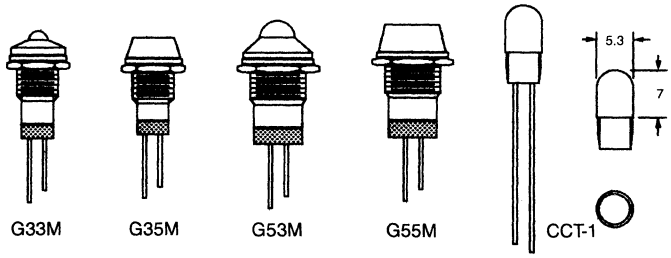




G70B/0552-X G70B/-X



G71B



G33M G35M G53M G55M CCT-1

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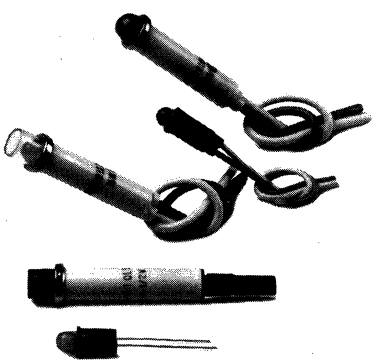

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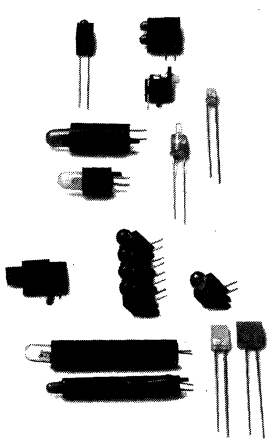

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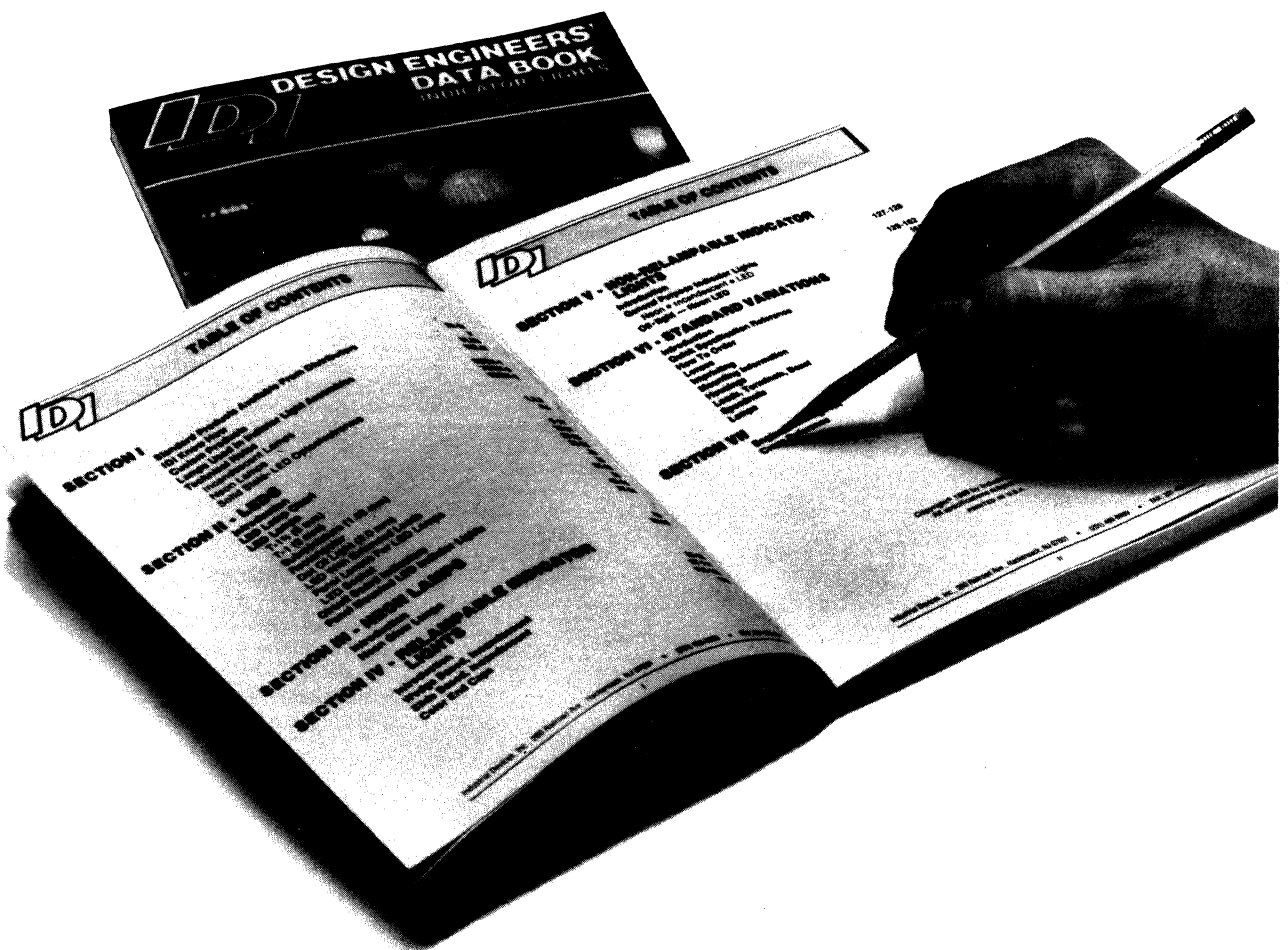

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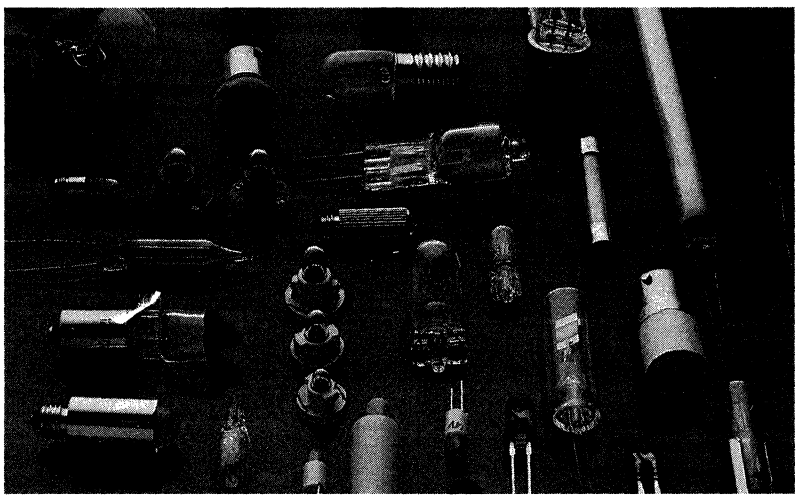

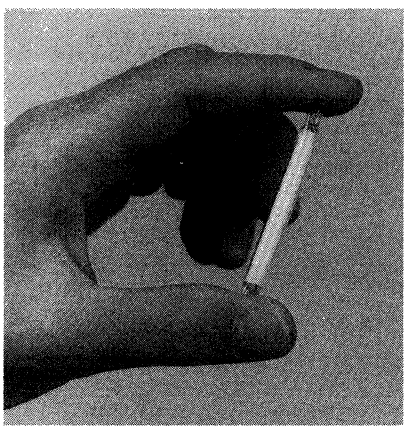

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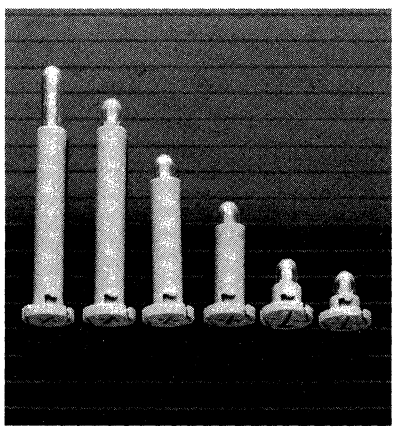
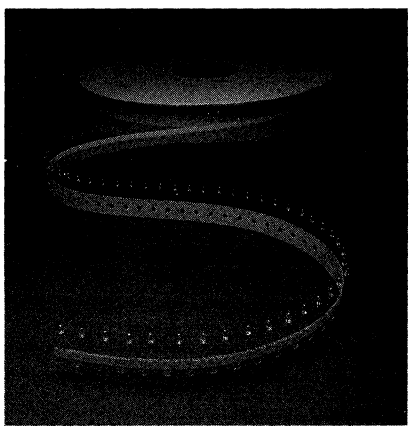


JKL NEO-WEDGE™ PCB LAMP SYSTEM

This patented design allows direct mounting of lamp assemblies to a PC board with a quarter turn twist, reducing labor costs and eliminating all secondary assembly operations. It is also available in a double-contact version for single sided boards that assures electrical contact whether lamp is pointing top or bottom, as well as a new gas filled line *guaranteed* for 2500 hours lamp life.



HIGH PRODUCTION TAPE & REEL LAMPS

This revolutionary concept permits utilization of leaded lamps with automatic insertion equipment, providing a practical and cost-effective solution to the problems of manual lamp insertion in what is otherwise an automatic operation. Available in high volume quantities on special order, to exacting customer specifications. Compatible with most auto-insertion systems. Consult factory.

STANDARD JKL LIGHTING PRODUCTS

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- Miniature LED Devices
- Neon Glow Lamps
- Sub-Miniature Indicator Lamps
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KINGBRIGHT LED SINCE 1980

Super Bright LED Lamps

Part No.	Light/Material	Wavelength nm	Lens	Intensity 20mA (mcd) Min. Typ.	Viewing Angle
3mm (T—1)					
L934SRD/B	red, GaAlAs	660	red-diffused	70– 90	100
L934SRD/C	red, GaAlAs	660	red-diffused	90– 100	100
L934SRD/D	red, GaAlAs	660	red-diffused	100– 200	100
L934SRD/E	red, GaAlAs	660	red-diffused	200– 300	100
L934SRC/B	red, GaAlAs	660	water-clear	250– 360	30
L934SRC/C	red, GaAlAs	660	water-clear	360– 500	30
L934SRC/D	red, GaAlAs	660	water-clear	500– 700	30
L934SRC/E	red, GaAlAs	660	water-clear	700–1000	30
5mm (T—1¾)					
L53SRD/B	red, GaAlAs	660	red-diffused	90– 100	120
L53SRD/C	red, GaAlAs	660	red-diffused	110– 200	120
L53SRD/D	red, GaAlAs	660	red-diffused	200– 300	120
L53SRD/E	red, GaAlAs	660	red-diffused	300– 500	120
L53SRC/B	red, GaAlAs	660	water-clear	400– 500	30
L53SRC/C	red, GaAlAs	660	water-clear	510–1000	30
L52SRC/D	red, GaAlAs	660	water-clear	1000–2000	30
L53SRC/E	red, GaAlAs	660	water-clear	2000–3500	30
8mm					
L793ID	red, GaAsP/GaP	625	red-diffused	8– 20	140
L793GD	green, GaP	565	green-diffused	5– 12.5	140
L793SGD	green, GaP	565	green-diffused	20– 30	140
L793YD	yellow, GaAsP/GaP	590	yellow-diffused	8– 20	140
L793ED	orange, GaAsP/GaP	625	orange-diffused	8– 20	140
L793SRD/B	red, GaAlAs	660	red-diffused	80– 100	140
L793SRD/C	red, GaAlAs	660	red-diffused	100– 200	140
L793SRD/D	red, GaAlAs	660	red-diffused	200– 300	140
L793SRD/E	red, GaAlAs	660	red-diffused	300– 400	140
L793SRC/B	red, GaAlAs	660	water-clear	500–1000	40
L793SRC/C	red, GaAlAs	660	water-clear	1000–1600	40
L793SRC/D	red, GaAlAs	660	water-clear	1600–2000	40
L793SRC/E	red, GaAlAs	660	water-clear	2000–3000	40
10mm					
L813ID	red, GaAsP/GaP	625	red-diffused	8– 20	140
L813GD	green, GaP	565	green-diffused	5– 12.5	140
L813SGD	green, GaP	565	green-diffused	20– 30	140
L813YD	yellow, GaAsP/GaP	590	yellow-diffused	8– 20	140
L813ED	orange, GaAsP/GaP	625	orange-diffused	8– 20	140
L813SRD/B	red, GaAlAs	660	red-diffused	80– 100	140
L813SRD/C	red, GaAlAs	660	red-diffused	100– 200	140
L813SRD/D	red, GaAlAs	660	red-diffused	200– 300	140
L813SRD/E	red, GaAlAs	660	red-diffused	300– 400	140
L813SRC/B	red, GaAlAs	660	water-clear	500–1000	40
L813SRC/C	red, GaAlAs	660	water-clear	1000–1600	40
L813SRC/D	red, GaAlAs	660	water-clear	1600–2000	40
L813SRC/E	red, GaAlAs	660	water-clear	2000–3000	40

2-Chip Single & Tri-Color LEDs

3mm (T—1)					
L937EGW	red/green	625/565	white-diffused	5.0– 12.5	100
L937EYW	red/yellow	625/590	white-diffused	5.0– 12.5	100
L937GYW	green/yellow	565/590	white-diffused	5.0– 12.5	100
2 x 5mm					
L117EGW	red/green	625/565	white-diffused	2.0– 4.0	100
L113SRSGW	red/green	660/565	white-diffused	10.0– 20.0	100
2 x 5mm					
L119EGW	red/green	625/565	white-diffused	2.0– 4.0	100
L119SRSGW	red/green	660/565	white-diffused	10.0– 20.0	100
5mm (T—1¾)					
L57EGW	red/green	625/565	white-diffused	5.0– 12.5	100
L57EYW	red/yellow	625/590	white-diffused	5.0– 12.5	100
L57GYW	green/yellow	565/590	white-diffused	5.0– 12.5	100
L53SRSGW	red/green	660/565	white-diffused	20.0– 30.0	100
L57IID	red	625/625	red-diffused	3.2– 20	120
L57GGD	green	565/565	green-diffused	3.2– 20	120
L57YYD	yellow	590/590	yellow-diffused	3.2– 20	120
L57SRSRD	red	660/660	red-diffused	60 – 200	120
5mm (T—1¾)					
L59EGW	red/green	625/565	white-diffused	8 – 20	100
L59SRSGW	red/green	660/565	white-diffused	20 – 30	100
L59EGW/CA	reg/green	625/565	white-diffused	8 – 20	100
L59EYW	red/yellow	625/590	white-diffused	8 – 20	100
L59GYW	green/yellow	565/590	white-diffused	8 – 20	100
L59EGC	red/green	625/565	water-clear	20 – 80	15
L59EYC	red/yellow	625/590	water-clear	20 – 50	15
L59GYC	green/yellow	565/590	water-clear	20 – 80	15
10mm					
L819IID	red	625/625	red-diffused	12.5– 40	140
L819GGD	green	565/565	green-diffused	8 – 20	140
L819YYD	yellow	590/590	yellow-diffused	12.5– 40	140
L818EGW	red/green	625/565	white-diffused	8 – 20	140
L819SRSGW	red/green	660/565	white-diffused	20 – 30	140

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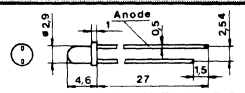
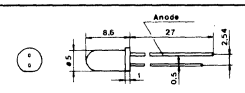
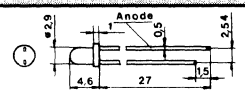
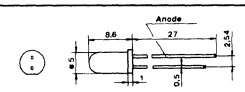
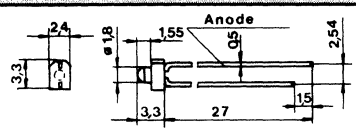
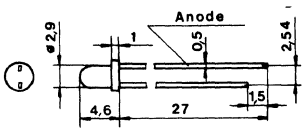
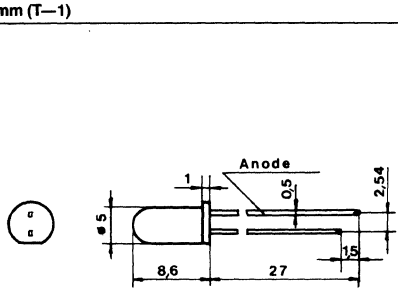
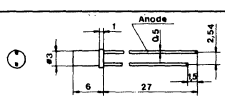
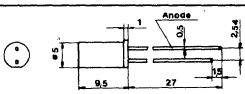
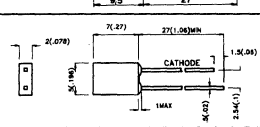
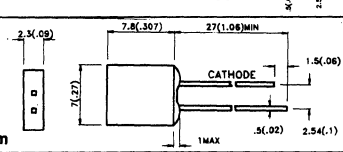
Low Current LED Lamps	Part No.	Light/Material	Wavelength nm	Lens	Intensity 2mA (mcd) Min. Typ.	Viewing Angle
 3mm (T-1)	L934LID	red, GaAsP/GaP	625	red-diffused	0.8 – 2.0	120
	L934LGD	green, GaP	565	green-diffused	0.8 – 2.0	120
	L934LYD	yellow, GaAsP/GaP	660	yellow-diffused	0.8 – 2.0	120
	L934LSRD	red, GaAlAs	660	red-diffused	8.0 – 20.0	120
 5mm (T–1¾)	L53LID	red, GaAsP/GaP	625	red-diffused	0.6 – 1.8	120
	L53LGD	green, GaP	565	green-diffused	0.6 – 1.8	120
	L53LYD	yellow, GaAsP/GaP	590	yellow-diffused	0.6 – 1.8	120
	L53LSRD	red, GaAlAs	660	red-diffused	8.0 – 12.5	120
Blue LED Lamps	**Part No.**	**Light/Material**	**Wavelength nm**	**Lens**	**Intensity 20mA (mcd) Min. Typ.**	**Viewing Angle**
 3mm (T–1)	L934BC	blue/SiC	470	water clear	7.0 – 14.0	30
	L934BT	blue/SiC	470	blue transparent	7.0 – 14.0	30
	L934BW	blue/SiC	470	white diffused	0.4 – 1.0	60
	L934BD	blue/SiC	470	blue diffused	0.4 – 1.0	60
 5mm (T–1¾)	L53BC	blue/SiC	470	water clear	7.0 – 14.0	30
	L53BT	blue/SiC	470	blue transparent	7.0 – 14.0	30
	L53BW	blue/SiC	470	white diffused	0.4 – 1.0	60
	L53BD	blue/SiC	470	blue diffused	0.4 – 1.0	60
Standard LED Lamps						
 1.8mm	L1060SRD	GaAlAs	660	red-diffused	32.0 – 40.0	30
	L1060HD	red, GaP	660	red-diffused	1.25– 5.0	30
	L1060GD	green, GaP	565	green-diffused	0.8 – 3.2	30
	L1060YD	yellow, GaAsP/GaP	590	yellow-diffused	2.0 – 5.0	30
	L1060ED	orange, GaAsP/GaP	625	orange-diffused	2.0 – 8.0	30
	L1060ID	red, GaAsP/GaP	625	red-diffused	2.0 – 8.0	30
 3mm (T–1)	L934RD	red, GaAsP	660	red-diffused	0.8 – 1.25	120
	L934HD	red, GaP	660	red-diffused	2.0 – 3.20	120
	L934GD	green, GaP	565	green-diffused	3.2 – 8.0	120
	L934SGD	green, GaP	565	green-diffused	20.0 – 30.0	120
	L934YD	yellow, GaAsP/GaP	590	yellow-diffused	3.2 – 8.0	120
	L934ED	orange, GaAsP/GaP	625	orange-diffused	3.2 – 8.0	120
	L934ID	red, GaAsP/GaP	625	red-diffused	3.2 – 8.0	120
	L934HT	red, GaP	660	red, transparent	8.0 – 12.5	16
	L934GT	green, GaP	565	green, transparent	12.5 – 32.0	16
	L934SGT	green, GaP	565	green, transparent	100.0 –150.00	16
	L934YT	yellow, GaAsP/GaP	590	yellow, transparent	12.5 – 50.0	16
 5mm (T–1¾)	L53RD	red, GaAsP	660	red-diffused	0.8 – 1.25	120
	L53HD	red, GaP	660	red-diffused	2.0 – 3.20	120
	L53GD	green, GaP	565	green-diffused	8.0 – 20.0	120
	L53SGD	green, GaP	565	green-diffused	20.0 – 30.0	120
	L53YD	yellow, GaAsP/GaP	590	yellow-diffused	8.0 – 20.0	120
	L53ED	orange, GaAsP/GaP	625	orange-diffused	8.0 – 20.0	120
	L53ID	red, GaAsP/GaP	625	red-diffused	8.0 – 20.0	120
	L53HT	red, GaP	660	red-transparent	8.0 – 20.0	16
	L53IT	red, GaAsP/GaP	625	red-transparent	32.0 –120.0	16
	L53GT	green, GaP	565	green-transparent	32.0 – 80.0	16
	L53SGT	green, GaP	565	green-transparent	100.0 –150.0	16
	L53YT	yellow, GaAsP/GaP	590	yellow-transparent	8.0 – 20.0	16
	L53RD	red, GaAsP	660	water-clear	2.0 – 5.0	16
	L53EC	red, GaAsP/GaP	625	water-clear	32.0 –120.0	16
	L53GC	green, GaP	565	water-clear	32.0 – 80.0	16
	L53SGC	green, GaP	565	water-clear	100.0 –150.0	16
	L53YC	yellow, GaAsP/GaP	590	water-clear	8.0 – 20.0	16
 3mm (T–1)	L424HDT	red, GaP	660	red-diffused	0.5 – 1.25	100
	L424GDT	green, GaP	565	green-diffused	1.25– 8.0	100
	L424YDT	yellow, GaAsP/GaP	590	yellow-diffused	1.25– 8.0	100
	L424EDT	orange, GaAsP/GaP	625	orange-diffused	1.25– 8.0	100
 5mm (T–1¾)	L483HDT	red, GaP	660	red-diffused	0.50– 1.25	100
	L483GDT	green, GaP	565	green-diffused	1.25– 8.0	100
	L483YDT	yellow, GaAsP/GaP	590	yellow-diffused	1.25– 8.0	100
	L483EDT	orange, GaAsP/GaP	625	orange-diffused	1.25– 8.0	100
 2×5mm	L113HDT	red, GaP	660	red top diffused	1.25– 2.0	120
	L113IDT	red, GaAsP/GaP	625	red top diffused	2.0 – 5.0	120
	L113GDT	green, GaP	565	green top diffused	2.0 – 3.2	120
	L113YDT	yellow, GaAsP/GaP	590	yellow top diffused	2.0 – 5.0	120
	L113EDT	orange, GaAsP/GaP	625	orange top diffused	2.0 – 3.20	120
 2.5×7mm	L153HDT	red, GaP	660	red top diffused	1.25– 2.0	120
	L153IDT	red, GaAsP/GaP	625	red top diffused	2.0 – 5.0	120
	L153GDT	green, GaP	565	green-diffused	2.0 – 3.2	120
	L153YDT	yellow, GaAsP/GaP	590	yellow top diffused	2.0 – 5.0	120
	L153EDT	orange, GaAsP/GaP	625	orange top diffused	2.0 – 3.2	120
	L153SRDT	red, GaAlAs	660	red top diffused	32.0 – 80.0	120

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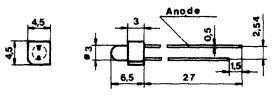
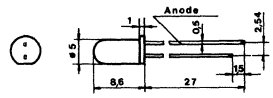
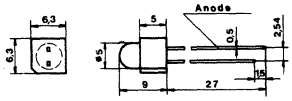
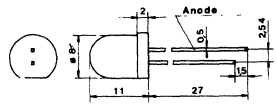
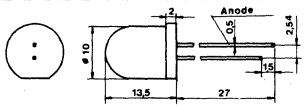
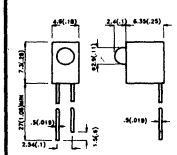
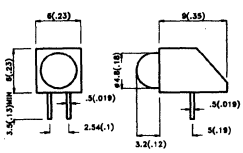
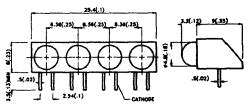
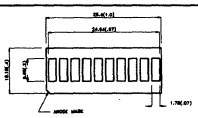
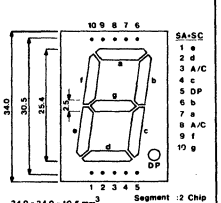
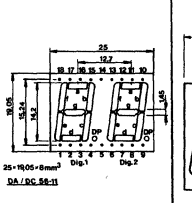
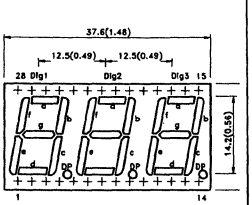
KINGBRIGHT LED SINCE 1980

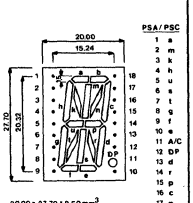
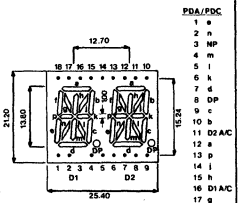
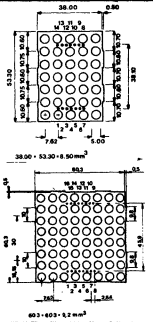
Blinking LED Lamps *Low current types available	Part No.	Light/Material	Wavelength nm	Lens	Intensity 20mA (mcd) Min. Typ.	Viewing Angle
 3mm (T—1)	L616BHD	red, GaP	660	red-diffused	1.2 – 2	100
	L616BGD	green, GaP	565	green-diffused	3.2 – 8	100
	L616BYD	yellow, GaAsP/GaP	590	yellow-diffused	3.2 – 8	100
	L616BID	red, GaAsP/GaP	625	red-diffused	3.2 – 8	100
	L616BSRD/B	red, GaAlAs	660	red-diffused	40 – 60	100
 5mm (T—1¾)	L56BHD	red, GaP	660	red-diffused	1.2 – 2	120
	L56BGD	green, GaP	565	green-diffused	3.2 – 8	120
	L56BYD	yellow, GaAsP/GaP	590	yellow-diffused	5 – 12.5	120
	L56BID	red, GaAsP/GaP	625	red-diffused	5 – 12.5	120
	L56BSRD/B	red, GaAlAs	660	red-diffused	50 – 70	120
 5mm (T—1¾)	L456BHD	red, GaP	660	red-diffused	1.2 – 2	120
	L456BGD	green, GaP	565	green-diffused	3.2 – 8	120
	L456BYD	yellow, GaAsP/GaP	590	yellow-diffused	5 – 12.5	120
	L456BID	red, GaAsP/GaP	625	red-diffused	5 – 12.5	120
	L456BSRD/B	red, GaAlAs	660	red-diffused	50 – 70	120
 8mm	L796BID	red, GaAsP/GaP	625	red-diffused	5 – 12.5	140
	L796BGD	green, GaP	565	green-diffused	3.2 – 8	140
	L796BYD	yellow, GaAsP/GaP	590	yellow-diffused	5 – 12.5	140
	L796BSRD/B	red, GaAlAs	660	red-diffused	80 –120	140
	L796BSRC/B	red, GaAlAs	660	water-clear	400 –800	40
 10mm	L816BID	red, GaAsP/GaP	625	red-diffused	5 – 12.5	140
	L816BGD	green, GaP	565	green-diffused	3.2 – 8	140
	L816BYD	yellow, GaAsP/GaP	590	yellow-diffused	5 – 12.5	140
	L816BSRD/B	red, GaAlAs	660	red-diffused	50 –120	140
	L816BSRC/B	red, GaAlAs	660	water-clear	400 –800	40

LED Lamp Arrays LED Bargraph Displays *Many other custom types available	Part No.	Light/Material	Wavelength nm	Lens	Intensity 10mA (mcd) Min. Typ.	Viewing Angle
3mm–L934 series  5mm–L73 series 	L934CB/RD	red, GaAsP	660	red-diffused	0.8 – 1.25	120
	L934CB/ID	red, GaAsP/GaP	625	red-diffused	3.2 – 8.0	120
	L934CB/GD	green, GaP	565	green-diffused	3.2 – 8.0	120
	L934CB/YD	yellow, GaAsP/GaP	590	yellow-diffused	3.2 – 8.0	120
	L73CB/1RDA	red, GaAsP	660	red-diffused	1.25– 2.0	60
	L73CB1IDA	red, GaAsP/GaP	625	red-diffused	5.0 – 8.0	60
	L73CB/1GDA	green, GaP	565	green-diffused	2.0 – 3.2	60
	L73CB/1YDA	yellow, GaAsP/GaP	590	yellow-diffused	3.2 – 5.0	60
	L73CB/1SRDA	red, GaAlAs	660	red-diffused	20.0 – 40.0	60
QUAD 5mm (T—1¾) 	L73CB/4RDA	red, GaAsP	660	red-diffused	1.25– 2.0	60
	L73CB/4IDA	red, GaAsP/GaP	625	red-diffused	5.0 – 8.0	60
	L73CB/4GDA	green, GaP	565	green-diffused	2.0 – 3.2	60
	L73CB/YDA	yellow, GaAsP/GaP	590	yellow-diffused	3.2 – 5.0	60
	L73CB/4SRDA	red, GaAlAs	660	red-diffused	20.0 – 40.0	60
10 SEGMENT BARGRAPHS DC10 Series 	DC10EWA	red, GaAsP/GaP	625	white-diffused	0.8 – 2.0	150
	DC10GWA	green, GaP	565	white-diffused	0.8 – 2.0	150
	DC10YWA	yellow, GaAsP/GaP	590	white-diffused	8.0 – 2.0	150
	DC10SRWA	red, GaAlAs	660	white-diffused	5.0 – 10.0	150
	DC7G3HWA	green/red	565/660	white-diffused	0.8 – 20	150

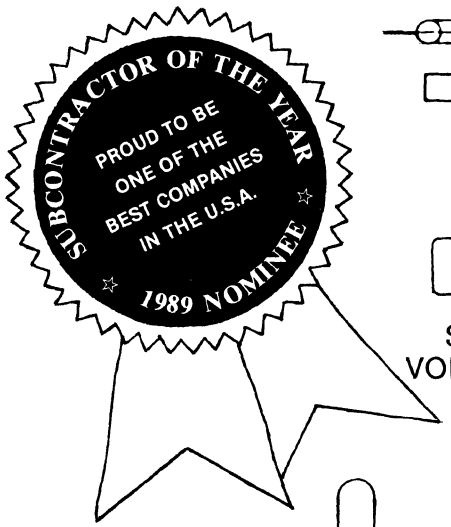
Seven Segment LED Displays

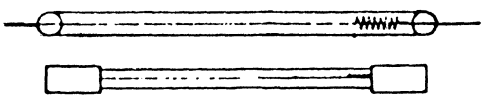
SINGLE DIGIT	DUAL DIGIT	MULTIPLE DIGIT
		
0.3″, 0.36″, 0.4″, 0.43″, 0.5″, 0.52″, 0.56″, 0.8″, 1.0″, 1.8″, 2.3″, 4.0″	0.3″, 0.4″, 0.5″, 0.56″	0.56″

Alphanumeric LED Displays

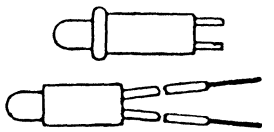
16 SEGMENT	14 SEGMENT	DOT MATRIX
		
0.8″	0.54″	5×7: 0.7″, 1.2″, 2.0″, 4.0″ 5×8: 2.3″ 8×8: 2.4″

NOTE: All displays are available in Red, Hi-Efficiency Red, Bright Red, Green, Yellow & Low Current (GaAlAs) Red.

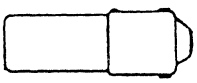




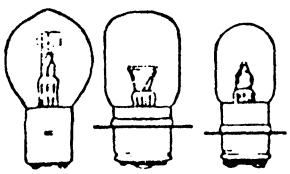
THIN LINE TYPES



CARTRIDGE TYPES



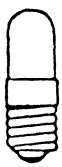
STANDARD VOLTAGE TYPES



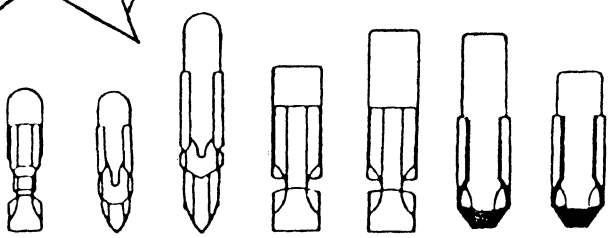
AUTO LAMPS



WEDGE BASE



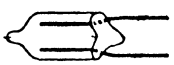
SCREW BASE



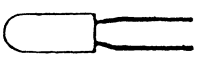
TELEPHONE SLIDE BASE — ALL TYPES



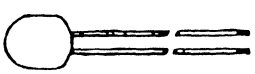
LENS END



NEONS



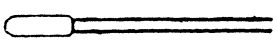
ALL GLASS INTEGRAL BI-PINS



SUBMINIATURES



MINIATURES



MICRO MINIATURES

SILICONE COLOR FILTERS — SOCKETS — SOCKET PINS

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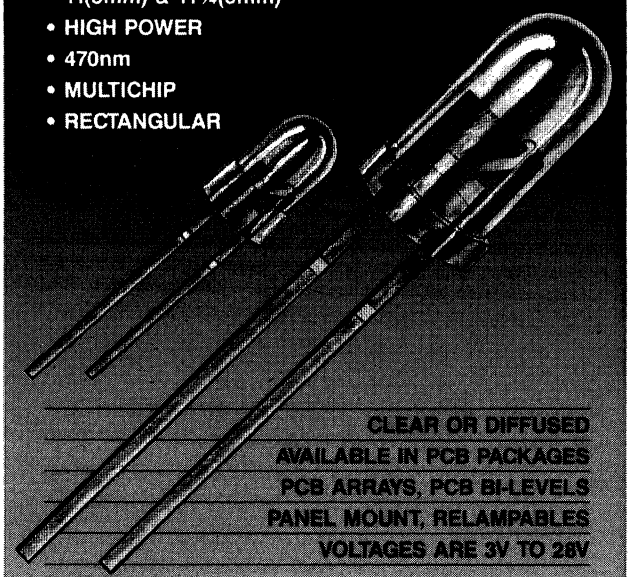
- 470nm
- MULTICHIP
- RECTANGULAR



CLEAR OR DIFFUSED
AVAILABLE IN PCB PACKAGES
PCB ARRAYS, PCB BI-LEVELS
PANEL MOUNT, RELAMPABLES
VOLTAGES ARE 3V TO 28V

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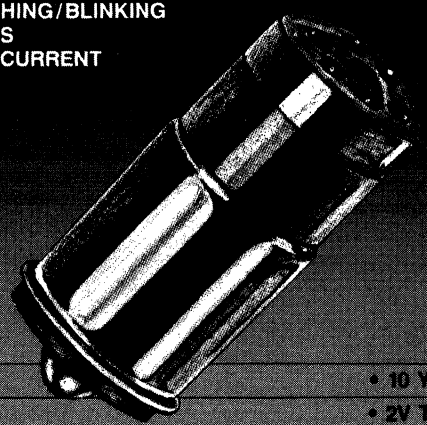
- 5K mcd ULTRA REDS
- INFRAREDS
- FLASHING/BLINKING
- BLUES
- LOW CURRENT



- 10 YEAR LIFE
- 2V TO 120VAC
- 8 COLORS AVAILABLE
- LOW POWER / SHOCK PROOF

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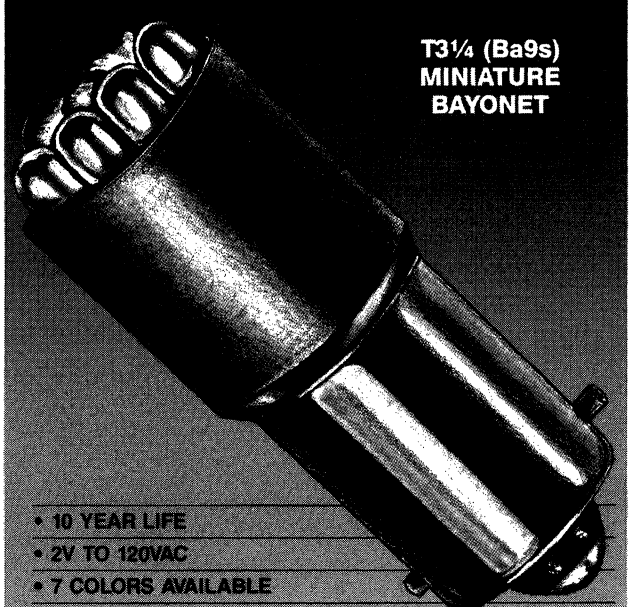
120 MB LEDs

T3¼ (Ba9s)
MINIATURE
BAYONET



- 10 YEAR LIFE
- 2V TO 120VAC
- 7 COLORS AVAILABLE
- LOW POWER / SHOCK PROOF

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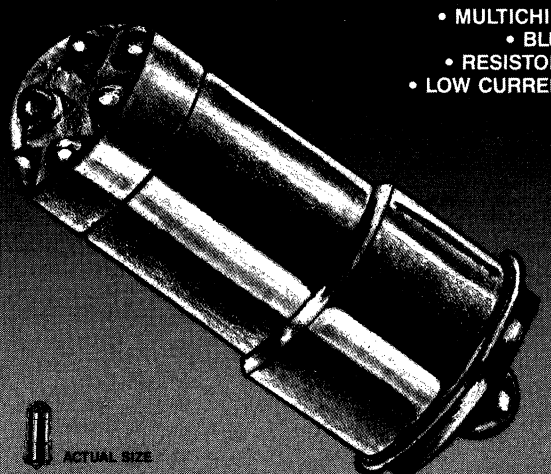
714/6839 LEDs

SUB-MIDGET FLANGE

- MULTICHIPS
- BLUE
- RESISTORS
- LOW CURRENT



- CHOICE OF 8 COLORS
- LOW POWER/SHOCKPROOF
- 2V TO 120 VAC • 10 YEAR LIFE
- MIXED COLORS IN DIFFUSED OR CLEAR

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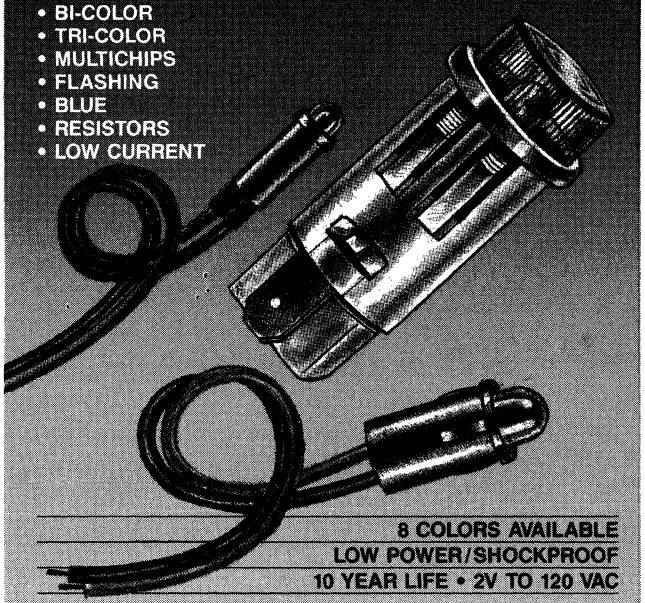
SNAP-IN LEDs

LOW COST PANEL MOUNTS

- BI-COLOR
- TRI-COLOR
- MULTICHIPS
- FLASHING
- BLUE
- RESISTORS
- LOW CURRENT



8 COLORS AVAILABLE
LOW POWER/SHOCKPROOF
10 YEAR LIFE • 2V TO 120 VAC

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RFI/EMI LEDs

RELAMPABLE PANEL MOUNTS

- BI-COLOR
- TRI-COLOR
- MULTICHIPS
- FLASHING
- BLUE



8 COLORS AVAILABLE
LOW POWER/SHOCKPROOF
10 YEAR LIFE • 2V TO 120 VAC

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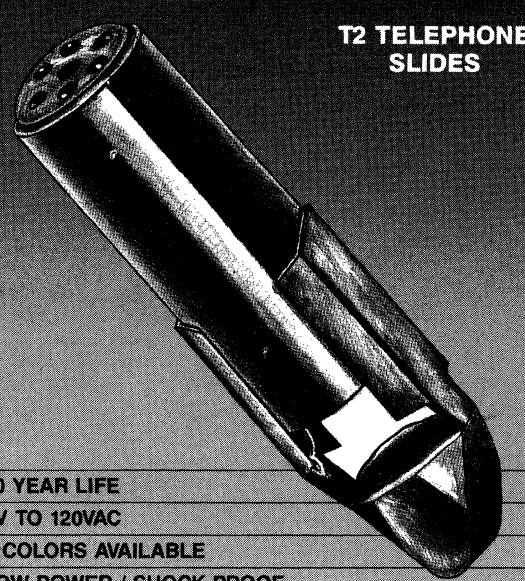
120 PSB LED

T2 TELEPHONE SLIDES



- 10 YEAR LIFE
- 2V TO 120VAC
- 7 COLORS AVAILABLE
- LOW POWER / SHOCK PROOF

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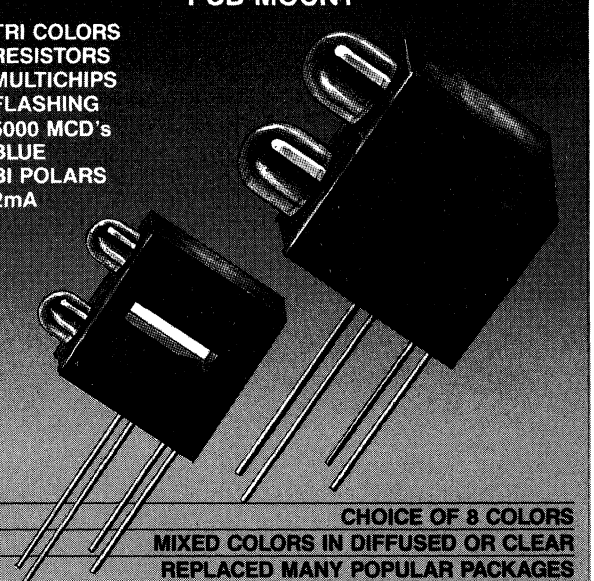
BiLEVEL LEDs

PCB MOUNT

- TRI COLORS
- RESISTORS
- MULTICHIPS
- FLASHING
- 5000 MCD's
- BLUE
- BI POLARS
- 2mA



CHOICE OF 8 COLORS
MIXED COLORS IN DIFFUSED OR CLEAR
REPLACED MANY POPULAR PACKAGES
T1 (3mm) • T1¾ (5mm) • SINGLE OR ARRAY

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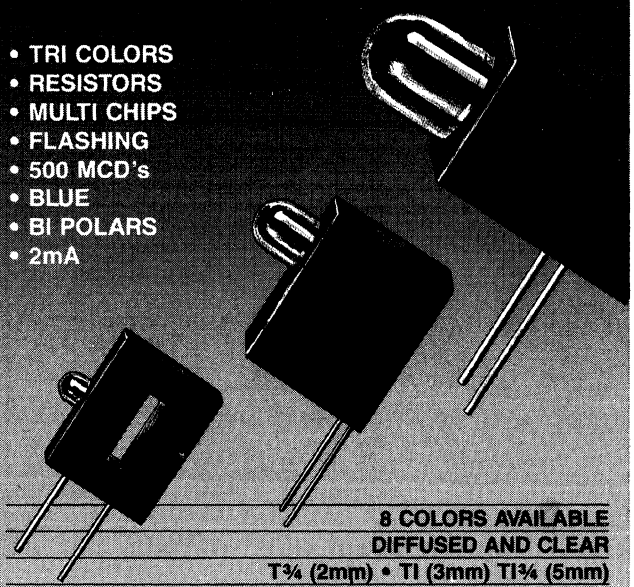
PCB LEDs

- TRI COLORS
- RESISTORS
- MULTI CHIPS
- FLASHING
- 500 MCD's
- BLUE
- BI POLARS
- 2mA



8 COLORS AVAILABLE
DIFFUSED AND CLEAR
T¾ (2mm) • TI (3mm) TI¾ (5mm)
REPLACES MANY POPULAR PACKAGES

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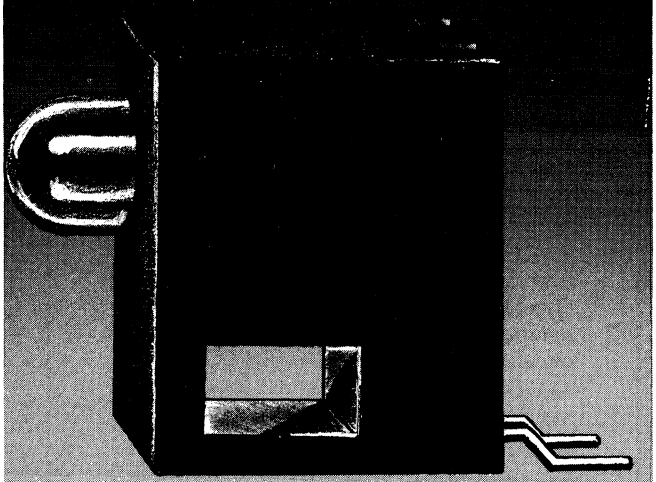
PCB LEDs

SURFACE MOUNT



8 COLORS AVAILABLE
CLEAR OR DIFFUSED • SINGLE OR ARRAYS
T¾(2mm) • TI(3mm) • TI¾(5mm)
WITH OR WITHOUT RESISTORS

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RED	DISCRETE LED LAMPS / ALL SHAPES, SIZES & TYPES
PURPLE	DISPLAYS, BARGRAPHS, DOT MATRIX / ALL SIZES & COLORS

Quality beyond specifications.

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M83287/02-Electrical Reset, Panel Mount. Highly visible, internal flag display features magnetic latching for positive indication. Non-volatile memory produces effective warning of system faults. Electrical reset available in 3-28 volt DC versions.

BHG, BGHD Series
M83287/03-Panel Mount Ball. Small and lightweight, this highly reliable unit features excellent visibility and is available in a variety of display color combinations. Positive magnetic latching with single or dual coil construction, from 1.5-28 volts DC.

MI61S, MI61R Series
M83287/01-Panel Mount Flag. Most popular manual resettable unit, with magnetic latching and positive indication. MI61R is designed to withstand high random vibration. Both units are environmentally sealed. Available in a range of DC voltages.

MB25 Series
M83287/05-P.C. Board Mounting. Small and lightweight, features low power 180 mw@ 20ms pulse. Non-volatile, wide angles display, dual coil and environmentally sealed construction. Available in 5 and 12 volts DC.

MI51LP Series
M83287/04-Low Power, Dual Drum. Requires only 50 mw pulse power for 25ms for positive latched fault indication. Available from 1.5 to 28 volts DC. Features manual reset and excellent shock and vibration characteristics.



The *only complete* line of Mil Qualified Fault Indicators.

- Magnetic latching type indicators require only pulse power for fault identification.
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- Family of five indicators are manually or electrically resettable, panel mounted or designed for PC mount.
- All indicators available in several types, most at more than one voltage level.
- Operating life up to one million cycles.

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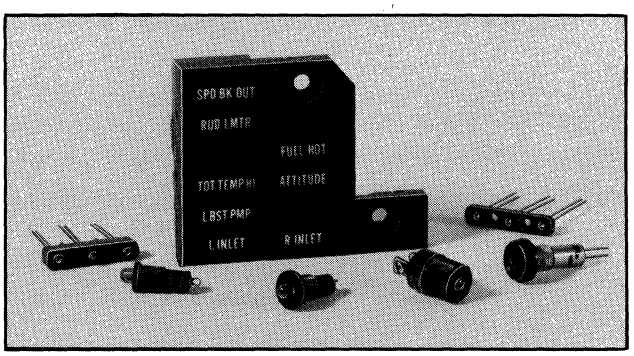
Custom Applications
Whatever your requirements for fault monitoring systems, Minelco can provide an indicator to meet your needs, illuminated or electromagnetic. Custom interfaces, legends, and colors are available in discrete or integrated modules tailored to your specifications. Standard units can be modified to exceed MIL-STD requirements in many areas such as shock, vibration, EMI-RFI shielding and environmental seals.

Minelco's high standards are reflected in a quality program maintained to MIL-Q-9858A and inspection system to MIL-I-45208A. The military and aerospace industry has relied on Minelco's quality design, production, and service for over 30 years. Minelco's sales and technical staff are ready to handle all indicator needs.

Custom Annunciators and Panels



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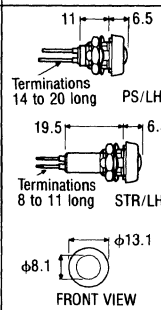
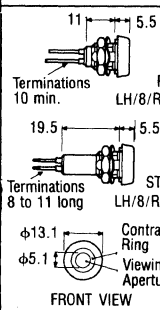
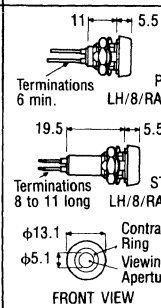
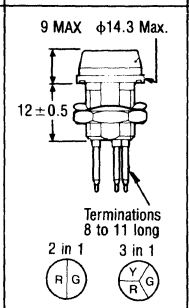
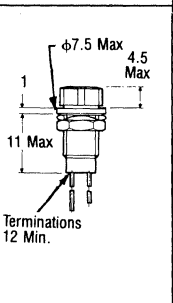
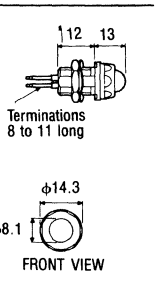
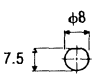
OXLEY SEALED MILITARY & PROFESSIONAL LED INDICATOR LAMPS

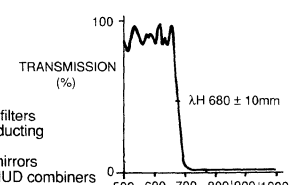
With Sunlight Viewability, NVG Compatibility, EMC, and Secure Lighting Features

Approved for MILITARY APPLICATIONS to DESC Selected Item Drawings 85122 and 87019

Series		STR/LH/8	STR/LH/8/RAF	STR/LH/8/RAPP	2/STR/LH23/10 3/STR/LH23/10	OXL/MIL/50	STR/LH23/10/—
	Panel and front sealing	PS/LH/8	PS/LH/8/RAF	PS/LH/8/RAPP			
Outline Dimensions (mm)							
Mounting Details (mm)		 Panel thickness 3 max.	 Panel thickness 3 max.	 Panel thickness 3 max.	 Panel thickness 6.5 max.	 Panel thickness 1 to 4	 Panel thickness 6.5 max.
Special Features		Plano-convex lens to provide even illumination over a large area of emission. Special functions available:— Low current (Type—/LC) Flashing (Type—/5/Z) Bi-color (Type 2/—) Integral resistor types for operation from 5, 12, 15, 24 or 28Vd.c. supplies available.	Sunlight viewable up to 100,000 lux. Focused light source for optimum forward viewing. Contrast ring. Optional anti-reflection coating. NVIS/NVG compatible types available.	Sunlight viewable up to 100,000 lux. Pin-point light source for very wide angle viewing. Contrast ring. Optional anti-reflection coating. NVIS/NVG compatible types available.	Multicoloured 2 in 1 and 3 in 1 lamps with segmented display areas. Standard segment colors shown in front views above 2 in 1 lamp has two LED's independently terminated. 3 in 1 has common cathode configuration as standard.	Miniature Lamps, high brightness LEDs (100% screened and burnt-in) in a 7.5 mm diameter aluminum package, similar in construction to the STR/-series lamps, MIL/50 fits a 5mm diameter hole for applications where panel space is limited.	Replacement for obsolescent incandescent types. Integral current limiting resistor and protection diode for operating from 5, 12, 15, 24 or 28 V d.c. supplies. Domed lens fitted as standard to give wide viewing angle.
Electro-magnetic Screening Mesh (Type-/-/-/SES)		Option on STR/LH/8 only	Option on STR/LH/8/RAF only	Option on STR/LH/8/RAPP only	Not Available	Available	Not Available
Standard Features		Rugged construction with sealed glass lenses. Panel sealing to a depth of 20 meters of sea water. High brightness LED's. 100% burnt in to optimize reliability. Black anodized shroud to enhance visual appearance, all metal construction for grounding when panel mounted. Nut mounted. STR/-types have sealed rear terminations. Pigtail terminations available for STR/-types.					

OTHER OXLEY DISPLAY PRODUCTS

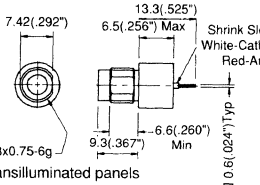
OMITEC THIN FILM COATINGS



- NVG compatible filters
- Transparent conducting windows
- Ring laser gyro mirrors
- Laser selective HUD combiners
- Thin films onto plastic optics
- Anti-reflection coatings

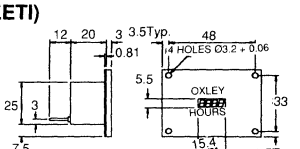
See Electro-optics Page B•1335

REAR MOUNT INDICATOR FOR AVIONICS



- Compatibility with transilluminated panels
- High panel density
- Flush/recessed mounting using sub-chassis
- Improved maintainability-panel removal is possible without disconnection.
- Panel engraving possible to within1mm of viewing aperture

OXLEY ELECTRONIC ELAPSED TIME INDICATOR (EETI)



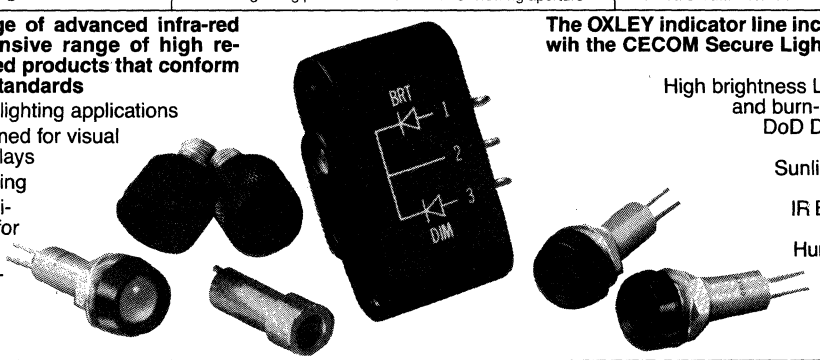
FEATURES

- Fully Solid State Circuitry
- Data-bus Readout
- Contrast Enhanced LED Readout
- EEPROM Non-Volatile Memory
- 10 Years Data Retention

Oxley meets the challenge of advanced infra-red technology with an extensive range of high reliability and quality assured products that conform to exacting U.S. military standards

- NVIS compatible cockpit lighting applications
- Color discrimination retained for visual warning and caution displays
- NVG Visible Covert Lighting
- Spectoradiometrically calibrated infra-red emitters for avionic formation lights.
- Custom NVG/NVIS Compatible Lighting

NVIS/NVG COMPATIBLE LIGHTING



The OXLEY indicator line includes parts complying wih the CECOM Secure Lighting Program.

High brightness LEDs 100% screening and burn-in to MIL-S-19500 US DoD DESC Selected items. ■

Sunlight readable displays ■

IR Blocking Optical Filters ■

Human factor engineered ■

IR FREE SECURE LIGHTING

FOR OTHER OXLEY PRODUCTS SEE:

A•2750 EMI FILTERS Page **A**•1705
B•2440 MILITARY COMPONENTS Page **B**•1025
B•3700 ELECTRO-OPTIC. THIN FILMS Page **B**•1335
C•2100 CONNECTORS, TEST POINTS Page **C**•1479

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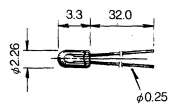
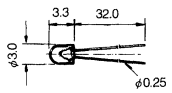
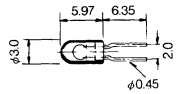
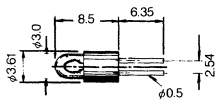
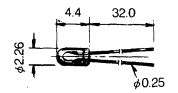
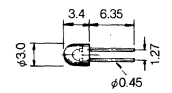
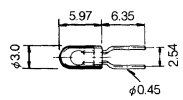
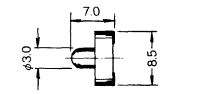
WIDE VARIETY SUB-MINIATURE INCANDESCENT LAMPS

T-3/4 Short Wire Terminal	T-1 Short Wire Terminal	T-1 IBP-G	T-1 Bi-Pin, Type-E
			
T-3/4 Wire Terminal	**T-1 Short IBP-A**	**T-1 IBP-E**	**T-1 Surface Mount**
			
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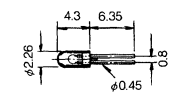
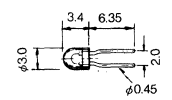
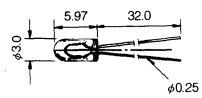
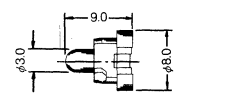
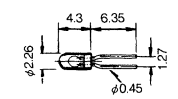
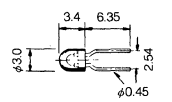
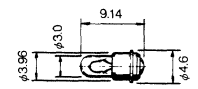
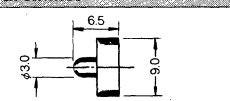
			
T-3/4 IBPS-A	**T-1 Short IBP-E**	**T-1 SMF**	**T-1 Grommet**
			
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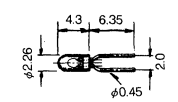
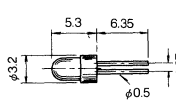
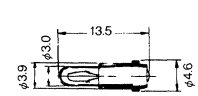
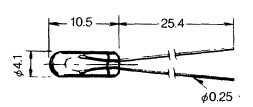
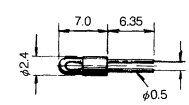
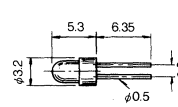
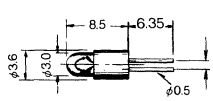
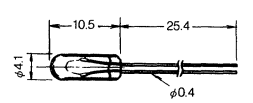
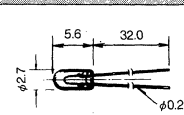
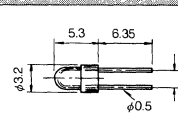
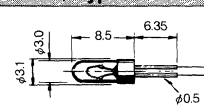
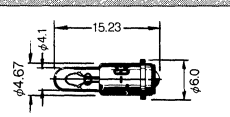
			
T-3/4 Bi-Pin	**T-1 Short BPG**	**T-1 Bi-Pin Std.**	**T-1 1/4 IBP**
			
T-7/8 Wire Terminal	**T-1 Short BPE**	**T-1 Bi-Pin, Type-A**	**T-1 1/4 MF**
			
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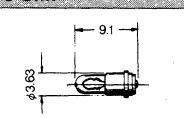
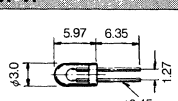
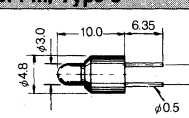
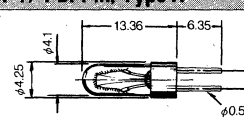
			

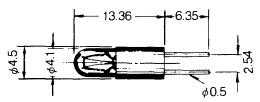
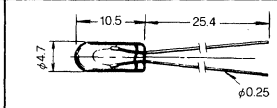
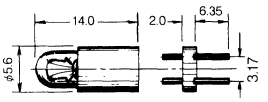
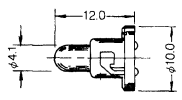
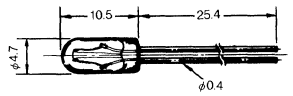
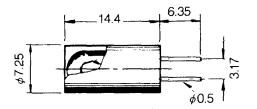
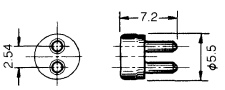
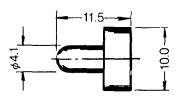
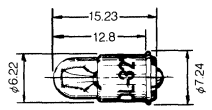
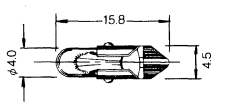
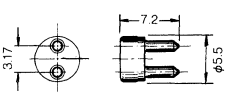
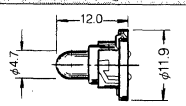
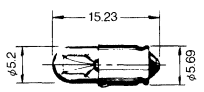
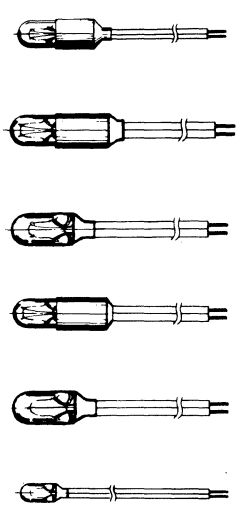
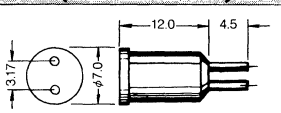
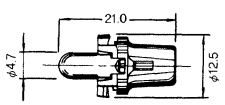
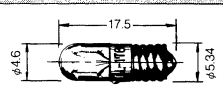
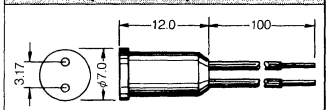
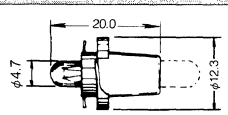
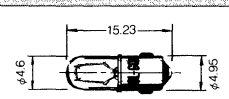
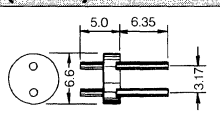
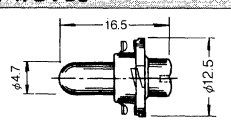
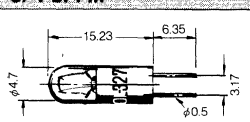
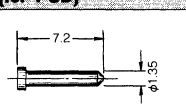
Unit in mm

OSHINO LAMPS LTD.
2-5-2, Minami-Shinagawa, Shinagawa-ku, Tokyo, 140 Japan
Tel: 03-3471-8548 Facsimile: 03-3450-3939 Telex: 242-2117

WAMCO, INC.
11555-A Coley River Circle, Fountain Valley, California 92708-4272
Tel: 714-545-5560 Facsimile: 714-545-6093 Telex: 678459 WAMCO INC FNVY

LAMPS

TYPICAL APPLICATIONS
AEROSPACE, AUTOMOTIVE TELECOMMUNICATION, etc.

T-1 1/4 Bi-Pin, Type-E	**T-1 3/4 Wire Terminal**	**T-1 3/4 BPR**	**BI-PIN LAMP SOCKETS**
			
T-1 1/4 Neowedge	**T-1 3/4 IBP**	**T-1 3/4 BPS**	**125-2E (for PCB)**
			
T-1 1/4 Grommet	**T-1 3/4 MF**	**T-4.5 Telephone Slide**	**125-2P (for PCB)**
			
T-1 1/2 Neowedge	**T-1 3/4 MG**	**Insulated Wire Lead Lamps**	**125-2B (for PCB & PANEL)**
			
T-1 1/2 PBA	**T-1 3/4 MS**		**125-3A (for PANEL)**
			
T-1 1/2 PBB	**T-1 3/4 MB**		**BPR (for PCB)**
			
T-1 1/2 PBC	**T-1 3/4 Bi-Pin**		**125-20 (for PCB)**
			

Unit in mm

OSHINO LAMPS LIMITED has been in business since 1931. We are a leading supplier of Sub-Miniature Lamps to the U.S. and European Aerospace, Automotive, Telecommunication and Computer Industries. We have a NATO Code Number S3774 and will certify lamps where applicable to U.S. Military Standards and Specifications and other international norms such as DIN, IEC and JIS. Our "OL" trademark stands for dependability, quality and reliability.

OSHINO LAMPS LTD.
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Tel: 03-3471-8548 Facsimile: 03-3450-3939 Telex: 242-2117

WAMCO, INC.
11555-A Coley River Circle, Fountain Valley, California 92708-4272
Tel: 714-545-5560 Facsimile: 714-545-6093 Telex: 678459 WAMCO INC FNVY

RODALE
Technical Sales Inc.

Technical Sales Inc.
577 Main Street, Islip, New York 11751
516-277-5454 Telex: 5106007812 FAX: 516-277-8375

sub-miniature lamps - off-shore high quantity

Over years of experience in lamp, business, **SUB-MINIATURE LAMP INDUSTRIES. (SLI)** has continuously developed newest technology and equipment in the manufacturing of high quality miniature and subminiature incandescent lamps.

Our subminiature lamps are designed to meet extremely small sizes (from T-5/16 0.04" dia. to T-4 0.5" dia.), extra long life and low cost requirements. They are also available with a wide variety of filament constructions, bases and wire terminal leads.

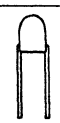
We supply all lighting needs for panel industry, indicators, computers, medical instrument, automobile, aircraft, electronic, telephone and other industries.

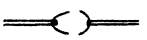
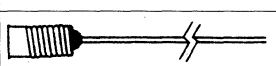
We also offer application engineering assistance to all customers in applying subminiature lamps in production design. Any inquire or new design is welcomed by our R&D Dept. Please contact us for additional information. We can assure you will get the complete satisfaction with our high quality, competitive price and speedy deliveries.

lamp types available

- T-3/8 Micro Lamps - Wire Terminal
- T-3/8 Micro Lamps - Axial Leads
- T-1/2 Micro Lamps - Wire Terminal
- T-3/4 Miniature Incandescent Lamps
- T-3/4 Integral Bi-Pin Lamps (IBP)
- T-1 Miniature Incandescent Lamps
- Short T-1 Incandescent Lamps
  O.L.. .145" (3.68mm) MAX.
- Super Short T-1 Incandescent Lamps
  O.L. .130" (3.30mm) MAX.
- T-1 Helium Retardant Incandescent Lamps
- T-11/4 Miniature Incandescent Lamps
- T-1 Integral Bi-Pin Lamps (IBP)
- T-13/4 Incandescent Lamps
- Line Filament Lamps
- T-11/4 Lens-End
- Special Incandescent Lamps
- Telephone Slide Lamps
- Neon Indicator Lamps

base types

 Wire Terminal	 Midget Grooved
 Bi-Pin	 Midget Bayonet BA 7S
 Micro Midget Flanged	 Miniature Bayonet BA 9S
 Sub Midget Flanged F4	 S.C. Bayonet BA 15S
 S.C. Midget Flanged F6	 D.C. Bayonet BA 15D
 S.C. Miniature Flanged	 D.C. Indexing BAY 15D

 Midget Screw E5	 Axial Lead
 Miniature Screw E10	 SF Type
 Candelabra Screw E12	 Snap Type
 Mignon Screw E14	 Telephone Slide
 Intermediate Screw E17	 Wedge
 Special	 Midget Screw E5 with lead wire

special specifications

Lens & Lamps, Plating, Frosting, W.C.F., Color Coding, IBP and other special requirements can be made upon your request. Call for our Complete Catalog and Specifications.

ROHM CORPORATION
ROHM Electronics Division
3064 Owen Drive, Antioch, TN 37013
Telephone (615) 641-2020 ■ Fax (615) 641-2022

LEDs

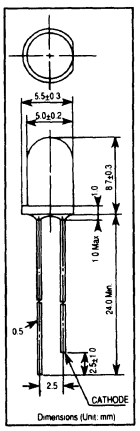
We turn it on for you.

Quality is our passion. We breathe it. We live it. And we believe that rigorous, uncompromising product quality results in the greatest possible economy for you.

ROHM optoelectronics offer you the highest guaranteed minimum brightness (3.6 mcd) in the industry. Our LEDs deliver absolutely consistent luminescence, uniformly matched colors, and a level of reliability unequaled anywhere.

New Products. Our new T 1-3/4 red lamps (SLA-580LT3 Series) using GaAlAs technology offer true sunlight visibility. Luminous intensities as high as 2000 mcd make them ideal for outdoor use.

New ROHM SLM-125 (red) and SLM-245 (red/green) surface mount LEDs are the brightest available, thanks to a new package created especially by ROHM for this application.



Standard T1 & T 1-3/4

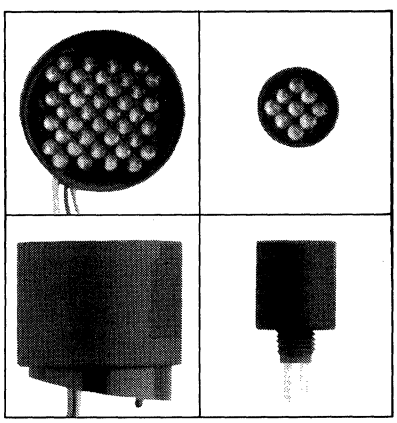
Colors:	Red, green, yellow, orange—all available in selectable wavelengths
Brightness:	10 - 1000 mcd
Viewing Angle:	12° - 50°

SuperBright T 1-3/4

Color:	Red
Brightness:	1 - 3 candlepower
Viewing Angle:	12°

Large, 2-Color, Outdoor Modules

Featuring exceptionally intense, clear illumination and a wide viewing angle, these large (50mm & 24mm diameter), red/green LED modules offer much longer life and lower power consumption than incandescent lighting. With resin-sealed polycarbonate casings, these modules are ideal for applications such as outdoor billboards, traffic signs, airport runway indicators and railroad directionals.

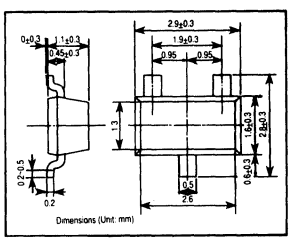


SLL-5080ML **50mm**

SLL-2518ML **24mm**

Surface Mount LEDs

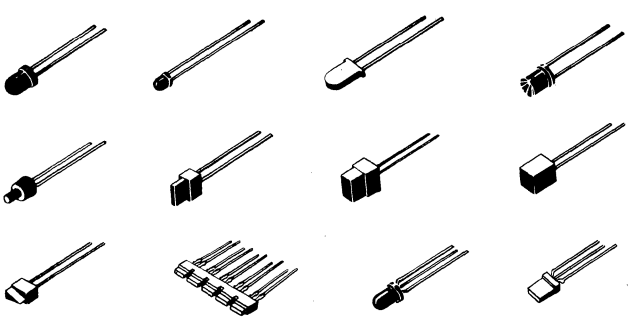
Colors:	Red, green, yellow, orange
Brightness:	5 - 25 mcd
Applications:	Status indicator Board level indicator Front panel illumination



Assorted Shapes, Colors & Viewing Angles

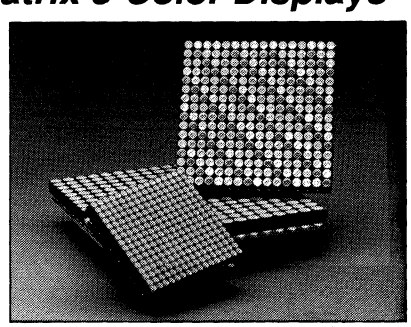
(Characteristics Similar to T 1-3/4)

■ Standard lamps can be modified to meet your specifications.

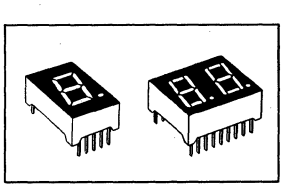


16x16 Dot Matrix 3-Color Displays

Each of the 256 dots in this module contains both red and green dies which may be switched for individual colors or combined to create orange. IC drivers for CPU interfacing are PCB-mounted on the back of each module. Modules may be laid as "seamless tiles," creating large, colorful, moving displays that outlast incandescent bulbs many times over.



LU Series	**64x64mm**
T1 & T1-3/4 LEDs	**96x96mm**
Red/Green	**144x144mm**



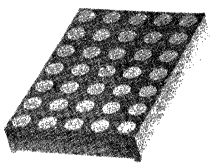
Single & Dual Digit Displays

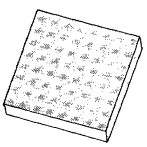
Color: Red, green, yellow, orange

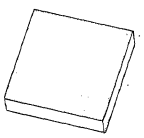
Call for Complete Specs on 1000s of Components!

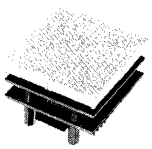
SHARP® Optoelectronics Dot Matrix LEDs/Dot Matrix LED Units

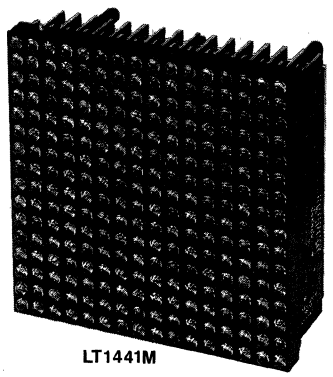

LT5101P series


LT5103D series


LT5105D series


LT5107D series


LT1401E series


LT1441M

Dot Matrix LEDs

Type	Character height (inch)	Common pins	Red GaAsP on GaP	Yellow-Green (HL) GaP	Yellow-Green (HL) + Red GAP + GaAsP on GaP	Orange GaP
5 × 7 dot matrix	1.08	Anode	LT5101D	LT5101E		
		Cathode	LT5102D	LT5102E		
	1.8	Anode	LT5103D	LT5103E		
		Cathode	LT5104D	LT5104E		
8 × 8 dot matrix	1.05	Anode	LT5105D	LT5105E		
		Cathode	LT5106D	LT5106E		LT5106S
	1.1	Anode			LT5007ED	
		Cathode	LT5008D	LT5008E	LT5008ED	
4 × 4 dot matrix	0.9	Anode	LT5107D	LT5107E	LT5107ED	
		Cathode	LT5108D	LT5108E	LT5108ED	
16 × 16 dot matrix	1.18	Cathode				LT5014S
	1.48	Anode	LT5005D	LT5005E		LT5005S

Dot Matrix LED Units

Type	Construct of Dots	Dot Pitch (mm)	Size (mm)	Color	Power Supply	Duty Cycle
LT1401D	16 × 16	3.8	60 × 60	Red	5V 1.6A	1/8
LT1401S	16 × 16	3.8	60 × 60	Sunset Orange	5V 1.6A	1/8
LT1401E	16 × 16	3.8	60 × 60	Green	5V 1.6A	1/8
LT1421ED	16 × 16	7.5	120 × 120	Green-Red	5V 3.2A	1/16
LT1450ED	16 × 16	4	64 × 64	Green-Red	5V	1/16
LT1460ED	16 × 16	6	96 × 96	Green-Red	5V	1/16
LT1480ED	16 × 16	2.5	40 × 40	Green-Red	5V	1/16
LT1441M	16 × 16	10	160 × 160	Green-Red	±5V 6.4A	Static
LT1455M	16 × 16	6	96 × 96	Green-Red	5V	1/8
LT1456M	16 × 16	6	96 × 96	Green-Red	5V	1/8
LT1445M	16 × 16	10	160 × 160	Green-Red	5V	1/8
LT1470M	16 × 16	20	320 × 320	Green-Red	±10V 16A	Static

High luminosity

Sharp's leading-edge opto-electronics technology is incorporated into its LED chips to provide amazingly high light emission. Thanks to our unique assembly technology, these units provide enough luminosity to even be used outdoors.

3 color display capability offers more creative freedom

Allowing you to display red, yellow-green and orange (by mixing the first two) makes the information more colorful and thereby more effective.

Reduced power consumption

Sharp's LED chips have superior luminous efficiency and provide a practical luminosity level at low current, reducing power consumption for the entire system.

Thin and light weight design

A thin and light weight body has been realized through our unique high-density design. It allows flexible unit configuration of just about any size, to best suit the available space in shops, offices, even outdoor locations.

High-speed operation

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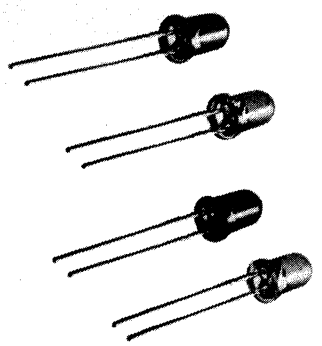


SHELLY

300 SERIES T-1
500 SERIES T-1 3/4

EXTRA BRIGHT SOLID STATE VISIBLE LED LAMPS

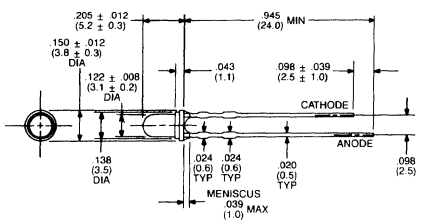
FEATURES

- IC COMPATIBLE
- 24° HALF INTENSITY ANGLE
- BINNED FOR BRIGHTNESS
- CHOICE OF COLORS
- TINNED LEADS

APPLICATIONS

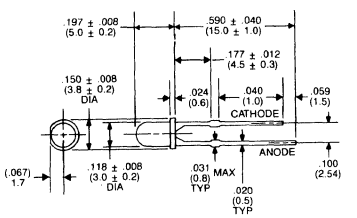
- BACKLIGHTED PANELS
- STATUS INDICATORS
- OVERLAYS
- ALPHANUMERIC DISPLAYS
- LIGHTED SWITCHES

T-1



PART NUMBER	LENS COLOR AND MATERIAL*	ELECTRO-OPTICAL CHARACTERISTICS				λP	MAX RATINGS (T_A = 25°C)		
		LUMINOUS INTENSITY		FORWARD VOLTAGE V_F@I_F = 20mA		I_F = 20mA	I_F	P_D	V_R
		TYP mcd	MIN mcd	TYP V	MAX V	TYP (nm)	(mA)	(mW)	(VDC)
SA 343R	Red diffused	80@20mA	36@20mA	2.1	3.0	635	25	75	3
SA 343G	Green diffused	80@20mA	36@20mA	2.2	3.0	565	25	75	3
SA 343Y	Yellow diffused	80@20mA	36@20mA	2.2	3.0	585	25	75	3
SA 343E	Orange diffused	80@20mA	36@20mA	2.1	3.0	610	25	75	3
SA 344R	Red clear	200@20mA	56@20mA	2.1	3.0	635	25	75	3
SA 344G	Green clear	200@20mA	56@20mA	2.2	3.0	563	25	75	3
SA 344Y	Yellow clear	200@20mA	56@20mA	2.2	3.0	585	25	75	3
SA 344E	Orange clear	200@20mA	56@20mA	2.1	3.0	610	25	75	3

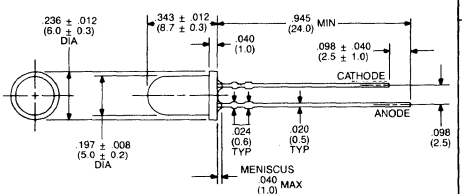
*Water clear available: see PART NUMBER DESIGNATION



PART NUMBER	LENS COLOR AND MATERIAL	ELECTRO-OPTICAL CHARACTERISTICS				λP	MAX RATINGS (T_A = 25°C)		
		LUMINOUS INTENSITY		FORWARD VOLTAGE V_F@I_F = 20mA		I_F = 20mA	I_F	P_D	V_R
		TYP mcd	MIN mcd	TYP V	MAX V	TYP (nm)	(mA)	(mW)	(VDC)
SA 353R	Red diffused	0.8@15mA	0.3@15mA	2.2	2.8	700	25	70	4
SA 353G	Green diffused	2.0@20mA	0.7@20mA	2.2	2.8	565	30	90	4
SA 353Y	Yellow diffused	4.0@20mA	1.4@20mA	2.2	2.8	590	30	90	4

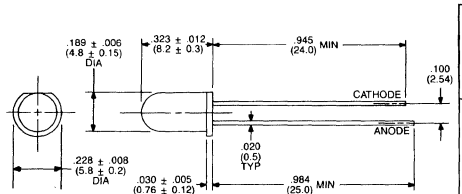
NOTE: OPERATING TEMPERATURE RANGE ON ALL LED's IS −25°C to +85°C.

T-1 3/4



PART NUMBER	LENS COLOR AND MATERIAL*	ELECTRO-OPTICAL CHARACTERISTICS				λP	MAX RATINGS (T_A = 25°C)		
		LUMINOUS INTENSITY		FORWARD VOLTAGE V_F@I_F = 20mA		I_F = 20mA	I_F	P_D	V_R
		TYP mcd	MIN mcd	TYP V	MAX V	TYP (nm)	(mA)	(mW)	(VDC)
SA 543R	Red diffused	100@20mA	40@20mA	2.1	3.0	635	25	75	3
SA 543G	Green diffused	100@20mA	40@20mA	2.2	3.0	565	25	75	3
SA 543Y	Yellow diffused	100@20mA	40@20mA	2.2	3.0	585	25	75	3
SA 543E	Orange diffused	100@20mA	40@20mA	2.1	3.0	610	25	75	3
SA 544R	Red clear	200@20mA	56@20mA	2.1	3.0	635	25	75	3
SA 544G	Green clear	200@20mA	56@20mA	2.2	3.0	563	25	75	3
SA 544Y	Yellow clear	200@20mA	56@20mA	2.2	3.0	585	25	75	3
SA 544E	Orange clear	200@20mA	56@20mA	2.1	3.0	610	25	75	3
SA 635R-5	Water clear	2000@20mA		1.8	2.6	665	30	70	3

*Water clear available: see PART NUMBER DESIGNATION



PART NUMBER	LENS COLOR AND MATERIAL	ELECTRO-OPTICAL CHARACTERISTICS				λP	MAX RATINGS (T_A = 25°C)		
		LUMINOUS INTENSITY		FORWARD VOLTAGE V_F@I_F = 20mA		I_F = 20mA	I_F	P_D	V_R
		TYP mcd	MIN mcd	TYP V	MAX V	TYP (nm)	(mA)	(mW)	(VDC)
SA 553R	Red diffused	9@20mA	4.5@20mA	2.1	2.7	630	30	81	4
SA 553G	Green diffused	3@20mA	1.5@20mA	2.1	2.7	565	30	81	4
SA 553Y	Yellow diffused	4@20mA	2@20mA	2.1	2.7	585	30	81	4
SA 554R	Red clear	40@10mA	56@ 20mA	2.1	2.7	630	30	81	4
SA 554G	Green clear	8@10mA	4@10mA	2.1	2.7	565	30	81	4
SA 554Y	Yellow clear	30@10mA	15@10mA	2.1	2.7	585	30	81	4

PART NUMBER DESIGNATION

SA □ □ □ □

Package Size	Package Style	Diffusion	Color
3 : T-1 ≈ 3mm	4 : Extra Bright	3 : Color diffused	R : Red
5 : T-1 3/4 ≈ 5mm	5 : Std Bright	4 : Color clear	G : Green
		*5 : Water clear	Y : Yellow
			E : Orange

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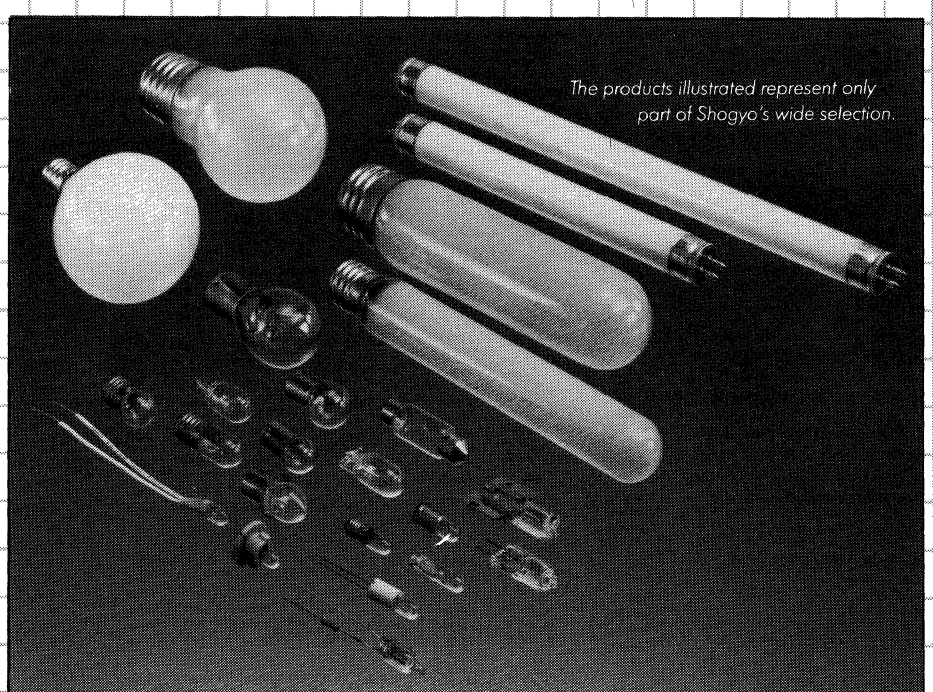

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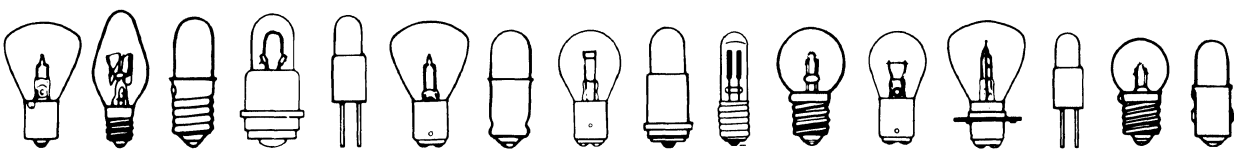

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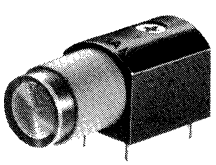
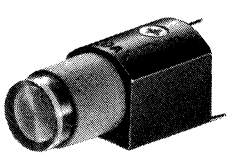
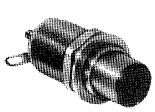




For the last 30 years The Sloan Company has been providing the finest indicator lights available.

For military applications, it's important to know that all of our material and processes meet or exceed military specs.





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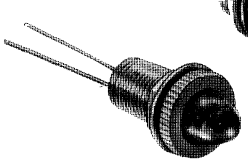

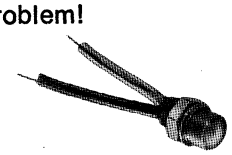

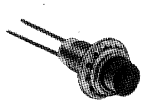

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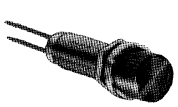





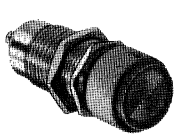

The Sloan Company

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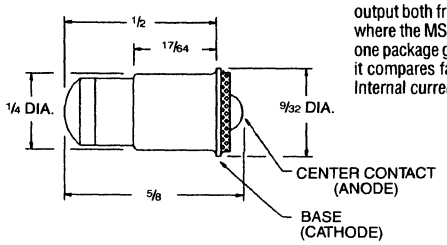
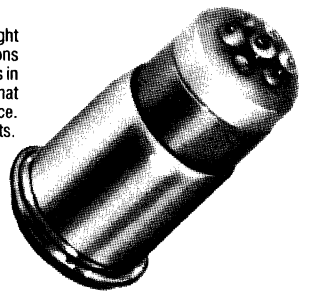
T-1¾ MIDGET FLANGED BASE LED

MODEL 510

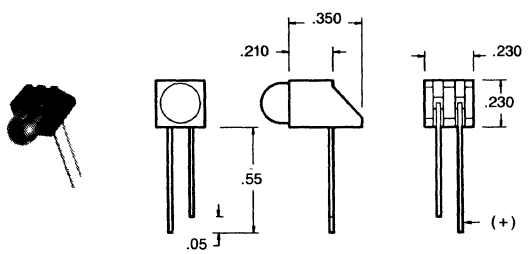


The Model 510 six chip LED T1¾ Midget Flange Base lamp has abundant light output both front and side viewing, for use in indicator lights and other applications where the MS25237 (327, 328, etc.) incandescent lamps are used. The six chips in one package give far greater light output totally than earlier single chip LEDs so that it compares favorably in use with the incandescent lamp it is intended to replace. Internal current limiting resistors allow for supply voltages from 5 up to 28 volts.



CIRCUIT BOARD MOUNT LED

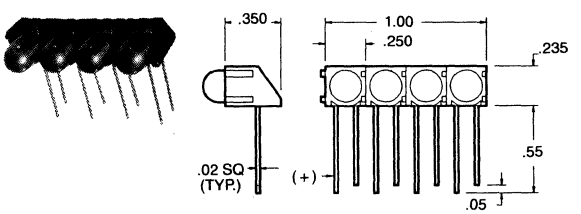
MODEL 210



Designed specifically for parallel mounting to printed circuit boards. Used as single indicator lights mounted in various places along the edge of the printed circuit board on any center-to-center distance.

CIRCUIT BOARD MOUNT LED

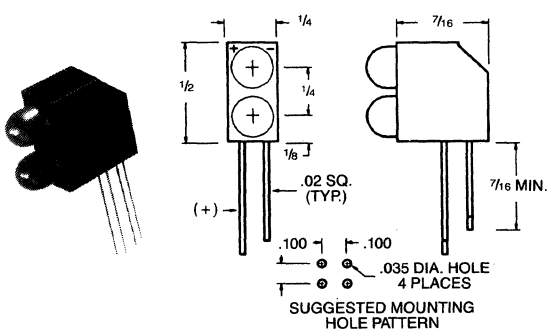
MODEL 211



Designed specifically for parallel mounting to printed circuit boards. Used where two or more indicator lights are needed in arrays of virtually any number. Close tolerance spacing makes assembly of the board with the front panel easy and trouble free.

CIRCUIT BOARD MOUNT LED

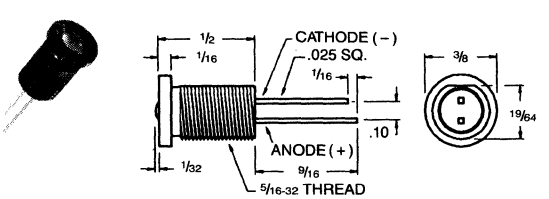
MODEL 220



This is an extremely versatile device for a wide range of applications and space saving status indicator for horizontal mounting in printed circuit boards. The bi-level feature saves board space by cutting space requirements in half. Standard .100 inch center to center distance of the leads make it easy for both assembly and servicing of the circuit board.

PANEL MOUNT LED

MODEL 250



Utilizes hermetically sealed solid state LEDs with high brightness and wide viewing angle. Can be supplied with standard, JAN Qualified, or JANTX LEDs. It can also be supplied with a current limiting resistor depending on your particular requirement. The Model 251 is supplied with an O-ring for proper panel sealing.

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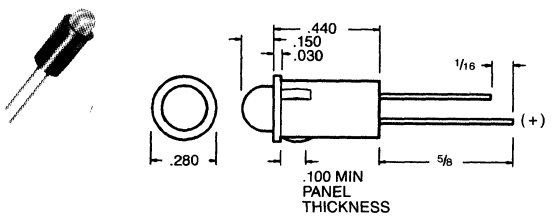
PANEL MOUNT LED

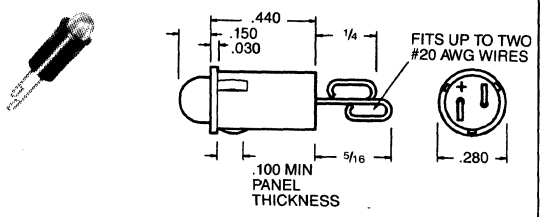
MODEL 240



This model uses high brightness LEDs mounted in easy press to fit bodies. Ideal for fast production, this model presses into place permanently, eliminating the need for mounting hardware. Uses straight terminal leads to which wires can be soldered directly or the leads can be hand soldered into PC boards either vertically or horizontally by bending the leads.

PANEL MOUNT LED

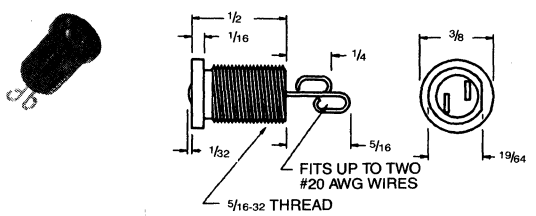
MODEL 241



Identical to Model 240 but has solder loops in the terminal leads to accommodate up to two #20 AWG or smaller wires. Robust terminal leads are formed with the loops in opposite directions to keep the wires apart from each other.

PANEL MOUNT LED

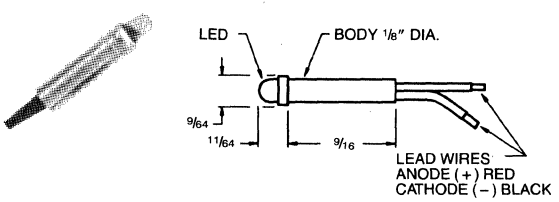
MODEL 252



Identical to the Model 250 except this model incorporates a standard package high bright LED. The Model 253 is supplied with an O-ring for proper panel sealing.

PANEL MOUNT LED

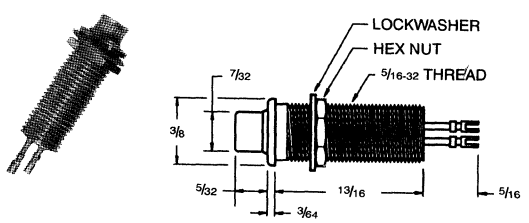
MODEL 5L3



The mini-cartridge provides front panel indication in applications where space is at a premium. The Model 5L3 is one of the smallest panel mount LED on the market. A series resistor is available allowing operation from sources up to 28 volts. Lead wires are color coded for polarity and provide simple solder connections. A speed clip permits easy and positive panel installation.

PANEL MOUNT LED

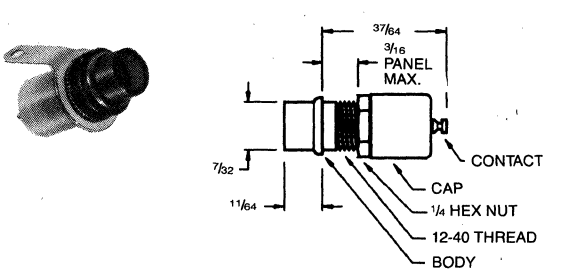
MODEL 3L5



This rugged unit houses high bright T1¾ LEDs in an all metal threaded housing. Termination is by wire wrap posts or solder lugs. Built in current limiting resistors allow these units to be powered from sources up to 28 volts.

PANEL MOUNT REAR RELAMP
INCANDESCENT OR LED

MODEL 107



Designed for rear replacement of T-1 size midget flanged base incandescent or LED lamps. Rugged construction allows operation at severe conditions. Available in different lens configurations. The two terminal version is the 107SI.

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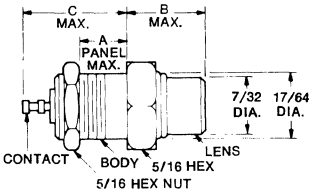
PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

MODEL 102S

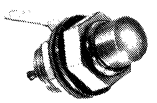


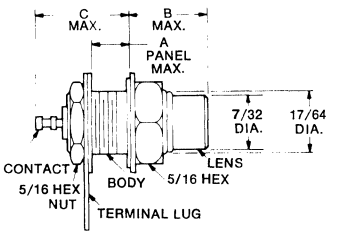


Utilizes the T-1 flanged-based incandescent lamp or LED. An internal silicone rubber pressure pad maintains electrical contact with the lamp and is an effective front-to-back of panel moisture seal.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Delrin per LP-392
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
HDWE—Brass SAE 72 Nickel Plate QQ-N-290 Phenolic per MIL-P-15035 Nylon MIL-M-20693

MODEL 102SI





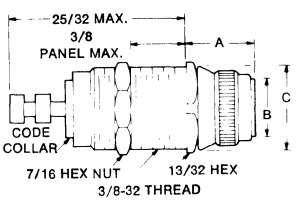
This is the two-terminal version of the basic 102S Model. It is created by the addition of special insulating hardware (above) which includes a solder lug as the second terminal.

NOTE 1—Both the 102S and the 102SI are available in four body styles: S-(above) provides a bright hex flange on the panel, SK-is a knurled flange, SS-a short low-profile hex, and SR-(above left) a small, plain flange.
NOTE 2—The 102S and 102SI are available in several lens styles: Q, QB, DSC, DS, STD. (Contact Factory)
NOTE 3—The 102 series can be furnished in a waterproof version, and can be RF shielded. (Contact Factory)

PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

MODEL 855S

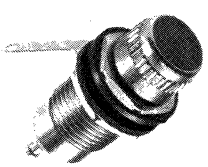


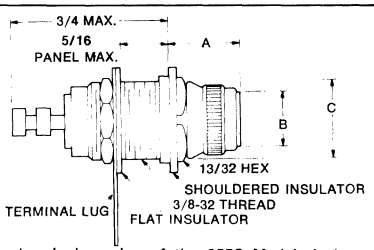


Among the features of the 855 Series are • Small Mounting Size • Front Relamping • Interchangeable Lens Assemblies. Contact pressure is maintained by a silicone rubber pressure pad which seals out moisture front to back of panel. Uses T-1¾ Flanged Base lamp, incandescent or LED.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Butyrate LP-349 Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727
CODE COLLAR—Nylon MIL-M-20693
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693 Linen Base Phenolic MIL-P-15035

MODEL 855SI





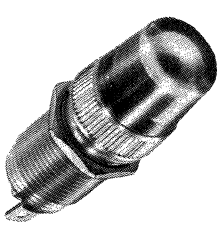
The 855SI Model is the two-terminal version of the 855S Model. It is created by the addition of special insulating hardware (above) which includes a solder lug as the second terminal.

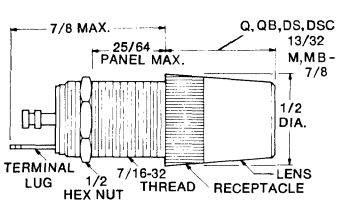
NOTE: Available in Lens styles—Q, QB, DSC, DS, STD, M, MB, D, SE, DDS, U and I, see last page.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693
LENS—Lexan LP-393 Butyrate LP-349 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Nickel Plate QQ-N-290

PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

MODEL 856



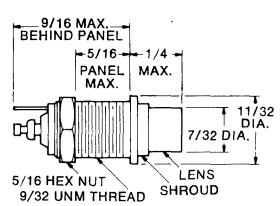


A two-terminal, front-relampable indicator light designed to use the T-1¾ midget flange based incandescent bulb or LED. An internal silicone-rubber pressure-pad maintains electrical contact inside the lamp body. It also provides an effective moisture seal front to back.
NOTE: Available in lenses styles: Q, QB, DSC, DS, M and MB.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693 Delrin per LP-329
LENS—Lexan LP-393 Alum. 2024 Brass SAE 72 Anodize per MIL-A-8625 Nickel Plate QQ-N-290
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727

MODELS—121, 122—123, 124





The 121 Model lamp holder is a two terminal, front relampable indicator light specifically designed for use with T-1 Midget Flange Based incandescent or LED lamps. The 122 is a waterproof version of the 121. The Model 123 is the same but with the more conventional 5/16-32 screw body. The 124 is the waterproof version of the 123.
Available in lens styles: STB, STC, DS, DSC, QB, Q.

MATERIAL & PROCESSES
BODY—Alum. 2024 Anodize MIL-A-8625 Nylon MIL-M-20693 Delrin per LP-392
LENS—Lexan LP-393 Alum. 2024 Brass SAE 72 Anodize per MIL-A-8625 Nickel Plate QQ-N-290
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727

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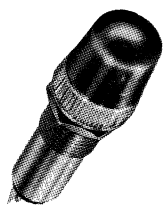
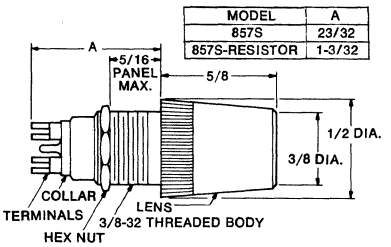
PANEL MOUNT FIXED LAMP

MODEL 857





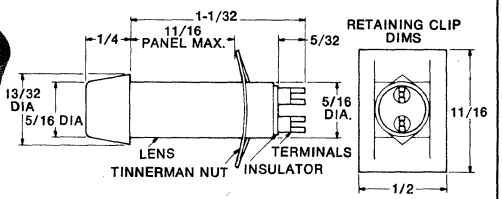
A sub-miniature fixed neon, offering optimum light dispersion and direction. Uses, Hi-Brightness or other NE-2 Series unbased bulb with or without resistors. Mounted in a ⅜ dia. hole with resistor, the Model 857 can be used directly on commercial line currents (115 VAC).

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 General Purpose Phenolic
LENS—Butyrate LP-349
TERMINALS—Brass SAE 72 Tin Plate per MIL-T-10727
HARDWARE—Brass SAE 72 Nickel Plate QQ-N-290

PANEL MOUNT FIXED LAMP
NEON OR INCANDESCENT

MODEL 858





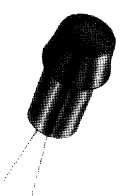
Uses the T-2 unbased neon lamp or can be supplied with the T-1 or T-1¾ unbased incandescent lamp. It accommodates long neon lamps (C2A Type) without dropping resistor built-in, as well as short neon lamps (A1C Type) with dropping resistor built-in. When resistor is built-in it can be used directly on commercial line current (115 volts A.C.). For LED applications see note below.

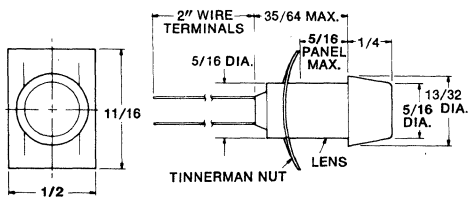
FOR LED APPLICATIONS LED can be supplied as a special in red, green and amber with or without built-in resistor. Voltage up to 28 volts available. (Contact factory).

MATERIAL & PROCESSES
LENS—Butyrate LP-349
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
TINNERMAN NUT—Carbon Steel Phosphate Oil Finish
INSULATOR—General Purpose Phenolic

PANEL MOUNT FIXED LAMP
NEON OR INCANDESCENT

MODEL 859





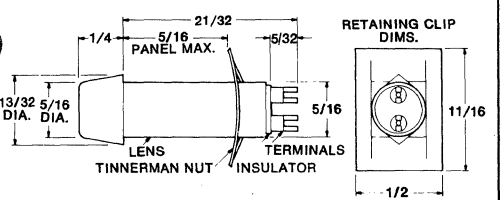
Uses the T-2 unbased neon lamp and long neon lamps without dropping resistor or with dropping resistor. It can also accommodate short neon lamps (A1C type) with or without resistor. With resistor the 859 Series can be used directly with commercial current (115 volts A.C.). Incandescent unbased lamps (T-1 or T-1¾) can also be furnished.

MATERIAL & PROCESSES
LENS—Butyrate LP-349
TINNERMAN NUT—Carbon Steel Phosphate Oil Finish

PANEL MOUNT FIXED LAMP
NEON OR INCANDESCENT

MODEL 862





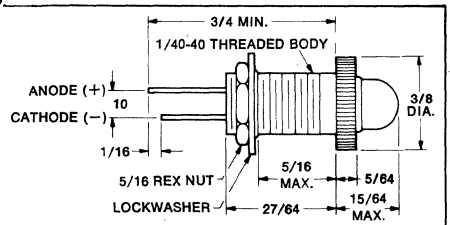
The 862 series accommodates short (A1C) neon lamps only with no resistor built in. Useful where space is limited behind the panel and offers wire wrap™ terminals for soldering.

MATERIAL & PROCESSES
LENS—Butyrate LP-349
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
INSULATOR—General Purpose Phenolic
TINNERMAN NUT—Carbon Steel Phosphate Oil Finish

PANEL MOUNT FIXED LAMP
LED

MODEL 1L3



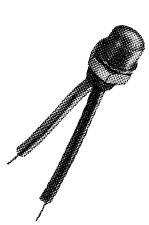


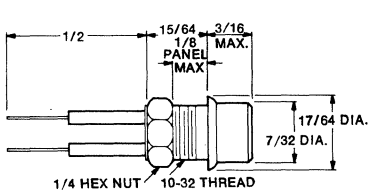
Designed for applications requiring LED indication without a lens. The 1L3 Model provides high brightness in the smallest threaded metal body available in the industry. Termination is by wire leads. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
HDWE—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—.02 Sq. Solid Cu. Tin plated for solderability

PANEL MOUNT FIXED LAMP
INCANDESCENT/LED

MODEL 105S/1L5S





Featuring a T-1 unbased commercial or MIL-Spec. lamp. Standard unit has two ½" long leads. Longer leads furnished upon request. RFI shielding and waterproofed version available. The 1L5S is the LED indicator model.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Lexan LP393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—32 AWG Solid Cu.

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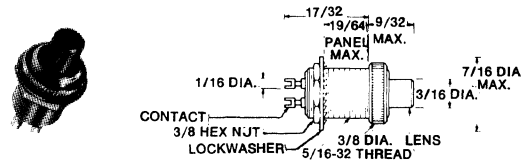
PANEL MOUNT FIXED LAMP
INCANDESCENT/LED

MODEL 106S/1L6



Specifically designed for use with T-1 unbased MIL-Spec., commercial incandescent or LED light source. Can be installed from front or rear of panel.

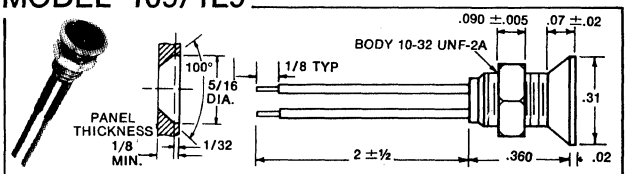
The light source in Model 1L6 is a special high bright T-1¾ LED protruding from a metal body. No lens is provided. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC.

NOTE: The 1L6 is available in red only.

MATERIAL & PROCESSES
BODY/HEX NUT/RD NUT—Brass SAE 72 Nickel Plated QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
LENS—Lexan LP-393 Nylon MIL-M-20693

T-1 UNBASED INCANDESCENT/LED PANEL MOUNT FIXED LAMP

MODEL 109/1L9



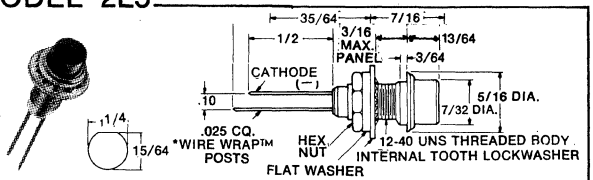
The new flush mount design can be used only with any T-1 size LED or incandescent lamp, including the new super bright LED which gives luminous intensity and color never before possible in the T-1 size. LED colors include red, green and amber with red, green amber, clear and white transparent and translucent lens, and are available with or without a resistor and RFI shielding.

The incandescent models offer the brightness and variety of incandescent colors, including red, green, amber, blue, white and clear with either transparent or translucent lens, and the option of RFI shielding.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Lexan LP-393
TERMINALS—26 AWG Stranded Cu. MIL-W-16878 24 AWG Solid Cu. **MIL-W-16878**
HARDWARE—Brass SAE 72 Nickel Plate QQ-N-290

PANEL MOUNT FIXED LAMP
LED

MODEL 2L5



This Series incorporate a red, green or amber T-1 size LED in an all-metal threaded body. Available with wire leads or wire wrap™ terminals. Two kinds of color contrast lenses are provided. When unlit, the white or clear lens material alone is visible. When lit, the color LED shows through plainly, giving the appearance of a lens which changes color.

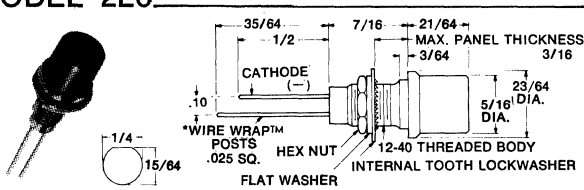
Built-in dropping resistors allow these units to be powered from sources up to 14VDC. Model 2L501 available with superbright LED.

Available with either a round body or flat sided "D" body for consistent terminal location and ease of tightening. *Gardener—Denver

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693
TERMINALS—Phosphor Bronze ¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

PANEL MOUNT FIXED LAMP
LED

MODEL 2L6

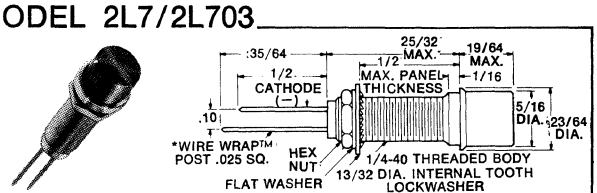


The 2L6 Model incorporates a red, green or amber T-1¾ size Hi-Bright LED in an all-metal threaded body, suitable for panel mounting. Large lens permits 180° visibility, up to 50 mcd. Termination is by wire-wrap™ posts, or wire leads. Lenses available in transparent material for head-on viewing or translucent material for side viewing. Built-in dropping resistors allow these units to be powered from sources up to 14 VDC. Bodies come round or in flat sided "D" for ease of tightening and consistent terminal location. *Gardener—Denver

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290
LENS—Nylon per MIL-M-20693 or Lexan per LP-393
TERMINALS—Phosphor Bronze—¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

PANEL MOUNT FIXED LAMP
HI-BRIGHT LED

MODEL 2L7/2L703

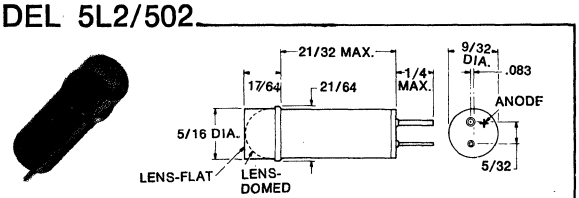


Utilizes a T-1¾ Hi-Bright LED. Permits 180° visibility, up to 50 mcd. The lens incorporates Fresnel rings and flutes which allow maximum distribution of light output. Also available with plain lens (no flutes or rings). Termination is by wire leads or wire-wrap™ post. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC. 2L703 is waterproof version. Bodies can be round or "D" type.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290 Nylon per MIL-M-20693
LENS—Lexan per LP-393
TERMINALS—Phosphor Bronze—¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

PANEL MOUNT FIXED LAMP
LED/INCANDESCENT/NEON

MODEL 5L2/502



These rugged aluminum cartridges incorporate LED, incandescent or neon light sources. Termination is by stainless steel pins suitable for use with a solder lug socket connector, wire wrap™ post adapter or lead wire terminal connector. *Gardener—Denver

Lens styles are flat or domed in transparent or translucent material. All lenses are furnished with fresnel rings for maximum distribution of light output.

MATERIAL & PROCESSES
BODY—Aluminum 3003 Anodize MIL-A-8625
LENS—Butyrate LP-349 Lexan LP-393
TERMINALS—Stainless Steel
HDWE.—General Purpose Phenolic Brass SAE 72 H.T. Spring Steel (Not shown).

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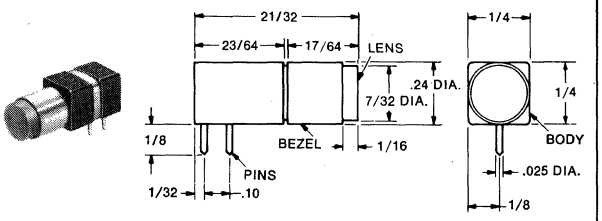
CIRCUIT BOARD MOUNT FRONT RELAMP INCANDESCENT OR LED

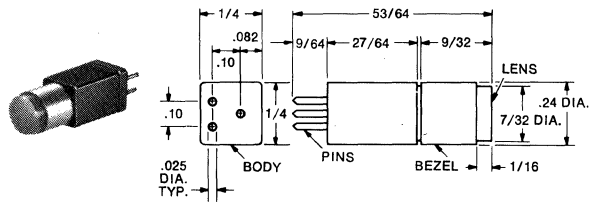
MODEL 101
PARALLEL MOUNT



Designed specifically for printed circuit board mounting. Uses any T-1 flange based lamp.

MATERIAL & PROCESSES
BODY—General Purpose Phenolic Nylon MIL-M-20693
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate per QQ-N-290
TERMINAL PINS—Brass SAE 72 Tin Plate MIL-T-20727 Berylium Copper

MODEL 111
PERPENDICULAR MOUNT



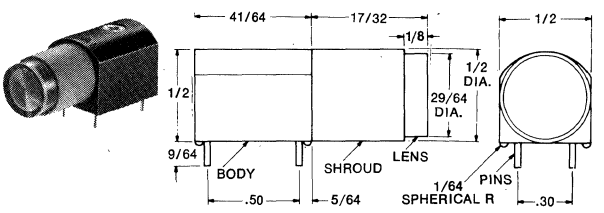
Same features as 101 Model but unit mounts perpendicular to surface of printed circuit board.

MATERIAL & PROCESSES
BODY—General Purpose Phenolic Nylon MIL-M-20693
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate per QQ-N-290
TERMINAL PINS—Brass SAE 72 Tin Plate MIL-T-20727 Berylium Copper

CIRCUIT BOARD MOUNT FRONT RELAMP INCANDESCENT OR LED

MODEL 864
PARALLEL MOUNT

Q8 Lens Shown



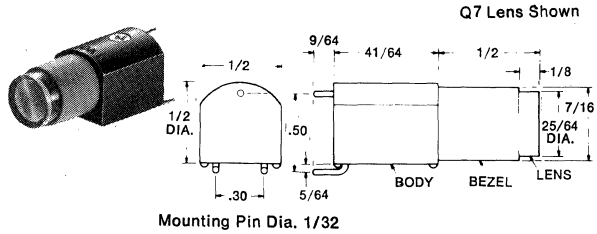
Mounting Pin Dia. 1/32

Designed specifically for printed circuit board mounting. May be used where illumination is need for the circuit board area as well as enunciation thru a panel.
Lens styles available in two diameters: 7/16" (7 series) Q7, QB7, DSC7, DS7 and ½" diameter (8 series) QB, QB8, DSC8, DS8.

MATERIAL & PROCESSES
BODY—Brass SAE 72 General Purpose Phenolic Linen Based Phenolic MIL-P-15035 Nylon MIL-M-20693 Nickel Plate QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727 Phosphor Bronze QQ-W-321

MODEL 874
PERPENDICULAR MOUNT

Q7 Lens Shown



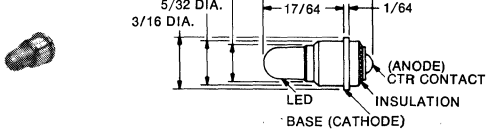
Mounting Pin Dia. 1/32

Same features as 864 Model but unit mounts perpendicular to surface of printed circuit board. Also available in two lens sizes.

MATERIAL & PROCESSES
BODY—Brass SAE 72 General Purpose Phenolic Linen Based Phenolic MIL-P-15035 Nylon MIL-M-20693 Nickel Plate QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727 Phosphor Bronze QQ-W-321

T-1 SUB-MIDGET FLANGED BASE LED

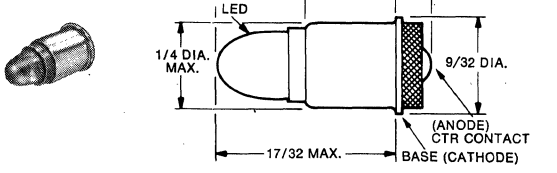
MODEL 4L001



The 4L001, available in diffused lens material is the Sloan T-1 based LED designed to offer diode reliability as a replacement unit in T-1 hardware. When maximum light output is desired using based LEDs in indicator applications, it is recommended that the lens be of transparent material with Fresnel rings. If translucent material is desired, then the lens should be without Fresnel rings.

T-1¾ MIDGET FLANGED BASE LED

MODEL 5L001



The versatile T-1¾ based LED is available in red, green or amber. Viable voltage range is 2.1 volts to 28 volts with power dissipation up to 400mW. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC. The higher voltage capability permits the Sloan T-1¾ based LED to be used as direct replacement for incandescent bulbs in applications where light intensity is not critical but diode reliability is required.

The Sloan Company

"THE TOUCH OF BRILLIANCE IN PANEL DESIGN"

7704 San Fernando Road, P.O. Box 367, Sun Valley, CA 91353
(213) 875-1123 • TWX 910-498-2250 • FAX: (818) 768-8326

GENERAL INFORMATION:

- RFI shielding available with virtually all models.
- It is wise to avoid using blue or green lenses with neon lamps.
- It is also wise to avoid using blue lenses with LED lamps.
- Ultra-bright, multichip and other exotic lamps available.
- All materials meet or exceed applicable military specs.

HOW TO ORDER

Example

LED 2L5 — RL — DL — 5/20

2L5	RL	DL	5/20
Model No.	Lens Color Transparent Red Lexan	Lens Style Domed Fresnel	Voltage/current

INCANDESCENT OR NEON

855S — A — STD. — 327

855S	A	STD.	327
Model No.	Lens Color Amber Gen. Purpose	Lens Style Standard	Lamp Type

INCANDESCENT LAMP ELECTRICAL SPECIFICATIONS

T-1 LAMPS

LAMP	VOLTS	CURRENT (A)	MSCP	LIFE (K HRS.)	INDUSTRY STD. NO
FB60	5	.060	.050	100	685*
FB59	28	.024	.150	16	—
FB44	18	.028	.150	10	—
					*MS-24515

T-1¾ LAMPS

327	28	.04	.340	4000	—
328	6	.20	.600	1000	—
387	28	.04	.300	7000	—

NEON LAMP ELECTRICAL SPECIFICATIONS

LAMP WITH RESISTOR	VOLTS A.C. OR D.C.	AMPS NOMINAL	WATTS NOMINAL	LIFE	RESISTOR
A1B	105-125	.03	1/25	25,000	220K
A1C	105-125	1.2	1/7	25,000	47K
A9A (NE-2E)	105-125	0.7	1/12	25,000	100K
C2A (NE-2H)	105-125	1.9	1/4	25,000	30K

NOTE: A1C and NE2H are high brightness. Other lamps available. Life figures for A.C—Life at D.C. ½ A.C. (Approx.). 862 Series cannot be supplied with resistor. We suggest that you do not order neon with Green or Blue lenses.

IMPORTANT: The lamps shown represent the most popular types normally requested. MANY OTHER LAMPS ARE AVAILABLE—PLEASE CONTACT FACTORY.

COLOR TABLE

LENS MATERIAL	LEXAN	LEXAN	GENERAL PURPOSE	BUTYRATE
Color	Transparent	Translucent	Translucent	Transparent
Red	RL	RLUC	R	RTP
Green	GL	GLUC	G	GTP
Blue	BL	BLUC	B	BTP
Amber	AL	ALUC	A	ATP
Clear	CL	—	—	CTP
White	—	WLUC	W	W

LED LAMP INFORMATION

We have virtually any LED you want. The two basic sizes are T-1 and T-1¾ with flanged bases. The brightest varies with color, with green lowest to red highest. To order extra or super bright lamps simply add 01 or 04 to the model number. One more suggestion do not order LEDs with blue lenses.

NO.	LAMP TYPE	T-1	T-1¾
—	Standard-Bright	2 mcd	3-8 mcd
01	Extra-Bright	8-18 mcd	15-18 mcd
04	Super-Bright	20 mcd	60-80 mcd

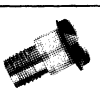
IMPRINTING

Lenses may be hot stamped, engraved, or opaqued and engraved so that the character only is displayed.

The chart below designates type size available for hot stamping. Size of lens determines size of type that can be used.

TYPE	ACTUAL SIZE	
	WIDTH	HEIGHT
2 Pt	.050	.060
6 Pt	.060	.080
8 Pt	.080	.110
10 Pt	.090	.120
12 Pt	.110	.160
NOTE: For other size type, contact factory.		

LENS STYLE

STYLE		DESCRIPTION
Q		Clear anodized bezel allows 180° visibility.
QB		Same as Q lens except with black anodized bezel.
DSC		Clear anodized bezel prevents sidelight emission.
DS		Same as DSC lens except with black anodized bezel.
STD		Full 180° visibility. Maximum illumination.
M		Large lens for maximum visibility from all angles. Engineered to offer the most uniform light distribution. Full 180° visibility.
MB		Same as M lens except with black anodized bezel.
D		Skirted lens covers metal parts for neat panel appearance. Large lighted surface assures positive indication.
SE		Edgelight for plastic panels. Small diameter light gasket minimizes wasted panel space.
DDS		DIMMER: Rotating outer collar changes light output from full to minimum. Rotation to dim can be clockwise or counter-clockwise. Easy adjustment with gloved hand.
U		UNLIMITED: Has no lens to diminish light output. Specifically suited to T-1¾ flanged based LED for maximum light output.

120 SERIES

STB		Full 180° visibility. Maximum illumination. Black bezel.
STC		Full 180° visibility. Maximum illumination. Clear bezel.
QB		Black anodized bezel allows 180° visibility.
Q		Same as QB lens except with clear anodized bezel.

STYLES

FLAT		NOTE: Lens style may be flat or domed, plain or lensed, meaning that the lens is provided with internal concentric rings on the inner face and flutes on the sides, thus giving better light distribution.
DOMED		

OPTO ELECTRONIC COMPONENTS/HI-SUPER BRIGHT LED LAMP

Stanley Opto Electronic Components

Stanley has attained the position of world's leader in bright LEDs, including the H-3000 (3000 mcd) and H-2000 (2000 mcd) GaAlAs (galium-aluminum-arsenide) red LEDs, a high-intensity pure green LED with a peak wavelength at 555 nm, and attractive bright yellow and orange LEDs to complete a series of 4 colors.
For the infrared region as well, Stanley Electric has captured the position of world leader with super-bright GaAlAs infrared LEDs, four types being available, having wavelengths of 850, 880, 925 and 950 nm. For use as light-receiving elements, a full Stanley line of phototransistors and PIN photodiodes is available, covering requirements in a wide range of applications.
Stanley is ready to respond to requirements for photosensors consisting of combinations of high-reliability light-emitting and light-receiving elements. Consult us on what these products can do for yours.

- Our super bright light emitting diode is the result of joint development by Stanley and the Semiconductor Research Promotion Association under the leadership of Professor Jun-ichi Nishizawa of Tohoku University.
- The LED won the 26th Ohkochi Memorial Prize, the 7th Harushige Inoue Award and the 1983 Nikkei Annual Award.
- Stanley's high-output infrared LED, DN series won the 1985 Nikkei Annual Award.


Ohkochi Memorial Prize


Harushige Inoue Award


Nikkei Memorial Award

■HI-SUPER BRIGHT LED LAMP

Shape	Type No.	Emitted Color	λp(TYP.) (nm)	Iv (TYP.) (mcd)	Iv (TYP.) IF (mA)	Resin Color
φ5	H-3000-L	Red	660	3,000	20	Water Clear
	H-2000-L	Red	660	2,000	20	Water Clear
	H-1000-L	Red	660	1,000	20	Water Clear
	ER-700-L	Red	660	700	20	Water Clear
	ER-500-L	Red	660	500	20	Water Clear
	ER-300-L	Red	660	300	20	Water Clear
φ5	HBR5066X	Red	660	300	20	Pastel Red
	HBG5066X	Green	555	150	20	Pastel Green
	HPG5066X	Green	560	200	20	Pastel Green
	HPY5066X	Yellow	570	300	20	Pastel Yellow
	HAY5066X	Yellow	580	150	20	Pastel Yellow
	HAA5066X	Orange	605	250	20	Pastel Orange
φ5 φ4	KR5004X	Red	660	800	20	Water Clear
	KR5505S	Red	660	300	20	Water Clear
	KR4505S	Red	660	200	20	Water Clear

■φ7.6 TYPE

Shape	Type No.	Emitted Color	λP(TYP.) (nm)	Iv (TYP.) (mcd)	Iv (TYP.) IF (mA)	Resin Color
	KR7001X	Red	660	1,000	20	Water Clear
	HBR7001X	Red	660	400	20	Water Clear
	HBR7071X	Red	660	60	20	Pastel diff
	HPY7071X	Yellow	570	60	20	Pastel diff
	ERPY7301X	Red	660	200	20	Water Clear
		Yellow	570	200	20	Water Clear

■BICOLOR LED LAMP

Shape	Type No.	Emitted Color	λP(TYP.) (nm)	Iv (TYP.) (mcd)	Iv (TYP.) IF (mA)	Resin Color
2×5	VRPY5341K	Red	630	4.0	20	White diff
		Yellow	570	4.0	20	
	VRBG5341K	Red	630	4.0	20	White diff
		Green	555	4.0	20	
φ3	VRPY3349S	Red	630	4.0	20	White diff
		Yellow	570	6.0	20	
	VRBG3349S	Red	630	4.0	20	White diff
		Green	555	1.6	20	
φ3	VRPY3312X	Red	630	8.0	20	White diff
		Yellow	570	16.0	20	
	VRPG3312X	Red	630	8.0	20	White diff
		Green	560	12.0	20	
	VRBG3312X	Red	630	8.0	20	White diff
		Green	555	6.0	20	
φ5	VRPY5314S/ 5315S	Red	630	20/12	20	White diff
		Yellow	570	24/20	20	
	VRBG5314S/ 5315S	Red	630	20/12	20	White diff
		Green	555	8/6	20	
φ5	VRPY5345X	Red	630	3.0	20	White diff
		Yellow	570	4.0	20	
	VRBG5345X	Red	630	3.0	20	White diff
		Green	555	1.6	20	

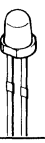
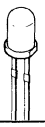
■PANEL LIGHTING LED LAMP

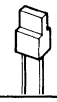
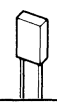
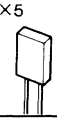
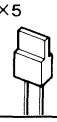
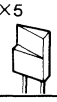
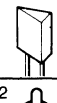
Shape	Type No.	Emitted Color	λp(TyP.) (nm)	Iv (TYP.) (mcd)	Iv (TYP.) IF (mA)	Resin Color
φ3	BR3665S	Red	660	3.0	20	Pastel Red
	PR3665S	Red	700	0.8	10	Pastel Red
	VR3665S	Red	630	3.0	20	Pastel Red
	BG3665S	Green	555	1.0	20	Pastel Green
	PG3665S	Green	560	3.0	20	Pastel Green
	PY3665S	Yellow	570	3.0	20	Pastel Yellow
	AY3665S	Yellow	580	3.0	20	Pastel Yellow
	AA3665S	Orange	605	3.0	20	Pastel Orange
φ5	BR5562X	Red	660	8.6	20	Pastel Red
	PR5562X	Red	700	0.6	10	Pastel Red
	VR5562X	Red	630	6.0	20	Pastel Red
	BG5562X	Oreen	555	1.6	20	Pastel Green
	PG5562X	Green	560	4.0	20	Pastel Green
	PY5562X	Yellow	570	6.0	20	Pastel Yellow
	AY5562X	Yellow	580	6.0	20	Pastel Yellow
	AA5562X	Orange	605	6.0	20	Pastel Orange
φ3	BR3361X	Red	660	12.0	20	Pastel Red
	MPR3361X	Red	700	1.6	10	Pastel Red
	MVR3361X	Red	630	8.0	20	Pastel Red
	MBG3361X	Green	555	6.0	20	Pastel Green
	MPG3361X	Green	560	12.0	20	Pastel Green
	MPY3361X	Yellow	570	20.0	20	Pastel Yellow
	MAY3361X	Yellow	580	10.0	20	Pastel Yellow
	MAA3361X	Orange	605	12.0	20	Pastel Orange
φ5	BR5763X	Red	660	30.0	20	Pastel Red
	MPR5763X	Red	700	4.0	10	Pastel Red
	MVR5763X	Red	630	20.0	20	Pastel Red
	MBG5763X	Green	555	10.0	20	Pastel Green
	MPG5763X	Green	560	20.0	20	Pastel Green
	MPY5763X	Yellow	570	30.0	20	Pastel Yellow
	MAY5763X	Yellow	580	20.0	20	Pastel Yellow
	MAA5763X	Orange	605	20.0	20	Pastel Orange
2×3	BR3363K	Red	660	20.0	20	Pastel Red
	MPR3363K	Red	700	4.0	10	Pastel Red
	MVR3363K	Red	630	16.0	20	Pastel Red
	MBG3363K	Green	555	12.0	20	Pastel Green
	MPG3363K	Green	560	30.0	20	Pastel Green
	MPY3363K	Yellow	570	60.0	20	Pastel Yellow
	MAY3363K	Yellow	580	40.0	20	Pastel Yellow
	MAA3363K	Orange	605	40.0	20	Pastel Orange
2×4	BR4868K	Red	660	10.0	20	Pastel Red
	MPR4868K	Red	700	1.5	10	Pastel Red
	MVR4868K	Red	630	8.0	20	Pastel Red
	MBG4868K	Green	555	4.0	20	Pastel Green
	MPG4868K	Green	560	8.0	20	Pastel Green
	MPY4868K	Yellow	570	12.0	20	Pastel Yellow
	MAY4868K	Yellow	580	10.0	20	Pastel Yellow
	MAA4868K	Orange	605	10.0	20	Pastel Orange
2.5×5	BR5379K	Red	660	24.0	20	Pastel Red /diff
	MPR5379K	Red	700	3.0	10	Pastel Red /diff
	MVR5379K	Red	630	20.0	20	Pastel Red /diff
	MBG5379K	Green	555	6.0	20	Pastel Green /diff
	MPG5379K	Green	560	24.0	20	Pastel Green /diff
	MPY5379K	Yellow	570	40.0	20	Pastel Yellow /diff
	MAY5379K	Yellow	580	24.0	20	Pastel Yellow /diff
	MAA5379K	Orange	605	44.0	20	Pastel Orange/diff
2×3	BR3822K	Red	660	4.0	20	Red Clear
	PR3822K	Red	700	0.8	10	Red Clear
	BG3822K	Green	555	2.0	20	Green Clear
	PY3822K	Yellow	570	4.0	20	Yellow Clear
	AY3822K	Yellow	580	4.0	20	Yellow Clear
	AA3822K	Orange	605	4.0	20	Orange Clear

STANLEY STANLEY CO., INC. 2661 Gates Avenue #200, Irvine CA 92714 • (714) 222-0777 • FAX (714) 222-0555 • 800-LED-LCD1

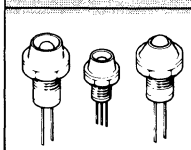
SUPER BRIGHT LED LAMP/PANEL MOUNT LED

■SUPER BRIGHT LED LAMP

Shape	Type No.	Emitted color	λp(TYP.) (nm)	Iv (TYP.) (mcd)	Iv (TYP.) IF(mA)	Resin Color
φ1.6 	EBR2202S/2222S	Red	660	8	20	Water/Red Clear
	BR2202S/2222S	Red	660	4	20	Water/Red Clear
	AR2202S/2222S	Red	650	2	20	Water/Red Clear
	PR2202S/2222S	Red	700	1.6	10	Water/Red Clear
	BG2202S/2222S	Green	555	2	20	Water/Green Clear
	PG2222SY	Green	565	3	20	Green Clear
	PY2202S/2222S	Yellow	570	4	20	Water/Yellow Clear
	AY2202S/2222S	Yellow	580	2	20	Water/Yellow Clear
	AA2202S/2222S	Orange	605	2.4	20	Water/Orange Clear
φ3 	BR3868S/3878S	Red	660	80/30	20	Pastel Red /diff
	MVR3868S/3878S	Red	630	40/20	20	Pastel Red /diff
	MPR3868S/3878S	Red	700	6/3	10	Pastel Red /diff
	MBG3868S/3878S	Green	555	20/10	20	Pastel Green /diff
	MPG3868S/3878S	Green	560	40/20	20	Pastel Green /diff
	MPY3868S/3878S	Yellow	570	60/30	20	Pastel Yellow /diff
	MAY3868S/3878S	Yellow	580	40/20	20	Pastel Yellow /diff
	MAA3868S/3878S	Orange	605	40/20	20	Pastel Orange/diff
φ4 	BR4565S/4575S	Red	660	20/12	20	Pastel Red /diff
	MVR4565S/4575S	Red	630	16/10	20	Pastel Red /diff
	MPR4565S/4575S	Red	700	3/1.2	10	Pastel Red /diff
	MBG4565S/4575S	Green	555	10/6	20	Pastel Green /diff
	MPG4565S/4575S	Green	560	20/12	20	Pastel Green /diff
	MPY4565S/4575S	Yellow	570	30/16	20	Pastel Yellow /diff
	MAY4565S/4575S	Yellow	580	20/8	20	Pastel Yellow /diff
	MAA4565S/4575S	Orange	605	20/8	20	Pastel Orange/diff
φ5 	EBR5504S/5534S	Red	660	160/30	20	Clear/Red /diff
	EBG5504S/5534S	Green	555	80/12	20	Clear/Green /diff
	EPY5504S/5534S	Yellow	570	160/45	20	Clear/Yellow /diff
	EAY5504S/5534S	Yellow	580	90/24	20	Clear/Yellow /diff
	EAA5504S/5534S	Orange	605	90/24	20	Clear/Orange/diff
	BR5504S/5534S	Red	660	80/20	20	Clear/Red /diff
	BG5504S/5534S	Green	555	40/8	20	Clear/Green /diff
	PY5504S/5534S	Yellow	570	80/30	20	Clear/Yellow /diff
	AY5504S/5534S	Yellow	580	60/16	20	Clear/Yellow /diff
	AA5504S/5534S	Orange	605	60/16	20	Clear/Orange/diff
φ5 	MVR5764X/5774X	Red	630	100/60	20	Pastel Red /diff
	MPR5764X/5774X	Red	700	10/6	10	Pastel Red /diff
	MBG5764X/5774X	Green	555	40/16	20	Pastel Green /diff
	MPG5764X/5774X	Green	560	100/40	20	Pastel Green /diff
	MPY5764X/5774X	Yellow	570	120/60	20	Pastel Yellow /diff
	MAY5764X/5774X	Yellow	580	80/40	20	Pastel Yellow /diff
	MAA5764X/5774X	Orange	605	100/50	20	Pastel Orange/diff
φ3 	BR3889S	Red	660	8.0	20	Pastel Red diff
	PR3889S	Red	700	0.9	10	Pastel Red diff
	VR3889S	Red	630	6.0	20	Pastel Red diff
	BG3889S	Green	555	1.6	20	Pastel Green diff
	PG3889S	Green	560	4.0	20	Pastel Green diff
	PY3889S	Yellow	570	5.0	20	Pastel Yellow diff
	AY3889S	Yellow	580	4.0	20	Pastel Yellow diff
	AA3889S	Orange	605	5.0	20	Pastel Orange diff
φ5 	BR5785X	Red	660	6.0	20	Pastel Red diff
	PR5785X	Red	700	0.9	10	Pastel Red diff
	VR5785X	Red	630	6.0	20	Pastel Red diff
	BG5785X	Green	555	1.6	20	Pastel Green diff
	PG5785X	Green	560	5.0	20	Pastel Green diff
	PY5785X	Yellow	570	6.0	20	Pastel Yellow diff
	AY5785X	Yellow	580	5.0	20	Pastel Yellow diff
	AA5785X	Orange	605	6.0	20	Pastel Orange diff
φ3.6 	BR4361F/4371F	Red	660	20/10	20	Pastel Red /diff
	MVR4361F/4371F	Red	630	8/6	20	Pastel Red /diff
	MPR4361F/4371F	Red	700	1.2/1.0	10	Pastel Red /diff
	MBG4361F/4371F	Green	555	6/3	20	Pastel Green /diff
	MPG4361F/4371F	Green	560	10/6	20	Pastel Green /diff
	MPY4361F/4371F	Yellow	570	12/10	20	Pastel Yellow /diff
	MAY4361F/4371F	Yellow	580	10/8	20	Pastel Yellow /diff
	MAA4361F/4371F	Orange	605	10/8	20	Pastel Orange/diff

Shape	Type No.	Emitted Color	λp(TYP.) (nm)	Iv (TYP.) (mcd)	Iv (TYP.) IF(mA)	Resin Color
2×2 	PR2651K	Red	700	0.5	10	Red diff
	BG2651K	Green	555	0.8	20	Green diff
	PG2651KY	Green	565	3.0	20	Green diff
	AY2651K	Yellow	580	2.0	20	Yellow diff
	AA2651K	Orange	605	2.0	20	Orange diff
1.5×4 	PR4652K	Red	700	0.6	10	Red diff
	BG4652K	Green	555	1.2	20	Green diff
	PG4652KY	Green	565	3.0	20	Green diff
	PY4652K	Yellow	570	4.0	20	Yellow diff
	AY4652K	Yellow	580	3.0	20	Yellow diff
	AA4652K	Orange	605	3.0	20	Orange diff
2×4 	PR4553K	Red	700	0.5	10	Red diff
	BG4553K	Green	555	1.0	20	Green diff
	PG4553KY	Green	565	3.0	20	Green diff
	PY4553K	Yellow	570	4.0	20	Yellow diff
	AY4553K	Yellow	580	2.0	20	Yellow diff
	AA4553K	Orange	605	2.0	20	Orange diff
2×5 	PR5551K	Red	700	0.5	10	Red diff
	BG5551K	Green	555	1.0	20	Green diff
	PG5551KY	Green	565	3.0	20	Green diff
	PY5551K	Yellow	570	4.0	20	Yellow diff
	AY5551K	Yellow	580	2.4	20	Yellow diff
	AA5551K	Orange	605	2.4	20	Orange diff
1×5 	PR5552K	Red	700	0.5	10	Red diff
	BG5552K	Green	555	1.0	20	Green diff
	PG5552KY	Green	565	3.0	20	Green diff
	PY5552K	Yellow	570	4.0	20	Yellow diff
	AY5552K	Yellow	580	2.4	20	Yellow diff
	AA5552K	Orange	605	2.4	20	Orange diff
5×5 	PR5553K	Red	700	0.5	10	Red diff
	BG5553K	Green	555	1.0	20	Green diff
	PG5553KY	Green	565	3.0	20	Green diff
	PY5553K	Yellow	570	4.0	20	Yellow diff
	AY5553K	Yellow	580	2.4	20	Yellow diff
	AA5553K	Orange	605	2.4	20	Orange diff
2.5×5 	BR5556K	Red	660	2.0	20	Red diff
	PR5556K	Red	700	0.5	10	Red diff
	BG5556K	Green	555	0.8	20	Green diff
	PG5556KY	Green	565	3.0	20	Green diff
	PY5556K	Yellow	570	3.0	20	Yellow diff
	AY5556K	Yellow	580	2.0	20	Yellow diff
	AA5556K	Orange	605	2.0	20	Orange diff
2.4×7.2 	BR7851K	Red	660	3.0	20	Red diff
	PR7851K	Red	700	0.5	10	Red diff
	PG7851KY	Green	565	3.0	20	Green diff
	PY7851K	Yellow	570	4.0	20	Yellow diff
	AA7851K	Orange	605	2.4	20	Orange diff
2×5 	PR5552T	Red	700	0.5	10	Red diff
	BG5552T	Green	555	1.0	20	Green diff
	PG5552TY	Green	565	3.0	20	Green diff
	AY5552T	Yellow	580	2.4	20	Yellow diff
	AA5552T	Orange	605	2.4	20	Orange diff
3×5 	PR5553T	Red	700	0.5	10	Red diff
	BG5553T	Green	555	1.0	20	Green diff
	PG5553TY	Green	565	3.0	20	Green diff
	AY5553T	Yellow	580	2.4	20	Yellow diff
	AA5553T	Orange	605	2.4	20	Orange diff
φ2 	PR2533D	Red	700	1.0	10	Red diff
	BG2533D	Green	555	2.0	20	Green diff
	AY2533D	Yellow	580	3.0	20	Yellow diff
	AA2533D	Orange	605	3.0	20	Orange diff
φ2 	PR2434D	Red	700	0.6	10	Red diff
	BG2434D	Green	555	1.2	20	Green diff
	AY2434D	Yellow	580	2.4	20	Yellow diff
	AA2434D	Orange	605	2.4	20	Orange diff

■PANEL MOUNT LED

Shape	Type No.	Emitted Color	Electro-Optical Characteristics VF (TYP.) (V)	VF (TYP.) IF (mA)	IR (MAX.) (μA)	IR (MAX.) VR (V)	λp (TYP.) (nm)	λp (TYP.) IF (mA)	Iv (TYP.) (mcd)	Iv (TYP.) IF (mA)	Resin Color
	SDB505ARD/BRD/CRD	Red	1.7	20	100	4	650	20	2.0	20	Red diff
	SDB505AGD/BGD/CGD	Green	2.1	20	100	4	555	20	2.0	20	Green diff
	SDB505AYD/BYD/CYD	Yellow	2.2	20	100	4	580	20	2.4	20	Yellow diff
	SDB506RG	Red	2.1	10	100	3	700	10	0.5	10	White diff
		Green	2.1	20	100	3	570	20	1.0	20	
	SDB205ARD/BRD/CRD	Red	1.7	20	100	4	650	20	2.0	20	Red diff
	SDB205AGD/BGD/CGD	Green	2.1	20	100	4	555	20	2.0	20	Green diff
	SDB205AYD/BYD/CYD	Yellow	2.2	20	100	4	580	20	2.4	20	Yellow diff

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SUPER BRIGHT CHIP TYPE LED/SUPER BRIGHT LED LIGHT BAR MODULE

■CHIP TYPE LED

(Single color)

Shape	Type No.	Emitted Color	λp(TYP.) (nm)	Iv (TYP.) (mcd)	Iv (TYP.) IF(mA)
3L×1.5W×1.5H 	BR1101W	Red	660	4.5	20
	VR1101W	Red	630	2.5	20
	PR1101W	Red	700	0.7	10
	BG1101W	Green	555	1.4	20
	PG1101W	Green	560	3	20
	PY1101W	Yellow	570	4	20
	AY1101W	Yellow	580	3.2	20
	AA1101W	Orange	605	3.6	20
3L×1.5W×1.5H 	BR1102W	Red	660	17	20
	VR1102W	Red	630	6	20
	PR1102W	Red	700	1.5	10
	BG1102W	Green	555	2.3	20
	PG1102W	Green	560	7.5	20
	PY1102W	Yellow	570	12	20
	AY1102W	Yellow	580	6	20
	AA1102W	Orange	605	9	20

(Bicolor)

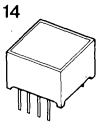
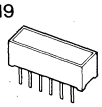
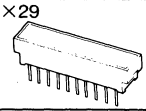
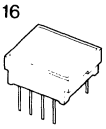
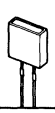
Shape	Type No.	Emitted Color	λp(TYP.) (nm)	※Iv(TYP.) (mcd)
3L×2.5W×1.5H 	BRBG1201W	Red/Green	660/555	4.5/1.4
	BRPG1201W	Red/Green	660/560	4.5/3
	BRPY1201W	Red/Yellow	660/570	4.5/4
3L×2.5W×1.5H 	BRBG1202W	Red/Green	660/555	9/4
	BRPG1202W	Red/Green	660/560	9/6
	BRPY1202W	Red/Yellow	660/570	9/8
3L×2W×1.5H 	BRBG1203W	Red/Green	660/555	10/2.3
	BRPG1203W	Red/Green	660/560	10/7.5
	BRPY1203W	Red/Yellow	660/570	10/12
3L×2.5W×1.5H 	BRBG1204W	Red/Green	660/555	17/2.3
	BRPG1204W	Red/Green	660/560	17/7.5
	BRPY1204W	Red/Yellow	660/570	17/12

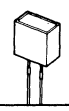
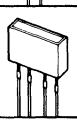
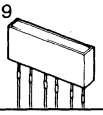
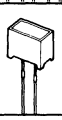
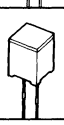
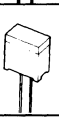
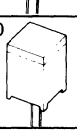
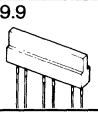
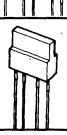
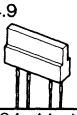
- These are ultracompact LED lamps suitable for surface mounting. They are packed in reels of 2500 pieces.

※IF=20mA

■SUPER BRIGHT LED LIGHT BAR MODULE

(Ta=25°C)

Shape	Type No.	Emitted Color	Number of Chips	λp (TYP.) (nm)	Iv (TYP.) (mcd)
14×14 	MU02-2201	Red	4	660	42
	MU02-3201	Orange	4	605	20
	MU02-4201	Yellow	4	570	42
	MU02-5201	Green	4	555	20
	MU02-9301	Red/Green	4/4	660/555	12/12
6×9 	MU03-2250	Red	1	660	10
	MU03-2201	Red	2	660	20
	MU03-3201	Orange	2	605	10
	MU03-4201	Yellow	2	570	20
	MU03-5201	Green	2	555	10
	MU03-9201	Red/Green	1/1	660/555	7/4
6×19 	MU04-2101	Red	3	660	32
	MU04-3101	Orange	3	605	16
	MU04-4101	Yellow	3	570	32
	MU04-5101	Green	3	555	16
6×29 	MU07-2101	Red	5	660	40
	MU07-3101	Orange	5	605	20
	MU07-4101	Yellow	5	570	40
	MU07-5101	Green	5	555	20
14×16 	MU08-2201	Red	4	660	42
	MU08-3201	Orange	4	605	20
	MU08-4201	Yellow	4	570	40
	MU08-5201	Green	4	555	20
	MU08-9301	Red/Green	4/4	660/555	12/12
φ6.4 	MU09-9101	Red/Green	1/2	660/555	8/6
	MU09-9102	Red/Yellow	1/2	660/570	8/12
	MU09-9103	Red/Orange	1/2	660/605	8/8
4.6×9.5 	MU11-2201	Red	2	660	20
	MU11-3201	Orange	2	605	10
	MU11-4201	Yellow	2	570	20
	MU11-5201	Green	2	555	10
9×9 	MU13-9101	Red/Green	1/5	660/555	12/14
	MU13-9102	Red/Yellow	1/5	660/570	12/40
3×8 	MU14-2101	Red	1	660	8
	MU14-3101	Orange	1	605	6
	MU14-4101	Yellow	1	570	8
	MU14-5101	Green	1	555	4

Shape	Type No.	Emitted Color	Number of Chips	λp (TYP.) (nm)	Iv (TYP.) (mcd)
5×8 	MU15-2101	Red	1	660	8
	MU15-3101	Orange	1	605	6
	MU15-4101	Yellow	1	570	8
	MU15-5101	Green	1	555	4
4×12 	MU16-2101	Red	2	660	16
	MU16-3101	Orange	2	605	12
	MU16-4101	Yellow	2	570	16
	MU16-5101	Green	2	555	8
4×19 	MU17-2101	Red	3	660	24
	MU17-3101	Orange	3	605	18
	MU17-4101	Yellow	3	570	24
	MU17-5101	Green	3	555	10
5×9 	MU20-2101	Red	1	660	8
	MU20-3101	Orange	1	605	6
	MU20-4101	Yellow	1	570	8
	MU20-5101	Green	1	555	4
6×6 	MU91-2001	Red	1	660	6
	MU91-3001	Orange	1	605	6
	MU91-4001	Yellow	1	570	6
	MU91-5001	Green	1	555	2.4
5×9 	MU92-2001	Red	1	660	6
	MU92-3001	Orange	1	605	6
	MU92-4001	Yellow	1	570	6
	MU92-5001	Green	1	555	2.4
10×10 	MU93-2001	Red	1	660	8
	MU93-3001	Orange	1	605	8
	MU93-4001	Yellow	1	570	8
	MU93-5001	Green	1	555	3
2×19.9 	BR0014(15)※	Red	3	660	16
	AA0014(15)※	Orange	3	605	10
	PY0014(15)※	Yellow	3	570	20
	BG0014(15)※	Green	3	555	6
2×9.9 	BR0034(35)※	Red	2	660	10
	AA0034(35)※	Orange	2	605	6
	PY0034(35)※	Yellow	2	570	12
	BG0034(35)※	Green	2	555	4
2×14.9 	BR0044(45)※	Red	2	660	10
	AA0044(45)※	Orange	2	605	6
	PY0044(45)※	Yellow	2	570	12
	BG0044(45)※	Green	2	555	4

※14, 34, 44 : White diff, 15, 35, 45,: Colored diff. IF=20mA

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INFRARED EMITTING DIODE/PHOTO TRANSISTOR/PIN PHOTO DIODE/OPTO SWITCH

■INFRARED EMITTING DIODE

AN series (GaAs) λp : 950nm (Ta=25°C)

Type No.	Shape	Absolute Maximum Ratings Pd (mW)	IF (mA)	Electro-Optical Characteristics Ie(mW/sr)	Δθ(deg.)	Application
AN 106	TO-18.Glass Lens	150	100	25	4	Photosensor, Photoswitch
AN 202	TO-18 Flat-Glass Lens	150	100	2.5	54	Photosensor, Photoswitch
AN 111	φ3 Ceramic	75	50	5	110	Photosensor
AN 303	φ3 Epoxy	150	100	9	15	Remotecontrol, Photosensor
AN 304	φ5 Epoxy	150	100	15	50	Remotecontrol, Photosensor
AN 305	φ5 Epoxy	150	100	25	18	Remotecontrol, Photosensor
AN 306	φ3 Epoxy	150	100	14	30	Photosensor
AN 501	Axial Leads. Epoxy	75	50	5	16	Photosensor
AN 505	Right Angle. Epoxy	150	100	4	5	Photointerrupter

VF=1.3V IF=50mA

BN series (GaAs) λp : 925nm (Ta=25°C)

Type No.	Shape	Absolute Maximum Ratings Pd (mW)	IF (mA)	Electro-Optical Characteristics Ie(mW/sr)	Δθ(deg.)	Application
BN 101	TO-18.Glass Lens	150	100	6.5	12	Photosenser, Photoswitch
BN 201	TO-18.Flat-Glass Lens	150	100	0.3	74	Photosensor, Photoswitch
BN 301	φ5 Epoxy	100	50	7.0	12	Remotecontrol, Photosensor
BN 401	φ5 Epoxy Flat Lens	100	50	0.8	96	Optical data transmission, Photosensor
BN 501	Axial Leads. Epoxy	60	40	1.5	52	Photosensor
BN 504	Right Angle. Epoxy	100	50	1.0	100	Photosensor
BN 505	Right Angle. Epoxy	100	50	1.5	26	Photointerrupter

VF=1.2V, IF=20mA

CN series (GaAlAs) λp : 880nm (Ta=25°C)

Type No.	Shape	Absolute Maximum Ratings Pd (mW)	IF (mA)	Electro-Optical Characteristics Ie(mW/sr)	Δθ(deg.)	Application
CN 106	TO-18.Glass Lens	150	100	30	6	Photosenser, Photoswitch
CN 202	TO-18.Flat-Glass Lens	150	100	3	30	Photosensor, Photoswitch
CN 303	φ3 Epoxy	150	100	12	20	Photoseosor
CN 304	φ5 Epoxy	150	100	20	35	Remotecontrol, Photosensor
CN 305	φ5 Epoxy	150	100	30	18	Remotecontrol, Photosensor
CN 306	φ3 Epoxy	150	100	18	24	Photosensor
CN 501	Axial Leads, Epoxy	75	50	6	18	Photosensor
CN 504	Right Angle, Epoxy	150	100	5	44	Photosensor
CN 505	Right Angle, Epoxy	150	100	5	7	Photointerrupter
CN 511	φ5 Epoxy Flat Lens	150	100	6	42	Autofocus mechanism, Optical data transmission

VF=1.45V, IF=50mA

DN series (GaAlAs) λp : 850nm (Ta=25°C)

Type No.	Shape	Absolute Maximum Ratings Pd(mW)	IF (mA)	Electro-Optical Characteristics Ie(mW/sr)	Δθ(deg.)	Application
DN 106	TO-18.Glass Lens	150	100	70	3	Photosensor, Photoswitch
DN 202	TO-18.Flat-Glass Lens	150	100	4	38	Photosensor, Photoswitch
DN 304	φ5 Epoxy	150	100	30	35	Remotecontrol, Photosensor
DN 305	φ5 Epoxy	150	100	80	15	Remotecontrol, Photosensor
DN 401	φ5 Epoxy Flat Lens	150	100	7	50	Photosensor, Autofocus mechanism
DN 511	φ5 Epoxy Flat Lens	150	100	9	28	Autofocus mechanism, Optical data transmission
DN 311	φ3 Epoxy Flat Lens	150	100	3.5	110	Optical fiber, Autofocus mechanism
DN 504	Side View Type	150	100	8	60	Photosensor

VF=1.55V, IF=50mA

■PHOTO TRANSISTOR

PS series λp : 800nm (Ta=25°C)

Type No.	Shape	Characteristics Ic (mA)	ID (μA)	VCEO (V)	Δθ(deg.)	Application
PS 101	TO-18.Glass Lens	6	0.2	30	14	Photosensor, Photoswitch
PS 201	TO-18.Flat-Glass Lens	3	0.2	30	50	Photosensor, Photoswitch
PS 114	φ3 Ceramic	3.5	0.1	20	48	Photosensor
PS 302	φ5 Epoxy	5	0.2	30	22	Photosensor, Photoswitch
PS 401	φ5 Epoxy	2.5	0.2	30	102	Photosensor, Photoswitch
PS 502	Axial Leads, Epoxy	15	0.2	30	46	Photosensor
PS 504	Right Angle, Epoxy	10	0.2	30	32	Photosensor
PS 505	Right Angle, Epoxy	14	0.2	30	30	Photointerrupter

PD series (photo darlington) λp : 800nm (Ta=25°C)

Type No.	Shape	Characteristics Ic (mA)	ID (μA)	VCEO (V)	Δθ(deg.)	Application
PD 101	TO-18.Glass Lens	15	1	20	6	Photosensor, Photoswitch
PD 201	TO-18.Flat-Glass Lens	6	1	20	74	Photosensor, Photoswitch
PD 302	φ5 Epoxy	12	1	20	18	Photosensor, Photoswitch
PD 401	φ5 Epoxy	4	1	20	110	Photosensor, Photoswitch
PD 502	Axial Leads. Epoxy	4	1	20	32	Photosensor
PD 504	Right Angle, Epoxy	15	1	20	40	Photosensor
PD 505	Right Angle, Epoxy	3.5	1	20	32	Photointerrupter

■PIN PHOTO DIODE

PP series λ : 950nm (Ta=25°C)

Type No.	Shape	Characteristics Ics (μA)	ID (nA)	VR (V)	Δθ(deg.)	Application
PP202	TO18 Glass Lens	13 ※1	10	80	100	Photosensor, Photoswitch Remote control
PP210	TO39 Glass Lens	55 ※1	30	35	120	
PP506	Right Angle, Epoxy	6.5※2	30	30	130	
PP506-1	Right Angle, Epoxy	5.5※2	30	30	130	Optical data transmission
PP506-2	Right Angle, Epoxy	3.5※2	30	30	130	Remote controls
PP601	Axial Angle, Epoxy	6.0※2	30	30	130	Smoke detector
PP601-1	Axial Angle, Epoxy	4.8※2	30	30	130	Autofocus mechanism
PP601-2	Axial Angle, Epoxy	3.0※2	30	30	130	Opto-electronic switch
PP403	φ3 Epoxy Flat Lens	1.5※2	30	30	90	

- This is strategic product to COCOM Regulations. It should not be exported without export license.

※1 VR=5V, Ee=5mW/cm²
※2 VR=5V, Ee=0.5mW/cm²

■OPTO SWITCH

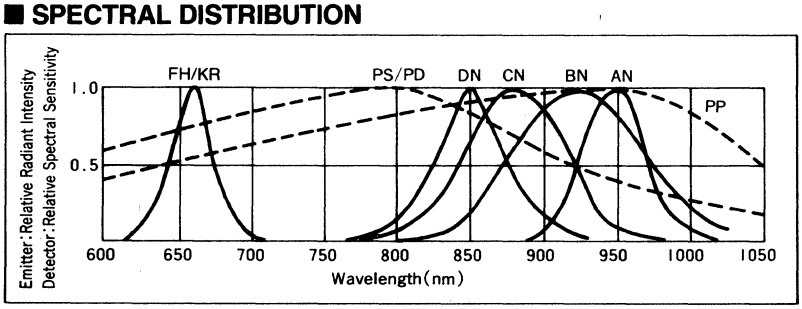
(Ta=25°C)

Type No.	Characteristics input VF (V) TYP.	input IR (μA) MAX.	output ICEO (μA) MAX.	Transfer Characteristics Ic (mA) TYP.	Tr·Tf(μSec) TYP.	CTR (%) TYP.	Application
KU107-01	2.1	100	0.2	1.5	7	15	Photointerrupter
KU107-02	1.2	10	0.2	10.0	7	50	Photointerrupter
KU108	1.7	100	0.2	1.0	7	10	Optocoupler
KU109-01	2.1	100	0.2	1.5	7	15	Photointerrupter
KU109-02	1.2	10	0.2	10.0	7	50	Photointerrupter
KU109-22	1.2	10	0.2	5.0	7	25	Photointerrupter
KU109-23	1.2	10	1.0	15.0	400	1500	Photointerrupter
KU110-01	2.1	100	0.2	1.5	7	15	Photointerrupter
KU110-02	1.2	10	0.2	10.0	7	50	Photointerrupter
KU110-22	1.2	10	0.2	1.0	7	5	Photointerrupter
KU111-32	1.2	10	0.2	0.8	7	4	Photointerrupter
KU116-32	1.2	10	0.2	0.8	7	4	Photointerrupter

■FOR PLASTIC FIBER USE (GaAlAs) λp : 660nm (Ta=25°C)

Type No.	Shape	Absolute Maximum Ratings Pd (mW)	IF (mA)	Electro-Optical Characteristics Ie (mW/sr)	fc (MHz)	Application
FH1011	φ5 Epoxy Flat Lens	140	70	1.2	7	Optical data transmission, Photosensor
FH 511	φ5 Epoxy Flat Lens	140	70	0.6	7	Optical data transmission, Photosensor
KR 311	φ3 Epoxy Flat Lens	140	70	1.7	7	Optical data transmission, Photosensor

■ SPECTRAL DISTRIBUTION



LCD

Stanley Liquid Crystal Display—Meeting Tough Requirements with Technology and a Proven Track Record of Performance

Liquid crystal displays are proving to be the frontrunners in keeping up with the diverse requirements of modern society and industry. To provide answers to your display requirements, Stanley has developed GMF series capable of graphic display and available in a wide range of sizes, and GMD series capable of displaying characters and messages. The Stanley product line includes guest-host LCDs that provide a colorfully attractive panel display and wide viewing angle, multicolor LCDs which feature individual color control, and high-contrast, high-reliability twisted-nematic liquid crystal. The bottom line is an LCD solution for virtually any display problem. These diverse LCD products are ready for immediate use in applications such as automotive displays, office-automation equipment, communications equipment, audio and home appliances.

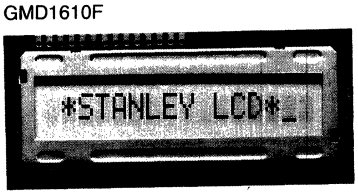


Okochi Memorial Technology Prize

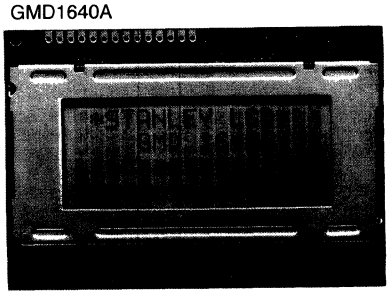
- *Stanley LCDs have been developed under the technical guidance of the late Prof. M. Wada of Tohoku University and Prof. T. Uchida (Dr. of Engineering). Stanley GH (guest-host) LCD was awarded in 1986 the 32nd Okochi Memorial Technology Prize.*

■DOT MATRIX MODULE (standard products) 〔Character Type〕

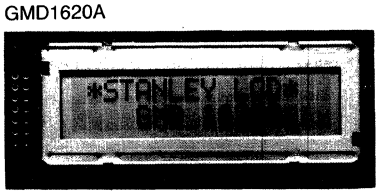
GMD1610F



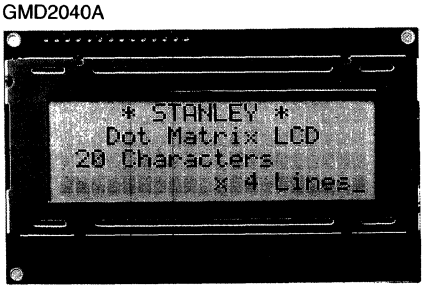
GMD1640A



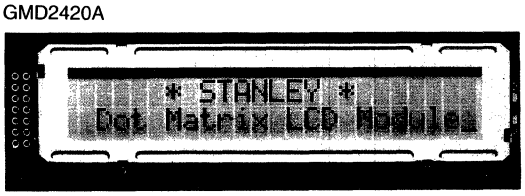
GMD1620A



GMD2040A



GMD2420A



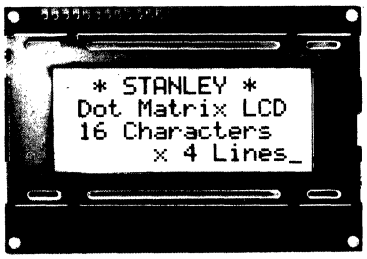
Model	Characters×Lines	Duty	Bias	Power Supply	Dimensions W×D×H (mm)	Viewing Area (mm)
GMD1610F	16×1	1/16	1/5	+5V	80×36×11	64.5×13.8
GMD1620A	16×2	1/16	1/5	+5V	85×36×11	63.5×15.8
GMD1640A	16×4	1/16	1/5	+5V	87×60×11	61.8×25.2
GMD2020A	20×2	1/16	1/5	+5V	115×36×11	83.0×18.6
GMD2040A	20×4	1/16	1/5	+5V	98×60×11	76.0×25.2
GMD2420A	24×2	1/16	1/5	+5V	118×36×11	93.5×15.8
GMD4020A	40×2	1/16	1/5	+5V	182×33.5×11	154.5×15.8

STANLEY I I STANLEY CO., INC. 2661 Gates Avenue #200, Irvine CA 92714 • (714) 222-0777 • FAX (714) 222-0555 • 800-LED-LCD1

LCD

■ LED BACKLIGHTING TYPE

GMD1640AL□



GMD1620AL□



GMD2420AL□



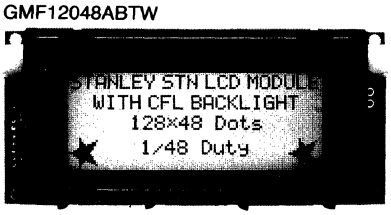
Model	Characters×Lines	Duty	Bias	Power Supply	Dimensions W×D×H (mm)	Viewing Area (mm)
GMD1610FL □	16×1	1/16	1/5	+5V	80×36×15	64.5×13.8
GMD1620AL □	16×2	1/16	1/5	+5V	85×36×15	63.5×15.8
GMD1640AL □	16×4	1/16	1/5	+5V	87×60×15	61.8×25.2
GMD2020AL □	20×2	1/16	1/5	+5V	115×36×16	83.0×18.6
GMD2040AL □	20×4	1/16	1/5	+5V	98×60×15	76.0×25.2
GMD2420AL □	24×2	1/16	1/5	+5V	118×36×15	93.5×15.8
GMD4020AL □	40×2	1/16	1/5	+5V	182×33.5×16	154.5×15.8

*GMD___AL□ indicates emission color. □ – R: Red (VR) O: Orange (AA) AY: Yellow (AY)
Y: Yellow (PY) G: Green (PG) Codes in parentheses indicate chip names.

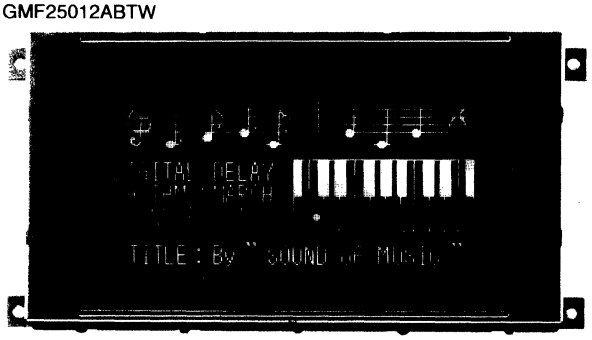
*A type is available with a single 5-V supply drive for the LCD.
*See the separate catalog for detailed specifications.

■STN TYPE LCD GRAPHIC DOT MATRIX MODULE (standard products) 〔Graphic Type〕

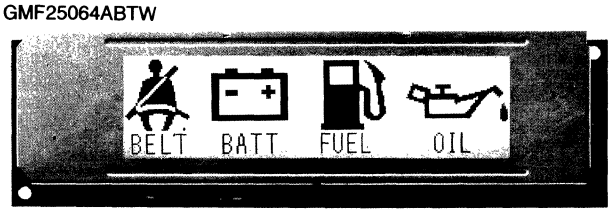
GMF12048ABTW



GMF25012ABTW



GMF25064ABTW



Model	Dot Pixels W×H (dots)	Duty	Power Supply	Dot Size (mm)	Dimensions W×D×H (mm)	Viewing Area (mm)
GMF240640S	240× 64	1/ 64	+5V −12V	0.48×0.48	180× 75×12	132× 39.0
GMF480640S	480× 64	1/ 64	+5V −12V	0.45×0.45	290× 73×12	246× 38.0
GMF250120S	256×128	1/ 64	+5V −12V	0.43×0.43	200×110×12	128× 66.5
GMF640200S	640×200	1/100	+5V −15V	0.33×0.33	270×145×13	245× 79.0
GMF640201S	640×200	1/200	+5V −20V	0.33×0.33	270×110×12	240× 79.0
GMF640400S	640×400	1/200	+5V −22V	0.27×0.27	254×170×13	201×127.0

CFL BACKLIGHTING TYPE

GMF25064ABTW	256× 64	1/ 64	+5V −20V	0.44×0.44	205×58×26.0	127.5×33.5
GMF25012ABTW	256×128	1/128	+5V −20V	0.44×0.44	194×96×22.0	127.5×68.0
GMF12048ABTW	128× 48	1/ 48	+5V −12V	0.63×0.63	132×60×19.0	90.0×36.0

*See the separate catalog for detailed specifications.

STANLEY ELECTRONICS **STANLEY CO., INC.** 2661 Gates Avenue #200, Irvine CA 92714 • (714) 222-0777 • FAX (714) 222-0555 • 800-LED-LCD1

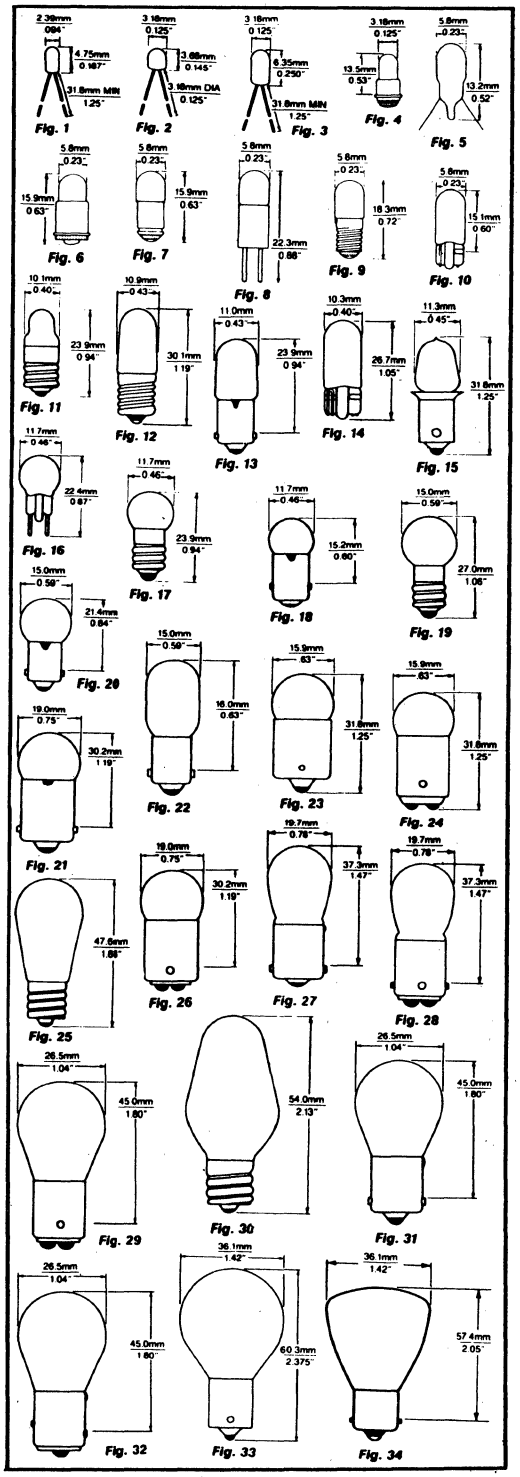
SYLVANIA Miniature Lighting

GTE Products Corporation
West Main Street, Dept. EM, Hillsboro, NH 03244

Lamp No.	Bulb	Volts *	Amps	M.S. C.P.	Fig.	Net Each, Lots of 1-9	10-99	100-499
PR2	B-3½	2.38	.50	.80	15	$0.82	$0.653	$0.571
PR3	B-3½	3.57	.50	1.50	15	.84	.674	.589
PR4	B-3½	2.33	.27	.40	15	.84	.674	.589
PR6	B-3½	2.47	.30	.45	15	.84	.674	.589
PR7	B-3½	3.7	.30	.90	15	.95	.758	.664
PR12	B-3½	5.95	.50	3.10	15	.84	.674	.589
PR13	B-3½	4.75	.50	2.20	15	.84	.674	.589
PR18	B-3½	7.2	.55	5.5	15	1.03	.821	.718
6S6	S-6	120	6W	.....	25	1.12	.982	.912
7C7	C7	115-125	7W	.....	30	1.08	.943	.876
12	G-3½	6.3	.15	.35	16	1.18	.947	.829
13	G-3½	3.7	.30	.98	17	.87	.695	.608
14	G-3½	2.47	.30	.50	17	.87	.695	.608
19	G-3½	14.4	.10	.90	16	1.68	1.347	1.179
27	G-4½	4.9	.30	1.4	19	1.29	1.032	.903
31	G-4½	6.15	.30	2.0	19	1.76	1.412	1.235
41	T-3¼	2.5	.50	.50	12	.85	.681	.596
43	T-3¼	2.5	.50	.50	13	1.05	.842	.736
44	T-3¼	6.3	.25	.90	13	.53	.421	.368
45	T-3¼	3.2	.35	.50	13	1.49	1.193	1.044
46	T-3¼	6.3	.25	.90	12	.75	.597	.522
47	T-3¼	6.3	.15	.52	13	.53	.421	.368
48	T-3¼	2.0	.06	.04	12	1.14	.912	.798
49	T-3¼	2.0	.06	.04	13	1.21	.968	.847
51	G-3½	7.5	.22	1.0	18	.71	.568	.497
53	G-3½	14.4	.12	1.0	18	.74	.589	.515
53X	G-3½	14.4	.12	1.0	18	1.00	.800	.700
55	G-4½	7.0	.41	2.0	20	.95	.758	.664
57	G-4½	14.0	.24	2.0	20	.66	.526	.461
57X	G-4½	14.0	.24	2.0	20	.97	.779	.682
63	G-6	7.0	.63	3.0	21	.89	.715	.626
67	G-6	13.5	.59	4.0	21	.76	.611	.535
81	G-6	6.5	1.02	6.0	21	1.21	.968	.847
82	G-6	6.5	1.02	6.0	26	.97	.779	.682
87	S-8	6.8	1.91	15.0	31	1.66	1.331	1.165
88	S-8	6.8	1.91	15.0	29	1.61	1.285	1.124
89	G-6	13.0	.58	6.0	21	.87	.694	.608
93	S-8	12.8	1.04	15.0	31	1.32	1.053	.921
112	TL-3	1.2	.22	.....	11	1.50	1.200	1.050
123	G-3½	1.25	.30	.10	17	.65	.521	.456
136	G-4½	1.25	.60	.20	19	1.76	1.412	1.235
158	T-3¼	14.0	.24	2.0	14	.95	.758	.664
161	T-3¼	14.0	.19	1.0	14	.84	.674	.589
168	T-3¼	14.0	.35	3.0	14	.84	.674	.589
194	T-3¼	14.0	.27	2.0	14	.63	.506	.442
222	TL-3	2.25	.25	.....	11	1.05	.842	.736
301	G-5	28.0	.17	3.0	23	2.39	1.915	1.676
302	G-5	28.0	.17	3.0	24	2.53	2.030	1.776
303	G-6	28.0	.30	6.0	21	2.53	2.030	1.776
305	S-8	28.0	.51	15.0	31	2.37	1.894	1.658
307	S-8	28.0	.67	21.0	31	2.37	1.894	1.658
308	S-8	28.0	.67	21.0	29	3.00	2.400	2.100
309	S-11	28.0	.9	32.0	33	3.42	2.738	2.395
313	T-3¼	28.0	.17	3.5	13	1.11	.885	.774
327	T-1¾	28.0	.04	.34	6	.92	.737	.645
328	T-1¾	6.0	.20	.34*	6	.95	.758	.664
330	T-1¾	14.0	.08	.5	6	.97	.779	.682
331	T-1¾	1.35	.06	.006	6	1.22	.977	.855
334	T-1¾	28.0	.04	.34	7	1.26	1.011	.885
344	T-1¾	10.0	.014	.004	6	1.18	.947	.829
382	T-1¾	14.0	.08	.30	6	1.18	.947	.829
387	T-1¾	28.0	.04	.30	6	.95	.758	.664
388	T-1¾	28.0	.04	.30	6	1.39	1.115	.976
680	T-1	5.0	.06	.03	3	1.81	1.450	1.269
682	T-1	5.0	.06	.029	4	2.45	1.960	1.715
683	T-1	5.0	.06	.05	3	1.37	1.097	.960
685	T-1	5.0	.06	.048	4	2.84	2.275	1.990
713	T-1	5.0	.075	.09	3	1.46	1.167	1.020
714	T-1	5.0	.075	.08	4	2.45	1.964	1.718
715	T-1	5.0	.115	.15	3	1.50	1.200	1.050
718	T-1	5.0	.115	.132	4	2.59	2.069	1.810
1003	B-6	12.8	.94	15.0	27	1.24	.989	.865
1004	B-6	12.8	.94	15.0	28	1.24	.989	.865
1034	S-8	12.8	1.80	32.0	32	1.26	1.011	.885
		14.0	.59	3.0				
1076	S-8	12.8	1.80	32.0	29	2.05	1.642	1.436
1133	RP-11	6.2	3.91	32.0	34	2.87	2.294	2.008
1156	S-8	12.8	2.10	32.0	31	1.26	1.011	.885
1157	S-8	12.8	2.10	32.0	32	.61	.485	.424
		14.0	.59	3.0				
1176	S-8	12.8	1.34	21.0	29	1.89	1.515	1.326
		14.0	.59	6.0				
1183	RP-11	5.5	6.25	50.0	34	4.61	3.690	3.229
1195	RP-11	12.5	3.0	50.0	34	6.29	5.032	4.403
1445	G-3½	14.4	.135	.7	18	.66	.526	.461
1447	G-3½	18.0	.15	1.5	17	.92	.738	.645
1495	T-4½	28.0	.30	6.0	22	2.05	1.642	1.436
1764	T-1¾	28.0	.04	.34	5	.81	.650	.568
1784	T-1¾	6.0	.20	.60	5	.81	.652	.570
1813	T-3¼	14.4	.10	.86	13	.84	.674	.589
1816	T-3¼	13.0	.33	3.0	13	1.03	.821	.718
1819	T-3¼	28.0	.04	.34	13	1.00	.800	.700
1820	T-3¼	28.0	.10	1.6	13	1.00	.800	.700
1829	T-3¼	28.0	.07	1.0	13	.92	.738	.645
1847	T-3¼	6.3	.15	.38	13	.61	.485	.424

*At 5 volts.

INDUSTRY STANDARD LAMPS
CONTINUED ON FOLLOWING PAGE



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SYLVANIA Miniature Lighting

GTE Products Corporation
West Main Street, Dept. EM, Hillsboro, NH 03244

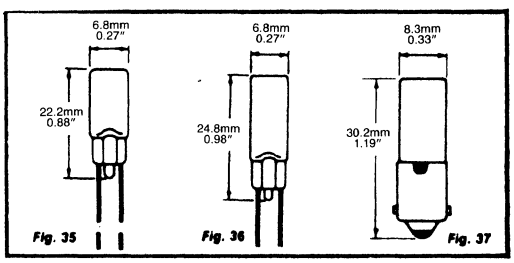
INDUSTRY STANDARD LAMPS (CONT'D)

See previous page for illustrations.

Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.	Net Each, Lots of 1-9	10-99	100-499
1850	T-3¼	5.0	.09	.25	13	$1.68	$1.347	$1.179
1864	T-3¼	28.0	.17	3.0	13	1.11	.885	.774
1869	T-1¾	10.0	.014	.004	5	1.17	.938	.821
1889	T-3¼	14.0	.27	2.0	13	.92	.738	.645
1891	T-3¼	14.0	.24	2.0	13	.79	.632	.553
1893	T-3¼	14.0	.33	2.0	13	.82	.653	.571
1895	G-4½	14.0	.27	2.0	20	.66	.526	.461
2162	T-1¾	14.0	.10	.5	5	.90	.723	.633
2182	T-1¾	14.0	.08	.30	5	.68	.543	.475
2187	T-1¾	28.0	.04	.30	5	.68	.543	.475
6832	T-1	5.0	.06	.05	2	$1.79	$1.431	$1.252
6833	T-¾	5.0	.06	.05	1	1.86	1.490	1.304
6838	T-1	28.0	.024	.15	3	2.33	1.863	1.630
6839	T-1	28.0	.024	.15	4	2.45	1.964	1.718
7152	T-1	5.0	.115	.15	2	1.55	1.241	1.085
7327	T-1¾	28.0	.04	.34	8	1.05	.844	.738
7328	T-1¾	6.0	.20	.6	8	1.22	.973	.852
7344	T-1¾	10.0	.014	.004	8	1.22	.977	.855
7382	T-1¾	14.0	.08	.30	8	1.33	1.064	.931
7387	T-1¾	28.0	.04	.30	8	1.06	.847	.741
7931	T-1¾	1.35	.06	.006	8	1.52	1.216	1.064

WIRE LEAD INDICATOR LAMPS (T-2 BULB) (FIG. 35)

Lamp No.	Volts	Amps.	M.S. C.P.	Net Each, Lots of 1-9	10-99	100-499
4ES	4	.04	.03	$1.29	$1.031	$0.902
5ES	5	.04	.04	1.29	1.031	.902
6ES	6	.04	.025	1.29	1.031	.902
10AS	10	.01	.001	1.63	1.302	1.139
10CS	10	.017	.01	1.36	1.085	.949
10ES	10	.04	.07	1.09	.868	.760
12ES	12	.04	.09	1.28	1.026	.897
16CS	16	.017	.016	1.28	1.020	.893
16ES	16	.04	.17	1.25	.999	.874
18ES	18	.04	.14	1.25	.999	.874
24CS	24	.017	.02	1.36	1.085	.949
24ES	24	.04	.12	1.25	.999	.874
28ES	28	.04	.25	1.25	.998	.873
48ES	28	.04	.44	1.52	1.216	1.064



WIRE LEAD PILOT LAMPS (T-2 BULB) (FIG. 36)

Lamp No.	Volts	Amps	M.S. C.P.	Net Each, Lots of 1-9	10-99	100-499
6PS	6	.14	.12	$1.29	$1.031	$0.902
12PS	12	.17	.35	1.25	.999	.874
24PS	24	.073	.5	1.25	.999	.874
28PS	28	.04	.29	1.25	.999	.874
48PS	48	.053	.7	1.25	.999	.874
60PS	60	.05	.73	1.57	1.260	1.102
120PS	120	.025	.36	1.41	1.129	.988
120PS/6	120	.052	1.43	1.41	1.129	.988

MINIATURE BAYONET PILOT LAMPS (T2½ BULB) (FIG. 37)

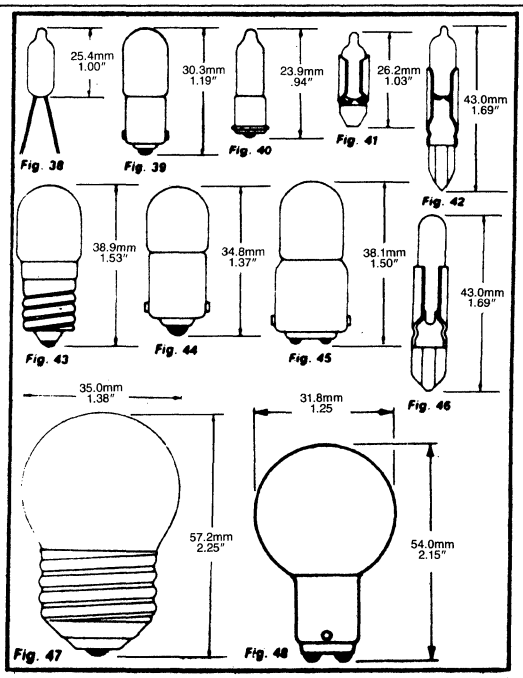
Lamp No.	Volts	Amps	M.S. C.P.	Net Each, Lots of 1-9	10-99	100-499
6MB	6	.140	.12	$1.97	$1.579	$1.382
12MB	12	.170	.35	1.86	1.485	1.299
24MB	24	.073	.50	1.86	1.485	1.299
28MB	28	.040	.29	1.86	1.485	1.299
48MB	48	.053	.70	1.94	1.555	1.361
60MB	60	.050	.73	2.03	1.627	1.423
90MB	90	.033	.37	1.86	1.485	1.299
120MB	120	.025	.36	1.83	1.466	1.283
120MB/6	120	.052	1.43	1.90	1.524	1.333

NEON GLOW INDICATOR LAMPS

Lamp No.	Bulb	Circuit Volts	Ext. Res. (K-ohms)	Fig.	Net Each, Lots of 1-9	10-99	100-499
NE-2 (A1A)	T-2	105-125	150	38	$0.50	$0.402	$0.352
NE-2A (A2A)	T-2	105-125	220	38	.50	.402	.352
NE-2V (A2B)	T-2	105-125	100	38	.50	.402	.352
NE-2E (A9A)	T-2	105-125	100	38	.65	.517	.453
NE-51 (B1A)	T-3¼	105-125	220	39	1.06	.851	.745
NE-51H (B2A)	T-3¼	105-125	27	39	1.06	.851	.745
NE-2H (C2A)	T-2	105-125	30	38	.50	.402	.352
NE-2D (C7A)	T-2	105-125	100	40	2.90	2.317	2.027
NE-2J (C9A)	T-2	105-125	30	40	2.66	2.132	1.865
NE-84 (K1A5)	T-2	105-125	30	41	.98	.788	.689

NEON GLOW CIRCUIT COMPONENT LAMPS

Lamp No.	Bulb	Start. Volts (DC)	Nom. Cur. (mA)	Fig.	Net Each, Lots of 1-9	10-99	100-499
NE-96 (4AB)	T-2	120-150	0.5	38	$4.56	$3.650	$3.194
NE-68 (5AC)	T-2	60-90	0.3	38	1.66	1.328	1.162
NE-81 (5AG)	T-2	64-80	0.3	38	1.91	1.531	1.339
NE-76 (5AG-A)	T-2	68-76	0.4	38	3.25	2.602	2.276
NE-83 (5AH)	T-2	60-100	5.0	38	1.53	1.227	1.073
NE-86 (5AJ)	T-2	55-90	1.5	38	3.15	2.523	2.208
NE-4 (6AB)	T-2	60-90	0.3	42	4.91	3.931	3.440



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INDICATOR CARTRIDGE LAMPS (T-2 BULB) (FIG. 50)

Lamp No.	Volts	Amps.	Average End F.C.	Net Each, Lots of 1-9	10-99	100-499
901	4	.04	145	$2.84	$2.271	$1.987
905	5	.04	225	2.84	2.271	1.987
909	6	.04	160	2.84	2.271	1.987
913	10	.01	—	2.84	2.271	1.987
914	10	.017	10	2.84	2.271	1.987
915	10	.04	540	2.84	2.271	1.987
918	12	.04	550	2.84	2.271	1.987
925	16	.017	75	2.84	2.271	1.987
926	16	.04	750	.87	.694	.608
930	18	.04	800	2.84	2.271	1.987
933	24	.017	200	2.84	2.271	1.987
934	24	.04	650	2.84	2.271	1.987
938	28	.04	1500	2.84	2.271	1.987
941	48	.04	3000	2.84	2.271	1.987

SOCKETS FOR INDICATOR CARTRIDGE LAMPS (FIG. 51)

Part No.	Overall Length	Mtg. Hole Dia.	Terminals	Net Each, Lots of 1-9	10-99	100-499
SM1	1 11/64"	.375"	Turret	$5.17	$4.136	$3.619
SM1A	1 11/64"	.375"	Solder	5.17	4.136	3.619

PILOT CARTRIDGE LAMPS (T-2 BULB) (FIG. 52)

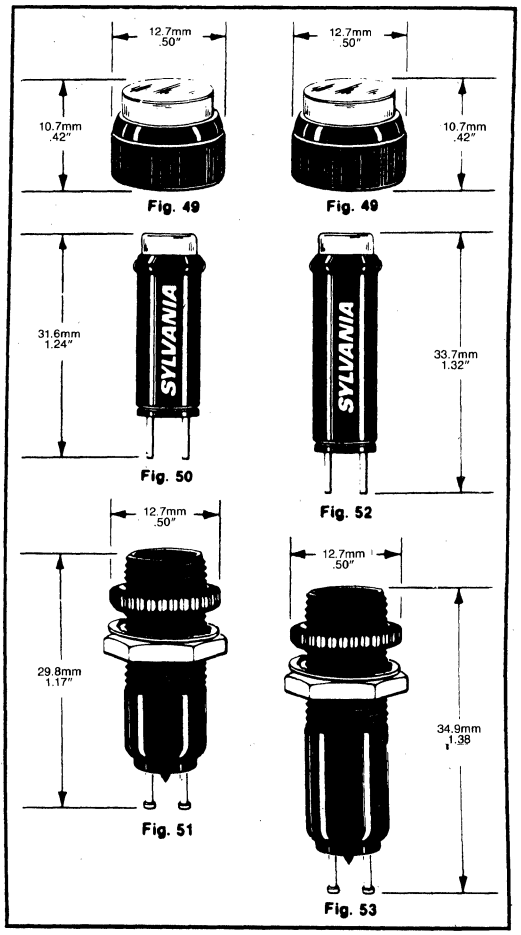
Lamp No.	Volts	Amps	Avg. End F.C.	Net Each, Lots of 1-9	10-99	100-499
6PC	6	.8	550	$2.39	$1.911	$1.673
12PC	12	2	2400	2.39	1.911	1.673
24PC	24	1.7	3000	2.39	1.911	1.673
28PC	48	1.1	1500	2.39	1.910	1.671
48PC	48	2.5	1500	2.39	1.911	1.673
60PC	60	3	1800	2.39	1.910	1.671
120PC	120	3	1000	2.44	1.955	1.711

SOCKETS FOR PILOT CARTRIDGE LAMPS (FIG. 53)

Part No.	Overall Length	Mtg. Hole Dia.	Terminals	Net Each, Lots of 1-9	10-99	100-499
SM2	1 3/8"	.375"	Turret	$5.17	$4.136	$3.619
SM2A	1 3/8"	.375"	Solder	5.17	4.136	3.619

LENSES FOR ABOVE SOCKETS (FIG. 49)

Lens Color	Lens No. Transparent	Lens No. Translucent	Net Each, Lots of 1-9	10-99	100-499
Amber	30140	.....	$1.14	$0.912	$0.798
Clear	30141	.....	1.14	.912	.798
Red	30142	30147	1.14	.912	.798
Blue	30143	30148	1.14	.912	.798
Green	30144	30149	1.14	.912	.798
Yellow	.....	30145	1.14	.912	.798
White	.....	30146	1.14	.912	.798

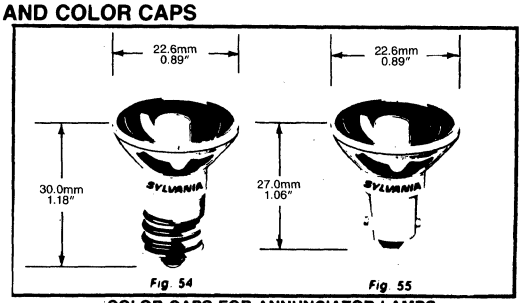


ANNUNCIATOR LAMPS AND COLOR CAPS

Long life annunciator lamps are designed for use in elevator panels, pushbutton stations, indirect decorative lighting and general signalling applications where a relatively high candlepower miniature light source is necessary. A high degree of light control is made possible by a self-contained aluminized reflector. Unique lighting and signalling effects are attainable using pyrex color caps shown in the chart. Ordering Data: For clear lamps, specify lamp number. For colored lamps, specify color as follows: 6RB/Red, etc. Caps are cemented to lamps when ordered in this manner. Caps may also be ordered separately.

ANNUNCIATOR LAMPS (FIGS. 54 AND 55)

Lamp No.	Base	Volts	Amps	Watts	Net Each, Lots of 1-9	10-99	100-499
6RC	Cand. Screw	6	.14	.8	$2.99	$2.388	$2.090
12RC	Cand. Screw	12	.17	2	2.99	2.388	2.090
24RC	Cand. Screw	24	.073	1.7	2.99	2.388	2.090
28RC	Cand. Screw	28	.04	1.1	2.99	2.388	2.090
60RC	Cand. Screw	60	.050	3	2.99	2.388	2.090
120RC	Cand. Screw	120	.025	3	2.99	2.388	2.090
6RB	Min. Bay	6	.140	.8	2.99	2.388	2.090
12RB	Min. Bay	12	.17	2	2.99	2.388	2.090
24RB	Min. Bay	24	.073	1.7	2.99	2.388	2.090
28RB	Min. Bay	28	.04	1.1	2.99	2.388	2.090
60RB	Min. Bay	60	.05	3	2.99	2.388	2.090
120RB	Min. Bay	120	.025	3	2.99	2.388	2.090



COLOR CAPS FOR ANNUNCIATOR LAMPS

Cap Color	Cap No.	Net Each, Lots of 1-9	10-99	100-499
Red	38071	$1.40	$1.116	$0.977
Yellow	38072	.65	.521	.456
White	38073	.65	.521	.456
Green	38074	.65	.521	.456
Blue	38075	.65	.521	.456

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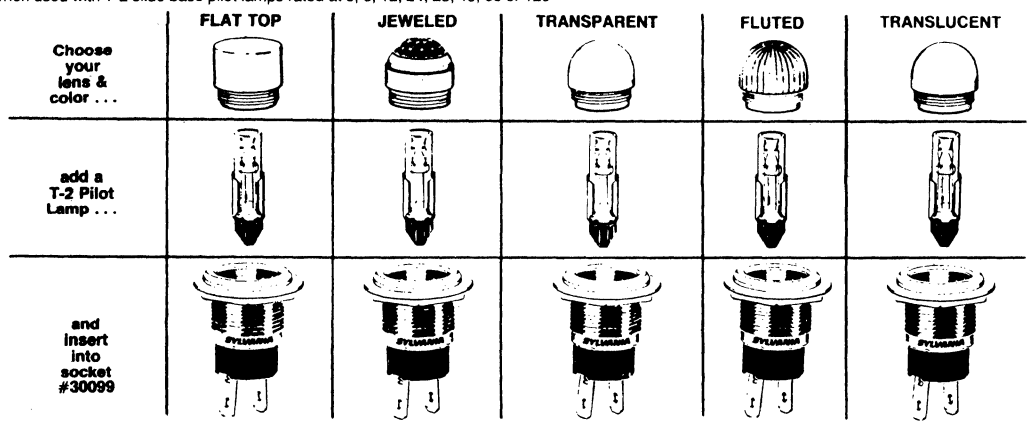
UNIVERSAL PILOT LAMP HOUSING

A variety of lens styles, each available in a choice of colors, plus a standard socket (P/N 30099) provide a wide choice of configurations for virtually every application when used with T-2 slide base pilot lamps rated at 5, 6, 12, 24, 28, 48, 60 or 120 volts. **Dimensions: Lenses**—Height, .38"; diameter, .63". **Socket**—Front of panel to end of terminals, .91"; mounting hole, .75" dia.



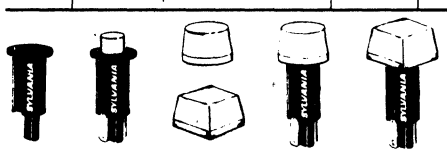
SOCKET AND LENSES

Part No.	Lens Type	Net Each, Lots of 1-9	10-99	100-499
30200	Flat Top Translucent—Red	**$1.11**	**$0.891**	**$0.780**
30212	Flat Top Translucent—Green	**1.11**	**.891**	**.780**
30213	Flat Top Translucent—Blue	**1.11**	**.891**	**.780**
30214	Flat Top Translucent—Yellow	**1.11**	**.891**	**.780**
30100	Jeweled—Red	**1.28**	**1.020**	**.893**
30102	Jeweled—Green	**1.28**	**1.020**	**.893**
30103	Jeweled—Blue	**1.28**	**1.020**	**.893**
30106	Jeweled—Amber	**1.28**	**1.020**	**.893**
30110	Transparent—Red	**.73**	**.587**	**.514**
30112	Transparent—Green	**.73**	**.587**	**.514**
30113	Transparent—Blue	**.73**	**.587**	**.514**
30111	Transparent—Amber	**.73**	**.587**	**.514**

Part No.	Lens Type	Net Each, Lots of 1-9	10-99	100-499
30114	Transparent—Yellow	**$0.73**	**$0.587**	**$0.514**
30116	Transparent—Clear	**.73**	**.587**	**.514**
30120	Fluted—Red	**.57**	**.456**	**.399**
30122	Fluted—Green	**.57**	**.456**	**.399**
30124	Fluted—Blue	**.57**	**.456**	**.399**
30126	Fluted—Amber	**.57**	**.456**	**.399**
30125	Fluted—Clear	**.57**	**.456**	**.399**
30130	Dome Translucent—Red	**.57**	**.456**	**.399**
30132	Dome Translucent—Green	**.57**	**.456**	**.399**
30131	Dome Translucent—Yellow	**.57**	**.456**	**.399**
30133	Dome Translucent—White	**.57**	**.456**	**.399**
30099	Pilot Lamp Socket	**2.66**	**2.128**	**1.862**

PILOT LAMP ASSEMBLIES

Socket P/N 30152 plug round (.70" dia. × .48" high) or square (.70" × .70" × .48" high) lens also uses T-2 slide base Pilot Lamps rated at 5, 6, 12, 24, 28, 48, 60 or 120 volts. Sockets can also be used without lens, with or without colored end cap covering end of bulb which extends .18" beyond .09" socket flange. **Dimensions:** Socket—1.31" M.O.L.; mounting hole—.50" dia.



LENSES

Color	Ordering Number: Round Lens	Square Lens
Red	**30160**	**30170**
Clear	**30161**	**30171**
Amber	**30162**	**30172**
White	**30163**	**30173**
Green	**30164**	**30174**
Blue	**30165**	**30175**

POLYPROPYLENE END CAPS*

Color	Ordering Number
Red	**38001**
Yellow	**38002**
White	**38003**
Green	**38004**
Blue	**38005**
Orange	**38007**

PYREX END CAPS#

Color	Ordering Number
Red	**38071**
Yellow	**38072**
White	**38073**
Green	**38074**
Blue	**38075**

*Polycarbonate end caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts.

#Pyrex end caps must be cemented to the lamp with a translucent silicon rubber adhesive.

PRICES FOR SOCKETS, LENSES AND END CAPS

Description	Net Each, Lots of 1-9	10-99	100-499
Pilot Lamp socket P/N 30152	**$1.03**	**$0.825**	**$0.722**
Lenses (round or square)	**.49**	**.391**	**.342**

Description	Net Each, Lots of 1-9	10-99	100-499
Pyrex end cap, red	**$1.40**	**$1.116**	**$0.977**
Polypropylene end caps	**.46**	**.370**	**.324**

PILOT LAMPS FOR ABOVE HOUSING AND ASSEMBLIES

Lamp No.	Design: Volts	Amps	Watts	Filament	M.S. C.D.	Average End Foot Candles	Rated Average Life (Hours)	Net Each, Lots of 1-9	10-99	100-499
5SLB	5	.12	.6	C-2V	...	1,600	2,500	**$1.63**	**$1.305**	**$1.142**
6PSB	6	.14	.8	C-2F	.12	500	20,000	**1.73**	**1.380**	**1.208**
6SLB	6	.144	.6	C-2V	...	1,700	2,500	**1.57**	**1.260**	**1.102**
12PSB	12	.17	2.0	C-2F	.35	2,000	12,000	**1.66**	**1.326**	**1.160**
24PSB	24	.073	1.7	C-2F	.50	3,000	10,000	**1.62**	**1.295**	**1.133**
28PSB	28	.04	1.1	C-2F	.29	1,600	5,000	**1.56**	**1.244**	**1.089**
48PSB	48	.053	2.5	C-7A	.7	1,800	7,500	**1.56**	**1.244**	**1.089**
60PSB	60	.05	3.0	C-7A	.73	2,600	7,500	**1.78**	**1.427**	**1.249**
120PSB	120	.025	3.0	CC-7A	.36	1,200	10,000	**1.67**	**1.337**	**1.170**

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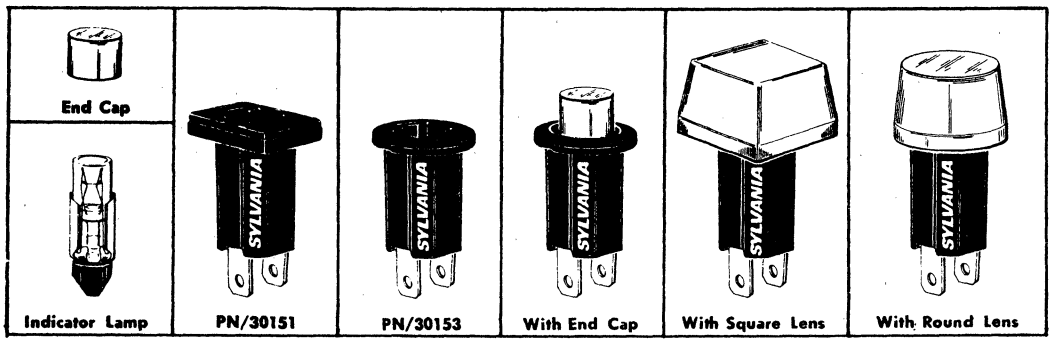
SINGLE SOCKET INDICATOR LAMP ASSEMBLIES

Available sockets include P/N 30153 (round flange) and P/N 30151 (rectangular flange). Sockets may be used with or without colored lens cap covering end of bulb which extends .18" beyond .09" flange. Socket P/N 30153 (round flange) can also be used with round (.70" dia. × .48" high) or square (.70" × .70" × .48" high) lenses. Both sockets 1.14" M.O.L. Mounting hole, .50" dia. Sockets accept T-2 lamps rated 4, 5, 6, 10, 12, 14, 16, 18, 24, 28 or 48 volts.



PRICING

Part Number	Description	Net Each, Lots of 1-9	10-99	100-499
30151	Socket, rectangular flange	$0.79	$0.629	$0.550
30153	Socket, round flange	.81	.652	.570
38001	End cap, (*), red	.46	.370	.324
38002	End cap, (*), yellow	.46	.370	.324
38003	End cap, (*), white	.46	.370	.324
38004	End cap, (*), green	.46	.370	.324
38005	End cap, (*), blue	.46	.370	.324
38007	End cap, (*), orange	.46	.370	.324
38071	End cap, Pyrex, red	1.40	1.116	.977
38072	End cap, Pyrex, yellow	.65	.521	.456
38073	End cap, Pyrex, white	.65	.521	.456
38074	End cap, Pyrex, green	.65	.521	.456

*Polypopylene and caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts.

Part Number	Description	Net Each, Lots of 1-9	10-99	100-499
38075	End cap, Pyrex, blue	$0.65	$0.521	$0.456
30160	Lens, round, red	.49	.391	.342
30161	Lens, round, clear	.49	.391	.342
30162	Lens, round, amber	.49	.391	.342
30163	Lens, round, white	.49	.391	.342
30164	Lens, round, green	.49	.391	.342
30165	Lens, round, blue	.49	.391	.342
30170	Lens, square, red	.49	.391	.342
30171	Lens, square, clear	.49	.391	.342
30172	Lens, square, amber	.49	.391	.342
30173	Lens, square, white	.49	.391	.342
30174	Lens, square, green	.49	.391	.342
30175	Lens, square, blue	.49	.391	.342

Pyrex end caps must be cemented to the lamp with a translucent silicone rubber adhesive.

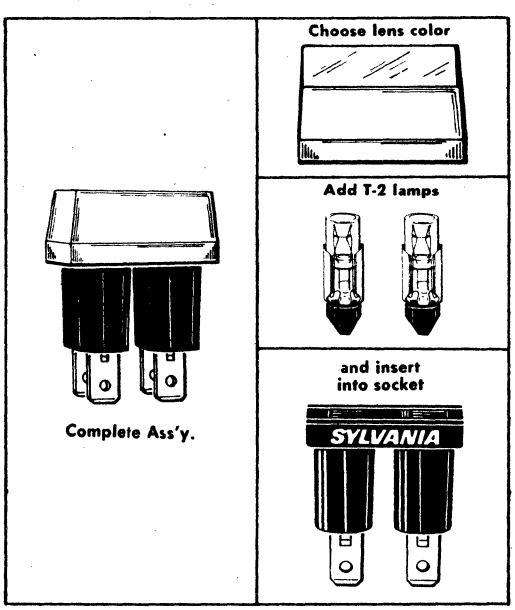
TWIN LIGHT INDICATOR LAMP ASSEMBLIES

TWIN LIGHT LENSES

Ordering Number	Color	Net Each, Lots of 1-9	10-99	100-499
30180	Red	$1.02	$0.812	$0.711
30182	Amber	1.02	.812	.711
30183	White	1.02	.812	.711
30184	Green	1.02	.812	.711
30185	Blue	1.02	.812	.711

TWIN LIGHT SOCKETS

Ordering Number	Description	No. of Contacts	Net Each, Lots of 1-9	10-99	100-499
31351	Both sides common	2	$2.26	$1.807	$1.581
31352	One side common	3	2.26	1.807	1.581
31353	Individual contacts	4	2.26	1.807	1.581



INDICATOR LAMPS FOR ABOVE ASSEMBLIES WILL BE FOUND ON FOLLOWING PAGE.

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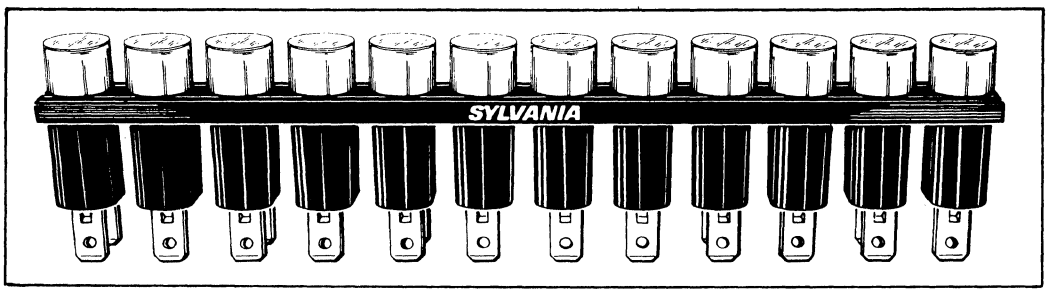
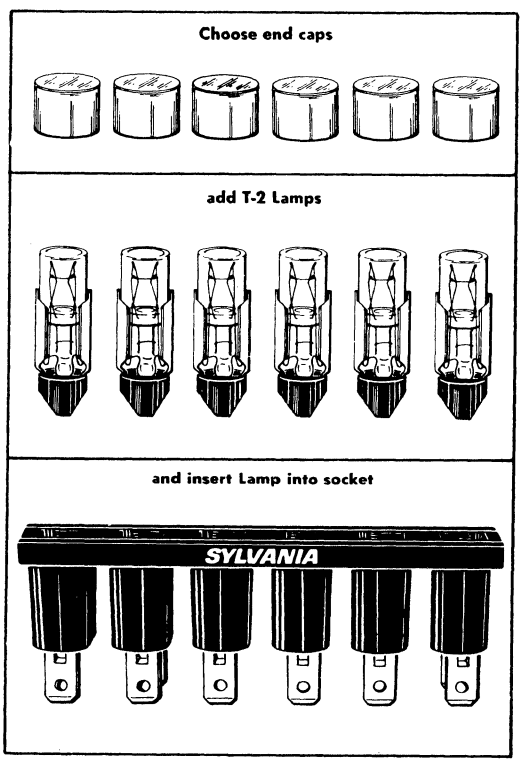
STRIP SOCKET ASSEMBLIES





Strip socket assemblies may be used with or without end caps. Polypropylene caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts. Pyrex caps must be cemented to the lamp with a translucent silicone rubber adhesive. Strip socket assemblies are available with 2 thru 12 sockets on ½" or ¾" centers; common ground or individual contacts. Sockets accept T-2 lamps rated at 4, 5, 6, 10, 12, 14, 16, 18, 24, 28 or 48 volts.

INDICATOR LAMP STRIP SOCKETS

Number of Sockets	Ordering Number			
	½" Centers		¾" Centers	
	Common Ground	Individual Contacts	Common Ground	Individual Contacts
2	31301	31311	31321	31337
3	31302	31312	31322	31338
4	31303	31313	31323	.....
5	31304	31314	31324	31339
6	31305	31315	31325	31333
7	31306	31316	31326	31334
8	31307	31317	31327	31341
9	31308	31318	31328	31342
10	31309	31319	31329	31343
11	31310	.....	.....	.....
12	31250	33250	31275	33275

SOCKET STRIP PRICING

Number of Sockets	Net Each, Lots of		
	1-9	10-99	100-499
2	$2.26	$1.807	$1.581
3	3.37	2.694	2.357
4	4.48	3.580	3.133
5	5.58	4.466	3.908
6	6.69	5.350	4.681
7	7.79	6.236	5.456
8	8.90	7.123	6.233
9	10.01	8.009	7.008
10	11.12	8.895	7.783
11	12.22	9.779	8.557
12	6.97	5.574	4.877

INDICATOR LAMPS FOR SINGLE SOCKET, TWIN LIGHT AND STRIP SOCKET ASSEMBLIES

Lamp Number	Design			Filament	M.S.C.D.	Average End Foot Candles	Rated Average Life (Hrs.)	Net Each, Lots of		
	Volts	Amperes	Watts					1-9	10-99	100-499
4ESB	4.0	.040	.16	C-6	.03	200	10,000	$1.86	$1.487	$1.301
5ESB	5.0	.040	.20	C-6	.04	225	8,000	1.86	1.437	1.301
6ESB	6.0	.040	.24	C-2V	.025	250	10,000	1.55	1.242	1.087
53B	6.0	.240	1.44	C-2V	.24	2,000	5,000	1.68	1.347	1.179
10ASB	10.0	.010	.10	C-2F	.001	.....	50,000	2.04	1.628	1.425
10CSB	10.0	.017	.17	C-2V	.01	60	20,000	1.85	1.476	1.292
10ESB	10.0	.040	.40	C-2V	.07	450	10,000	1.27	1.015	.888
12ESB	12.0	.040	.48	C-2V	.09	650	10,000	1.64	1.316	1.151
14FSB	14.0	.080	1.12	C-2F	.50	4,000	500	1.76	1.412	1.235
16CSB	16.0	.017	.27	C-2F	.016	80	15,000	1.82	1.454	1.272
16ESB	16.0	.040	.64	C-2F	.17	800	7,500	1.62	1.295	1.133
18ESB	18.0	.040	.72	C-2F	.14	850	5,000	1.72	1.379	1.206
24CSB	24.0	.017	.42	C-2F	.02	100	15,000	1.68	1.345	1.177
24ESB	24.0	.040	.96	C-2F	.12	850	8,000	1.62	1.295	1.133
28ESB	28.0	.040	1.12	C-2F	.25	1,500	6,000	1.62	1.295	1.133
48ESB	48.0	.040	1.92	CC-2F	.44	3,000	5,000	1.81	1.452	1.270

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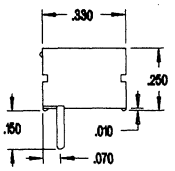
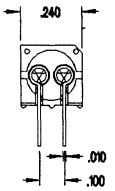
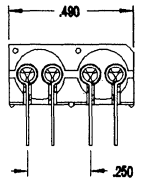
P-C-LITE™ PCB Socket for LED, Horizontal Mount, THT.*

Socket, 6/6 nylon U.L. 94 V0, allows right angle installation of LEDs on printed circuit boards, LED can be inserted from either end of socket. LEDs are replaceable. Component also accommodates other opto-electronic devices. Single and multiple sockets available. 10K piece price 28 to 65 cents.

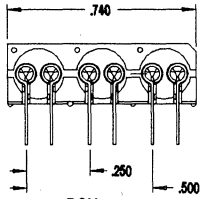




PCH 330



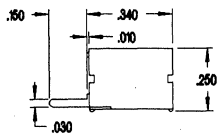
PCH 660

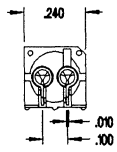


PCH 990

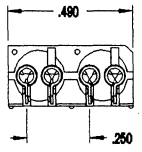
P-C-LITE™ PCB Socket for LED, Vertical Mount, THT.*

Socket, 6/6 nylon U.L. 94 V0, allows vertical installation of an LED on either side of a printed circuit board. Clearance holes thru the PCB allow the LED to be installed on one side while the socket is attached to the opposite side of the PCB. LEDs are replaceable. Component also accommodates other opto-electronic devices. Single and multiple sockets available. 10K piece price 28 to 65 cents.

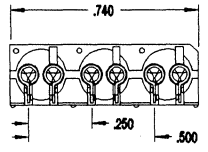




PCV 220



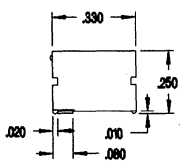
PCV 440

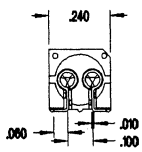


PCV 880

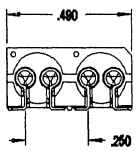
P-C-LITE™ Surface Mount Socket for LED, Horizontal Mount, SMT.*

Socket, 6/6 nylon U.L. 94 V0, allows surface mounting of socket to the PCB along with other components. Heat sensitive LEDs can be installed after IR oven operations have been completed. Unit also accommodates other opto-electronic devices. These devices as well as the LEDs are replaceable. Single and multiple sockets available. 10K piece price 28 to 66 cents.

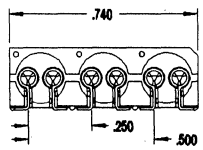




SMD 330



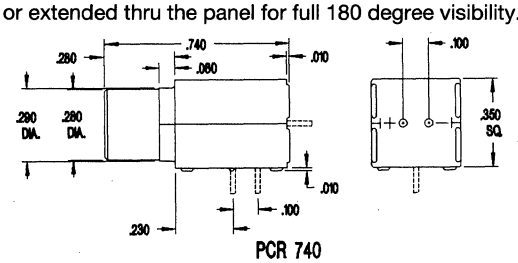
SMD 660



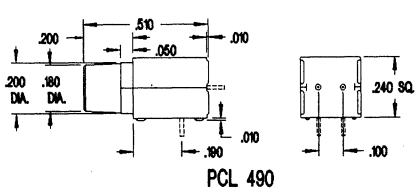
SMD 990

P-C-LITE™ PCB Mounts for T1 & T1 3/4 LEDs*

Mount, 6/6 nylon. Lens, polycarbonate. The mounts, combined with Cliplite lens series, permit either horizontal or vertical mounting of standard T1 or T1 3/4 LED to a PC board. See Cliplite data on lenses. The PCB mounted unit permits the lens to be flush mounted with front panel or extended thru the panel for full 180 degree visibility. 10K piece price 21 to 24 cents.



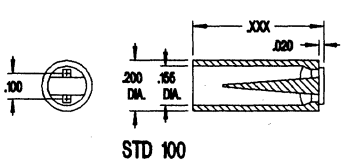
PCR 740



PCL 490

P-C-LITE™ PCB LED & Passive Component Standoff

Standoff, 6/6 nylon. Cylindrical body, dual-tapered lead entry ports, lead separation center barrier and raised clearance pads. Body protects the leads from damage by outside agencies. The center barrier protects the leads from possible internal shorting. Clearance pads allow thorough removal of contaminates resulting from the soldering process. Available in heights varying from .120 to .990 inch in increments of .010 on an inch. 10K piece price 3 to 4 cents.



STD 100

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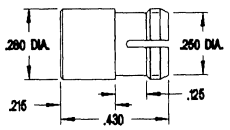
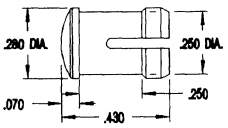
CLIPLITE **Lens/Mounts for T1 & T1 3/4 LEDs***

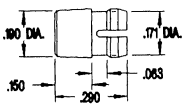
Lens, polycarbonate, standard height or low profile. Mounts LED thru front of panel, 180 degrees viewing angle, 125% apparent brightness increase, provides ESD protection. Easily installed in panels from 1/32 to 1/4 inch thickness, no tools required. Colors available red, green, amber, yellow clear and blue. 10K piece price 10 to 11 cents.



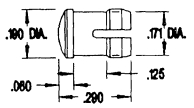
CLF 280



CLB 300



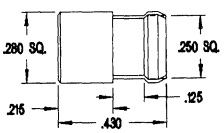
SML 190



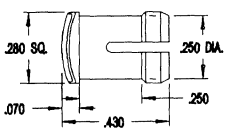
SMB 200

CUBELITE **Square Lens/Mounts for T1 & T1 3/4 LEDs***

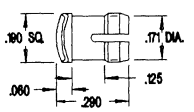
Lens, square, polycarbonate, standard height or low profile. Mounts LED thru front of panel, 180 degrees viewing angle, increases apparent brightness, provides ESD protection. Easily installed in panels from 1/32 to 1/4 inch, no tools necessary. Colors available red, green, amber, yellow, clear and blue. 10K piece price 10 to 12 cents.



SQL 360



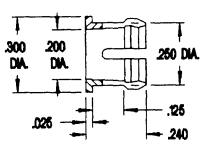
SQB 400



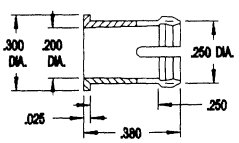
SMQ 250

CLIPMOUNT **Black or Chrome for T1 3/4 LEDs***

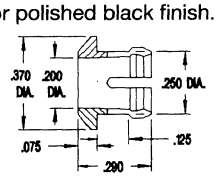
Mounting clips, polycarbonate, for panel mounting T1 3/4 LEDs. Panel thickness from 1/32 to 1/4 inch. Available in standard clip & ring style or reflector type. Inner or outer reflector clip mounts in either chrome or polished black finish. 10K piece price 8 to 22 cents.



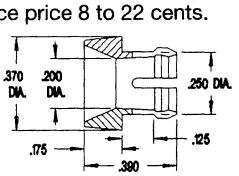
CLP 125



CLP 250



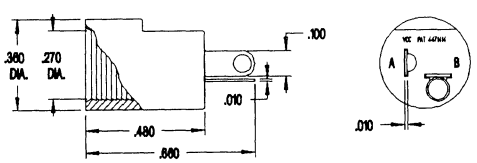
CLP 127



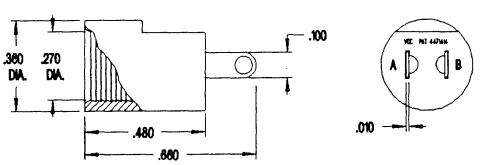
CLP 129

CONXRITE **Solderless Connector for Panel Mounting T1 3/4 LEDs***

Solderless connector, polypropylene, allows for mounting or replacement of panel mounted T1 3/4 LEDs. Resistors for current limiting to 28 volts. Mates with CLF 280, CLB 300, SQB 400 lens mounts and CLP series clip mounts. No assembly tools required. 10K peice price 32 to 42 cents.



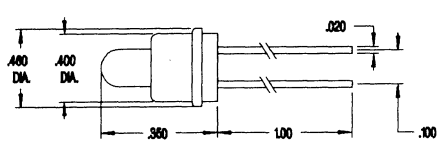
CNX 310 W/RESISTOR



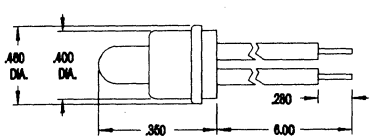
CNX 310 W/O RESISTOR

INCANDESCENT LAMP **Assembly for Panel & PCB Mounting**

Subminiature lamp assemblies, for panel and PCB mounting. Aged and selected, 5 thru 28 volts. Mates with CLF 280, CLB 300, SQL 360, SQB 400 lenses, CNX 310 connectors, PCH, PCV, PCR, and SMD circuit board sockets. Available in bi-pin or with 6 inch wire leads.



BI-PIN LAMP



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PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
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Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
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Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
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Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
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Military Qualified Products List **B**•1002
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Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
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Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
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Relays, Product Selection Guide **B**•1397
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SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
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Switches, Product Selection Guide **B**•1639
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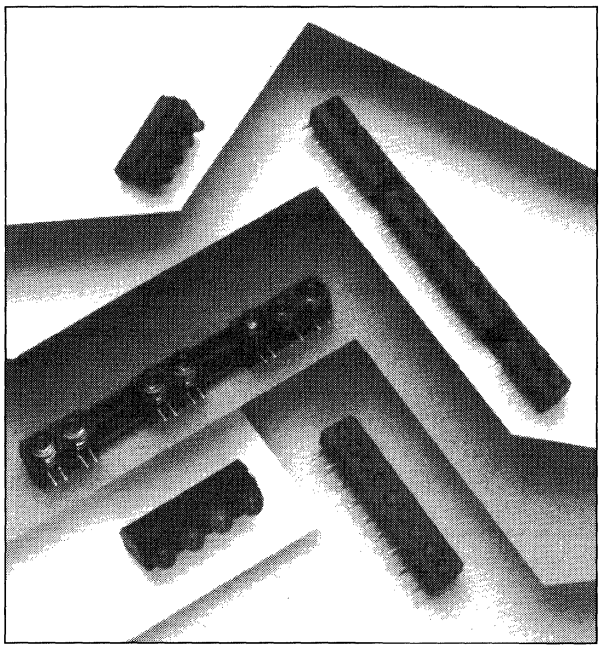
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

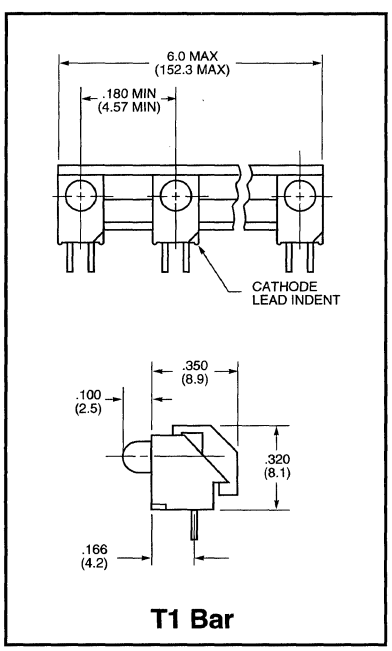
RA Series
Right Angle LED Bars

Special Features

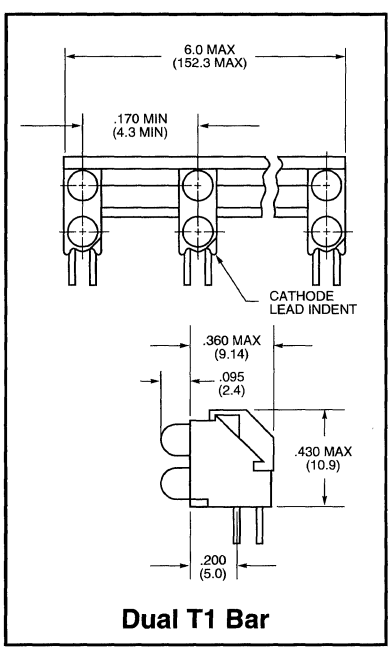
- One-step PC board mounting
- Available with 2 to 33 T1 or 2 to 24 T1 3/4 LEDs in one convenient assembly
- Bar provides consistent alignment for multiple LED mounting
- Customized to your specifications
  - Variable LED spacing – Minimum .180" for T1,
    – Minimum .245" for T1 3/4
  - Maximum bar length – 6"
  - Color combinations available at no extra cost
- Available in high-efficiency red, green, yellow, orange; ultrabright red; bicolor; 2mA and 5V internal resistor LEDs
- Lead pinout compatible with industry standards
- Can be supplied with single-in-line or dual-in-line leads
- Bottom standoff facilitates board washing



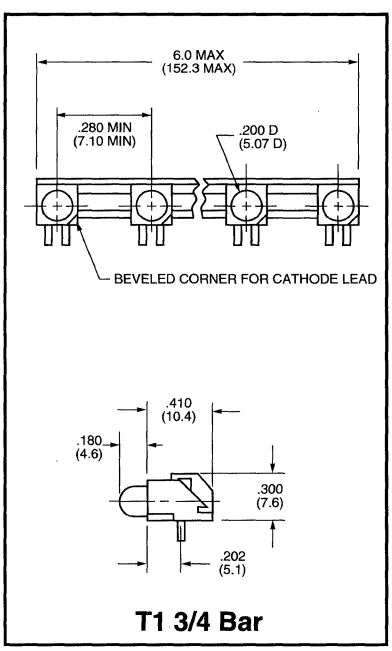
Right Angle LED Bars



T1 Bar



Dual T1 Bar



T1 3/4 Bar

The quality program in our Huron, South Dakota factory, where these parts are manufactured, meets or exceeds MIL-Q-9859A. Call or write for our complete catalog.

WILBRECHT ELECTRONICS

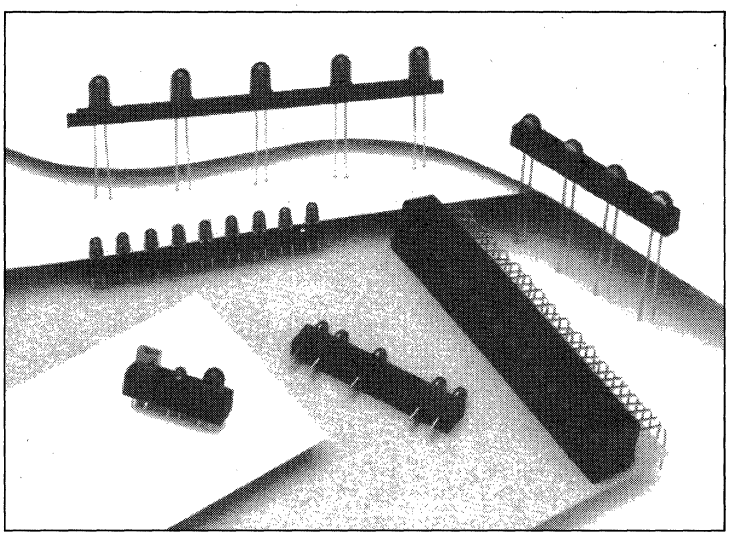
LEDCO DIVISION

346 Chester St.
St. Paul, MN 55107
612 222-2791
FAX 612 222-7639

PC Board Mount
Vertical LED Bars – No assembly required

Special Features

- One-step PC board mounting
- Customized to your specifications
  - Variable LED spacing
  - Color combinations available at no extra cost
  - Assembly heights built to your specifications without tooling charges
- Bar provides consistent LED alignment
- Polarity identification on bar
- Wave solderable and chemically cleanable
- Any size, color or type LED can be used – Hi-efficiency T1 and T1 3/4 LEDs, 2mA T1 and T1 3/4 LEDs and 2mm x 5mm rectangular LEDs are standard



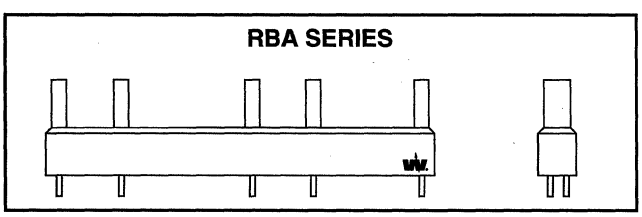
Bar Mounted LEDs

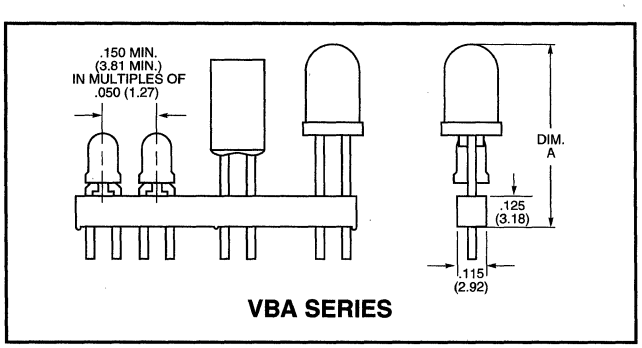
RBA Series:

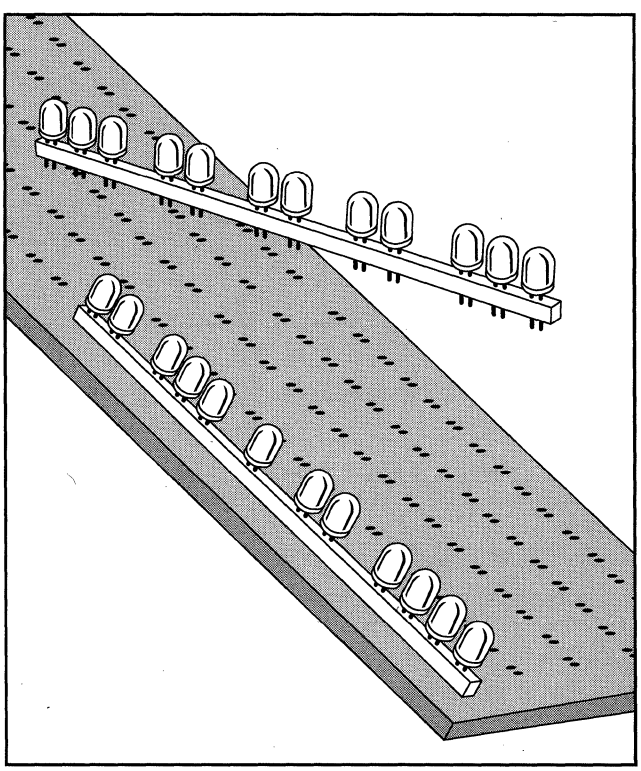
- Can be supplied with single-in-line or dual-in-line leads

VBA Series:

- Bottom standoff facilitates board washing
- Removable stabilizing foot available
- Can be supplied with single-in-line or dual-in-line leads
- Can be supplied in lengths up to 3 inches







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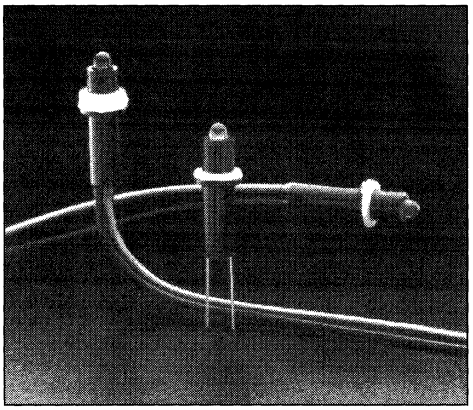
L41 T1 Rear Mount LED Indicator

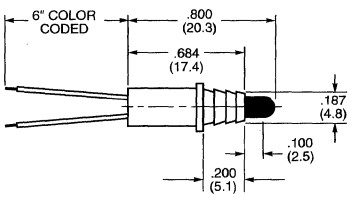


Panel Mount LED Assemblies

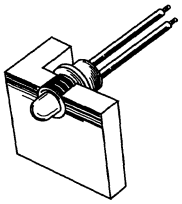
Special Features

- Rear mounting, friction-fit — no mounting hardware required
- Simplified one-piece construction
- Optional internal resistor
- Sealed against moisture and dust
- Available for panel thickness .062", .125", .187" and .220"
- Custom body lengths available without tooling charges
- Wide variety of LEDs available
- Easily wired into pre-assembled harness

Package Dimensions



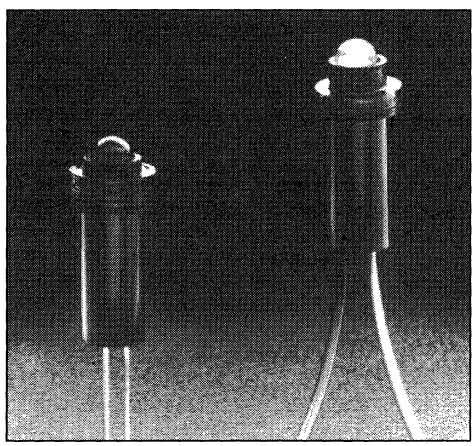
Mounting



Specifications

Mounting hole: .....187" (3/16")
Termination: .....22 AWG 6" color coded leads stripped to 1/4" standard; Optional bipin available
Body Material:.....Black butyrate plastic
Operating & Storage Temperature range:.....-55°C to 100°C

L61 T1 3/4 Rear Mount LED Indicator

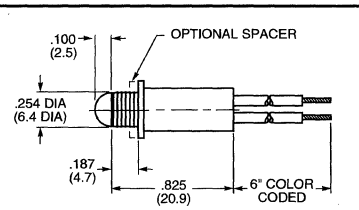


Panel Mount LED Assemblies

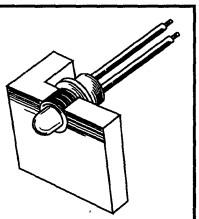
Special Features

- Rear mounting, friction-fit — no mounting hardware required
- Simplified one-piece construction
- Optional internal resistor
- Sealed against moisture and dust
- Available for panel thickness .062", .125" and .187"
- Custom body lengths available without tooling charges
- Wide variety of LEDs available
- Easily wired into pre-assembled harness

Package Dimensions



Mounting



Specifications

Mounting hole: .....250" (1/4")
Termination: .....22 AWG 6" color coded leads stripped to 1/4" standard; Optional bipin available
Body Material:.....Black butyrate plastic
Operating & Storage Temperature range:.....-55°C to 100°C

The quality program in our Huron, South Dakota factory, where these parts are manufactured, meets or exceeds MIL-Q-9858A. Call or write for our complete catalog.

WILBRECHT ELECTRONICS

LEDCO DIVISION ®

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eem selection guide fiber optic equipment-2475

DATA LINKS

Receivers

Manufacturer	Starting EEM Page No.	Unidirectional	Bidirectional	Light Source	Bit Rate (NRZ)	Rise time/Fall time (ns) (typical)	Operating Temperature
Interoptics	B•1217	√	√	LED, Laser	to 125 Mb/s	5–10ns	-40°C–100°C
Litton Poly-Scientific	B•1218	√	√	Varied	Varied	Varied	Varied
Meret Corp.	B•1225	√	√	LED's/Lasers	0—1Gb/s		
Optelcom Inc.	B•1227	√	√		6Hz - 75MHz Analog D.C. to 20Mb/sec Digital		-20°C–60°C
Ross Engineering	B•1230	√		LED		10ns	-40°C–65°C
S. I. Tech	B•1231	√	√	LED	up to 40Mbps		-40°C–80°C

Transmitters

Manufacturer	Starting EEM Page No.	Unidirectional	Bidirectional	Light Source	Bit Rate (NRZ)	Rise Time/Fall Time (ns) (typical)	Operating Temperature
Interoptics	B•1217	√	√	LED, Laser	to 125 Mb/s	5–10 ns	-40°C -+100°C
Litton Poly-Scientific	B•1218	√	√	Varied	Varied	Varied	Varied
Meret Corp.	B•1225	√	√	LED's Laser	0—1Gb/s		
Optelcom Inc.	B•1227	√	√	LED, Laser	6Hz - 75MHz Analog D.C. to 20Mb/sec Digital		-20°C -+60°C
Ross Engineering	B•1230	√		LED		10ns	-40°C -+ 65°C
S. I. Tech	B•1231	√	√	LED	up to 40Mbps		-40°C–80°C

eem selection guide fiber optic equipment-2475

CABLE

Loose Tube

Manufacturer	Starting EEM Page No.	General Purpose			Heavy Duty (Direct Burial)			Telecommnications (Aerial)			Multipurpose		
		All Glass		PCS	All Glass		PCS	All Glass		PCS	All Glass		PCS
		Single Mode	50–100 Micron	200 Micron	Single Mode	50-100 Micron	200 Micron	Single Mode	50–100 Micron	200 Micron	Single Mode	50–100 Micron	200 Micron
Interoptics	B•1217	√	√		√	√	√	√	√		√	√	
Meret Corp.	B•1225	√	√	√	√	√	√				√	√	√
S. I. Tech	B•1231		√										

Tight Buffer

Manufacturer	Starting EEM Page No.	Standard			Plenum			Breakout		
		All Glass		PCS	All Glass		PCS	All Glass		PCS
		Single Mode	50–100 Micron	200 Micron	Single Mode	50-100 Micron	200 Micron	Single Mode	50–100 Micron	200 Micron
Interoptics	B•1217	√	√	√	√	√		√	√	√
Meret Corp.	B•1225	√	√	√	v	√	√	√	√	√
S. I. Tech	B•1231		√							

CONNECTORS

Manufacturer	Starting EEM Page No.	Style (Diamond, SMA, DIN47256, NTT, FC, ST, SC, FDDI, etc.)	Single Mode	Multi-mode	Inner diameter range	Connecting Loss (dB)
Interoptics	B•1217	(all)	√	√	80µ - 1.0mm	0.1dB
Meret Corp.	B•1225	St, SMA	√	√		
S. I . Tech	B•1231	SMA, ST, Bicenic	√	√		

SYSTEMS (Custom)

Manufacturer	Starting EEM Page No.	Optical Sensing	Trans-mission
Litton Poyscientific	B•1218	√	√
Meret Corp.	B•1225		√
Ross Engineering	B•1230		√
S. I. Tech	B•1231		√

MINIGLOSSARY FIBER OPTICS

Acceptance Angle
The maximum angle within which light will be accepted by an element such as a detector or waveguide. In the latter, it is quantified as half the vertex angle of the cone within which optical power may be coupled into bound modes of a fiber.

Aligned Bundle
An assembly of fibers in which the coordinates of each fiber are the same at the two ends of the bundle, also called *Coherent Bundle*.

Bend Radius
The radius of curvature that an optical fiber can bend without breaking.

Bundle
Multiple optical fibers in a single housing used to transmit light or images.

Cladding
The low refractive index material that surrounds the core of the fiber to contain core light while protecting against surface contaminant scattering. In all-glass fibers, the cladding is glass.

Effective Numerical Aperture
The real numerical aperture of a fiber when the computed NA is not valid due to a change in the glass indices during the drawing and fusion process.

Fiber Bundle
A rigid, or flexible, concentrated assembly of glass or plastic fibers used to transmit optical images or light.

Fiber Optic Light Guide
A bundle of optical fibers arranged randomly for the purpose of transmitting energy, not images.

Fiber Optic Probe
A flexible optical probe having a bundle of glass fiber arranged to transmit an image

Gap Loss
The optical power loss caused by space between axially aligned fibers.

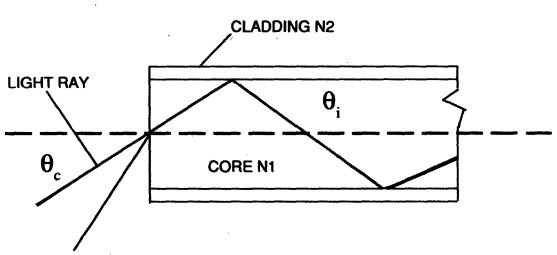
Image Transducer
Any arrangement of a bundle of optical fibers that alters the shape of the image. For example, by a systematic regulation of the spacing of the fibers from the entrance end to the exit end, a distortion of the image can occur that may be used to neutralize or compensate for the distortion introduced by the lens, prism or mirror components in an optical system.

Large-Core Fiber
Optical fiber with a large core, often a step-index fiber. "Large" is sometimes defined as greater than 85 μm.

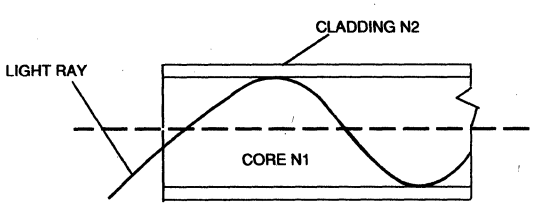
Multifibers
An array of optically distinct fibers that are fused into one strand. They are used to keep the resolution efficiency of the smaller single fibers and eliminate difficulty in handling. Their specific usage is determined by their flexibility or rigidity.

Packing Fraction
The ratio of the active core area of the fiber bundle to the total area at its light emitting or receiving end.

Plastic Fiber
Fiber in which both the core and cladding are made of plastic.



(a) Light propagation in a step index fiber.



(b) Path of light rays in a graded index fiber.

INTEROPTICS

ONE OF THE **PURDY** GROUP OF COMPANIES

OPTO/LINK

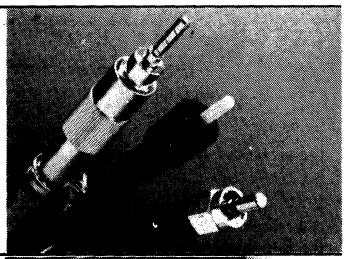
INTEROPTICS offers a wide range of fiber optic products for telecom, datacom, precision instrument, industrial, medical, and military applications.

Here are just some of the products INTEROPTICS can supply for your fiber optic needs:

CONNECTORS, ADAPTERS, AND RECEPTACLES

Diamond	DIN-47256
FC/NTT	ST
SMA	Biconic
FDDI	SC

Amphenol®
3M
DIAMOND®



CABLES AND CABLE ASSEMBLIES

Standard pigtails and patchcords.
Custom versions on cable or fiber.
Special assemblies on customer supplied devices.

Buffered fiber	Multifiber
Simplex	Singlemode
Duplex	Multimode



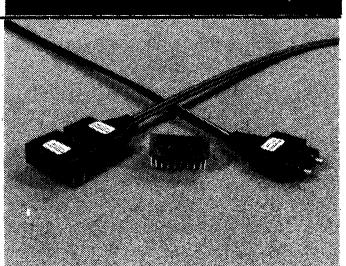
NETWORKING PRODUCTS

RS 232 and RS 422 modems
RS 232 master/slave port expander systems
RS 232 to GPIB converters
GPIB IEEE488 Bus expander systems
Centronics Bus extenders



DATA LINKS

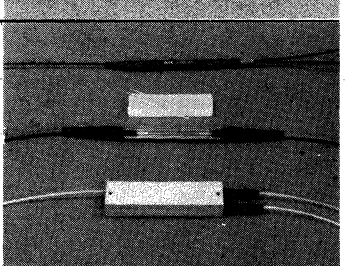
TTL transmitters, receivers, and transceivers
Data rates from DC to 40 Mb/s.
Systems from connectorless plastic fiber to connectorized glass cable.
Distances from 5 to 3500 meters.



SPECIALTY PRODUCTS

A complete line of couplers from 1 x 2 to 32 x 32
A compete line of splicing systems.
WDM's—wavelength divisional multiplexers (800/1300 nm and 1300/1530 nm).

Amphenol®
3M
DIAMOND®



TERMINATION EQUIPMENT

A complete line of termination tooling.
Available as parts or in a complete kit.
Convex polishing machines and special ferrule viewing systems.

Amphenol®
3M
DIAMOND®



INFORMATION Let us supply you with our expertise in fiber optics.

If you have any comments or questions, or if you just want to know how fiber optics can work for you, please contact us at INTEROPTICS.

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Litton

Poly-Scientific

Fiber Optic Products
1213 North Main Street
Blacksburg, Virginia
24060-3100
800-336-2112
FAX 703-953-1841
TWX 710-875-3694

From Fiber Optic Components to Complete System Engineering Capabilities... We Speak the Language of Light

Litton Poly-Scientific has become a recognized supplier for a broad range of fiber optic components and systems. From simple point-to-point links to complex data bus or LAN networks, our expertise covers a wide variety of digital and analog data transmission systems for military, industrial and commercial applications.

We can work to your specifications or design and manufacture systems or sub-systems to meet your specific requirements.

Our active components include transmitters, receivers, transceivers and repeaters in traditional, hybrid and rack-mounted versions. Passive components include WDMs, low loss couplers, fiber optic rotary joints and extensive experience with various fiber types, cable harnesses and connectors.

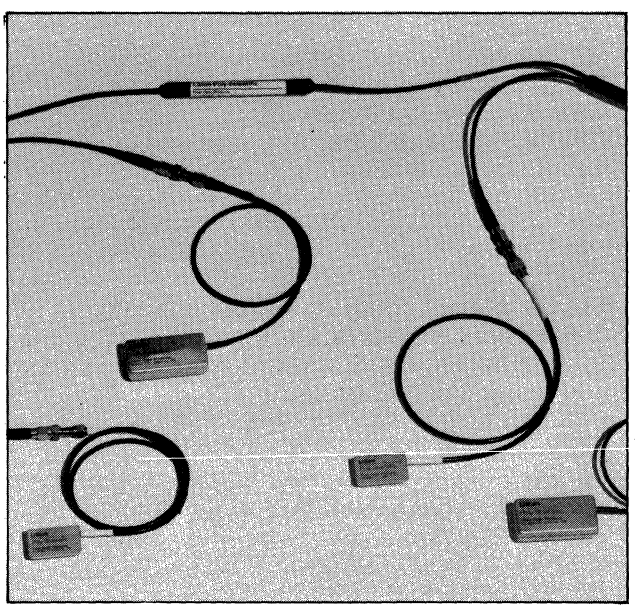
The following pages are designed to give you an overview of our product and systems capabilities.

Fiber Optic Data Bus and Sensor Systems for Land, Sea, Air and Space Applications

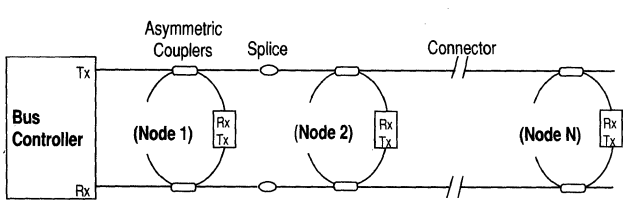
Litton has pioneered the research and development of single and dual fiber linear data bus technology. Recent progress in improving both active and passive components for access on and off the bus has resulted in the viability of this topology for a variety of large system applications. For each node, our hybridized digital transmitters and receivers feature high launch power, superior sensitivity and wide dynamic range. The extremely low excess loss of our bi-directional couplers has dramatically increased the number of system taps.

When compared to token ring or star topologies, a linear bus offers many unique advantages. From the standpoint of installation, modification and future growth, the simple architecture of the linear bus makes it a more cost-effective option. The star requires home-runs of fiber from a central location to each node. If the star is damaged, it is highly probable that a significant portion of the bus will become inoperative. In addition, the star is labor and material intensive. Although the ring (particularly those involving token passing protocols) addresses these concerns, it retains the potential for data transfer problems. These include accumulated jitter, additive effects of error and bypassing failed devices on the bus.

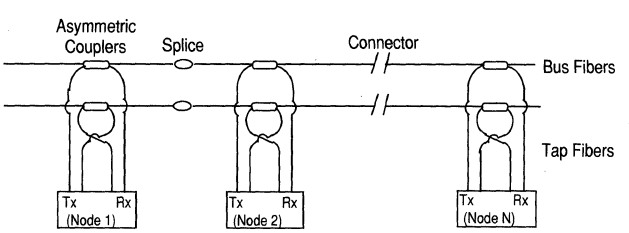
We are familiar with a wide variety of data bus topologies including MIL-STD-1773, ARINC 629 (DATAC), and HSDB. Let us put our experience and expertise to work for your next system application.



MIL-STD-1773 Single Fiber Linear Data Bus



Dual Fiber Linear Data Bus



Call us toll-free at **800-336-5917** (in Virginia, call 703-953-4751) for more information.

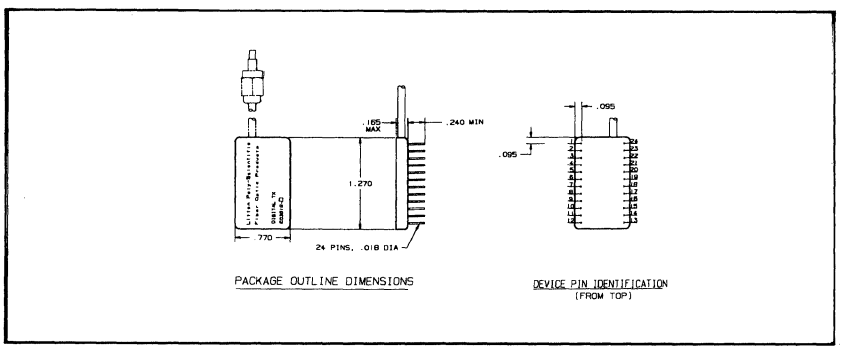
Litton

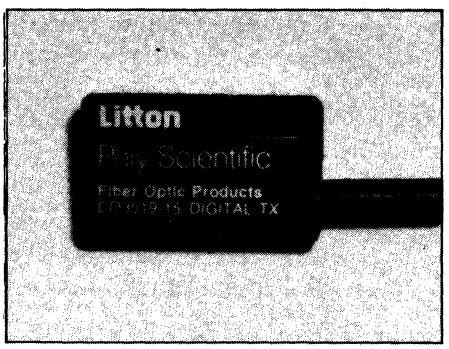
Poly-Scientific

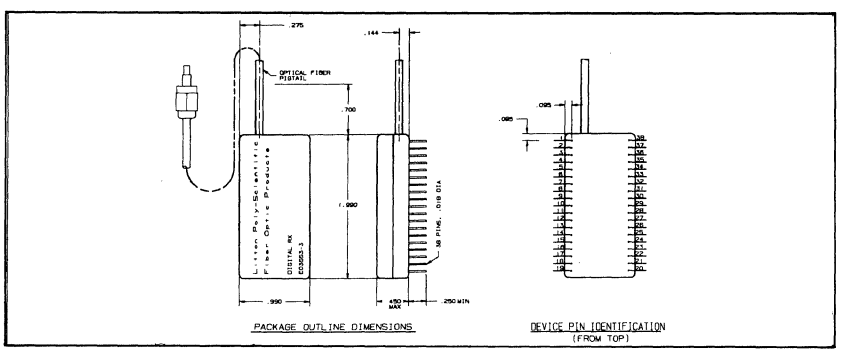
Fiber Optic Products
1213 North Main Street
Blacksburg, Virginia
24060-3100
800-336-2112
FAX 703-953-1841
TWX 710-875-3694

Miniature, Hybridized Transmitters and Receivers for Point-To-Point and Data Bus Applications

AC or Edge-coupled with data rates up to 50 Mbps Manchester. Transmitters with high launch power, and receivers with superior sensitivity and broad dynamic range. TTL and ECL compatible (interface circuits may be required). Qualifiable to MIL-STD-883. Due to ongoing development, specifications are subject to change.









Type	Data Rate	Part No.	Electrical Interfaces	Dynamic Range (min)	Peak Launch Power Into 100μ Fiber	Peak Rx Sensitivity (min)	Wavelength	Supply Voltage Requirements	Special Features
Hybrid Digital Tx	DC to 100 Mb/s NRZ	TX5000*	ECL	N/A	-7dBm	N/A	850nm	+5 or -5	• Single Voltage • Can be used with any receiver below
Hybrid Digital Rx AC coupled	1MHz to 25Mb/s NRZ	RX5237*	TTL or ECL	16dB	N/A	-28dBm 10^{-9} BER	850nm	+5 or -5	• Single Voltage
Hybrid Digital Rx AC coupled	50 Mb/s Manchester Encoded	RX5418*	ECL	20dB	N/A	-34dBm 10^{-9} BER	850nm	+/- 5 +15	• 16 bit preamble required for Burst Manchester
Hybrid Digital Rx AC coupled	20 Mb/s Manchester Encoded	RX5447*	ECL	20dB	N/A	-36dBm 10^{-9} BER	850nm	+/- 5 +15	• 16 bit preamble required for Burst Manchester
Hybrid Digital Rx Edge coupled	Up to 1 Mb/s Manchester Encoded	RX5326*	TTL	20dB	N/A	-42dBm 10^{-9} BER	850nm	+/- 5 +/- 15	• Fanout 5 LS loads • Burst Manchester
Hybrid Digital Rx Edge coupled	Up to 2 Mb/s Manchester Encoded	RX5346*	TTL	20dB	N/A	-42dBm 10^{-9} BER	850nm	+/- 5 +/- 15	• Fanout 5 LS loads • Burst Manchester
Hybrid Digital Rx Edge coupled	Up to 20 Mb/s Manchester Encoded	RX5347*	TTL	20dB	N/A	-35dBm 10^{-9} BER	850nm	+/- 5 +15	• Burst Manchester
Hybrid Digital Rx Edge coupled	Up to 50 Mb/s Manchester Encoded	RX5318*	ECL	20dB	N/A	-28dBm 10^{-9} BER	850nm	+/- 5 +15	• Burst Manchester

* All part numbers are with 100/140μ fiber less optical connector.

Call us toll-free at **800-336-5917** (in Virginia, call 703-953-4751) for more information.

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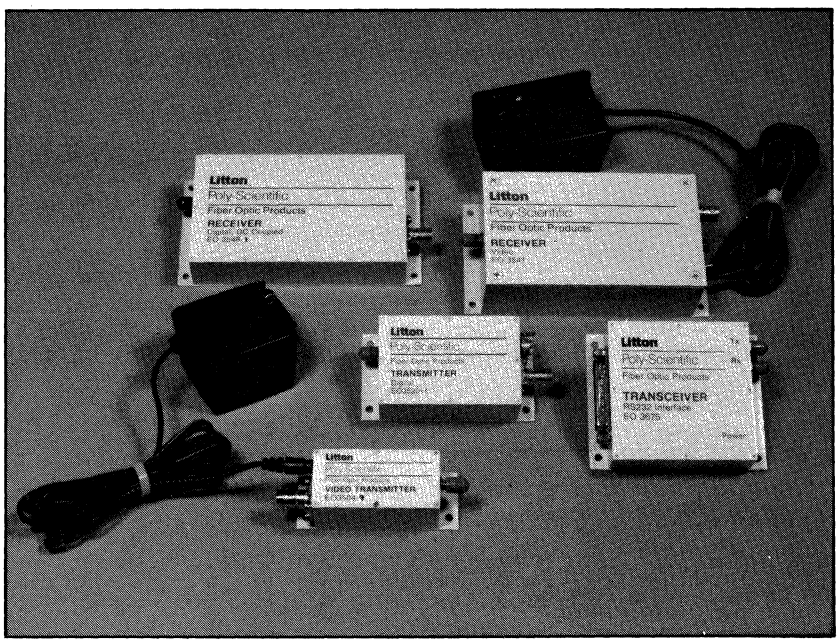
Poly-Scientific

Fiber Optic Products
1213 North Main Street
Blacksburg, Virginia
24060-3100
800-336-2112
FAX 703-953-1841
TWX 710-875-3694

Traditional Transmitters and Receivers for Standard or Custom Applications

Many of our transmitters and receivers are custom-built according to the special needs of our customers. Listed below are representative examples. A variety of packaging and connector options are available. Transmitters and receivers available with 1300nm sources and detectors.

- **Analog systems**
- **Digital systems**
- **Video systems**
- **RS 232 and RS 422**



Type	Data Rate	Part-No.	Electrical Interfaces	Dynamic Range (min)	Peak Launch Power Into 100μ Fiber	Peak Rx Sensitivity (min)	Wavelength	Supply Voltage Requirements	Package Dimensions	Special Features
Video Tx	Link Bandwidth 5Hz≥ 10 MHz	EO3504-9	RS 170	N/A	-12dBm Flat Field	N/A	850nm	110 VAC power supply included	1.25"x3.25"x1.12"	For use with EO3541-1 or EO3541-9
Video Rx		EO3541-1	RS 170	8dB	N/A	-32dBm	850nm	110 VAC power supply included	1.12"x5.75"x3.0"	For use with EO3504-9
Video Rx		EO3541-9	RS 170	12dB	N/A	-24dBm	850nm	110 VAC power supply included	1.12"x5.75"x3.0"	For use with EO3504-9
Digital Tx	DC-50Mb/s NRZ	EO3520-8	50 ohm Terminated 3V max	N/A	-10dBm	N/A	850nm	+/- 5	1.12"x3.75"x2.0"	For use with EO3560 or EO3548
Digital Rx	100 Kb/s to 50 Mb/s NRZ	EO3560-7	TTL	15dB	N/A	-32dBm 10^{-9} BER	850nm	+/- 5	1.12"x5.75"x3.0"	For use with EO3520-8
Digital Rx Edge Coupled	DC to 12 Mb/s NRZ	EO3548-1 *	TTL	20dB	N/A	-35dBm 10^{-9} BER	850nm	110 VAC power supply included	1.12"x5.75"x3.0"	For use with EO3520-8
Digital Rx Edge Coupled	DC to 12 Mb/s NRZ	EO3548-2	TTL	8dB	N/A	-45dBm 10^{-9} BER	850nm	110 VAC power supply included	1.12"x5.75"x3.0"	APD detector. For use with EO3520-8
RS 232 Tx/Rx	DC to 100 Kb/s NRZ	EO3675-2	RS 232	25dB	-10dBm	-34dBm 10^{-9} BER	850nm	110 VAC power supply included	.875"x3.75"x3.0"	• Suitable for star coupler (LAN) • DTE or DCE • One pair constitutes a set
RS 422 Tx/Rx	DC to 100 Kb/s NRZ	EO3674-2	RS 422	25dB	-10dBm	-35dBm 10^{-9} BER	850nm	+/- 5	.875"x3.75"x3.0"	One pair constitutes a set

* Lower data rates are available with improved sensitivity.

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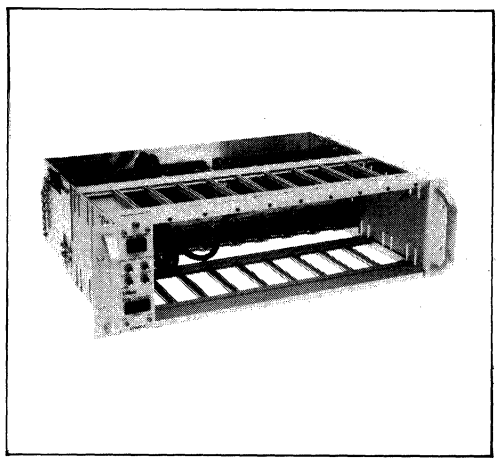
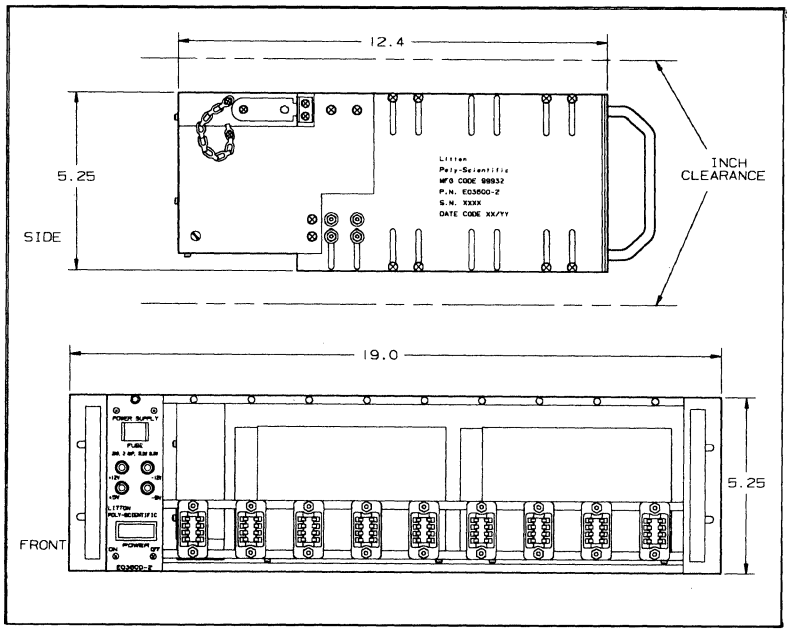
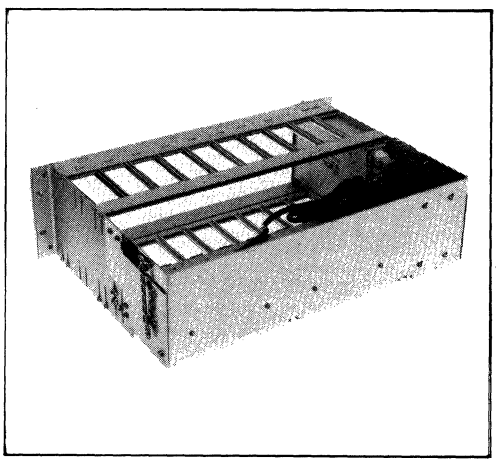
Rack-Mounted Transmitter and Receiver Systems

Many of our traditional components are available in modular, 19" rack-mounted versions.Ten bays can accommodate up to eighteen standard transmitters and receivers plus a common power supply. Connected to a 110 VAC outlet, it has a master on/off switch and a fuse for protection from overloads.

All connections (electrical and optical) are on the backplane of the modules. SMA receptacles for optical interfaces and BNC connectors for the electrical interface are standard. Other connector interfaces are available upon customer request.







Type	Data Rate	Part No.	Electrical Interfaces	Peak Launch Power Into 100μ Fiber	Peak Rx Sensitivity	Dynamic Range	Wavelength	Special Features
Digital Tx/Rx Edge Coupled	DC - 12Mbs NRZ	EO3603-1	50ohm terminated 3V max	-10dBm	-35dBm	20dB	850nm	1 Tx + 1 Rx per module
Video Tx	Link Bandwidth 5Hz ≥ 10MHz	EO3606-1 *	RS 170	-10dBm Flat Field	N/A	N/A	850nm	
Video Rx		EO3608-1 *	RS 170	N/A	-32dBm	8dB	850nm	
Digital Tx/Tx	DC - 50Mb/s NRZ	EO3609-1 *	50ohm terminated 3V max	-10dBm	N/A	N/A	850nm	2 Tx's per module
Digital Rx/Rx Edge Coupled	50Mb/s Manchester	EO3633-1	TTL	N/A	-28dBm	15dB	850nm	2 Rx's per module
Digital Tx/Tx	DC - 50Mb/s Manchester	EO3635-1	50ohm terminated 3V max	-10dBm	N/A	N/A	850nm	2 Tx's per module
Dual Channel RS 232	DC - 100Mb/s NRZ	EO4304-1	RS 232	-16dBm (50 μ)	-38dBm	25dBm	1300nm	DB25 Pigtailed connectors

* 1300nm options available. Consult factory.
Note: EO3600-2 Rack Enclosure/Power Supply required for above modules.

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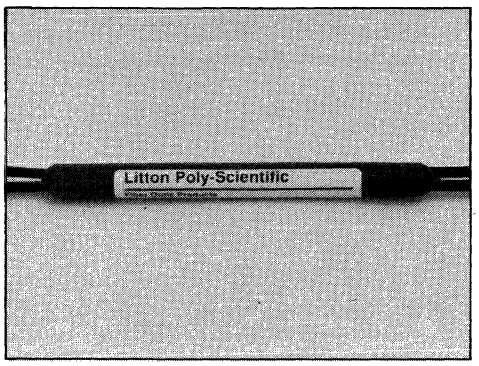
Low-Loss, Bi-Directional Couplers

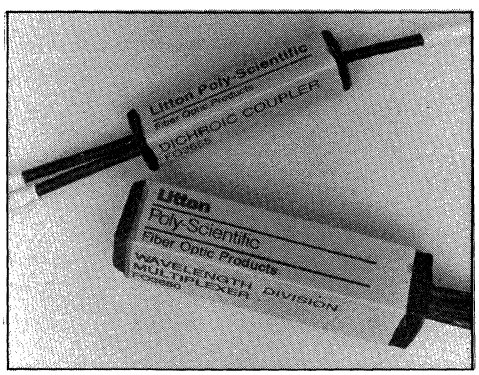
Our multi-mode symmetric and asymmetric couplers can be used in stand-alone or linear data bus applications. Designed for use in harsh environments, couplers without connectors will operate in temperatures ranging from -60° to 200° C. Various fiber sizes and types in a variety of split ratios are available.



Part No.	Type	Pigtail Length	Excess Loss	Split Ratio Tolerance	Package Size	
					Length	Diameter
FO3666	Asymmetric	≥ .5 meter	Typically ≤ .2dB	N/A	4.0"	.375"
FO3668	Symmetric 50/50	≥ .5 meter	≤ 1.0dB	+/- 5%	4.0"	.375"
FO3669	Symmetric 90/10	≥ .5 meter	≤ .5dB	+/- 3%	4.0"	.375"
FO3662	Symmetric Custom	Please call for more information.			4.0"	.375"

Wavelength Division Multiplexers

As their name implies, WDMs enable multiple channels of analog and/or digital data to be multiplexed, transmitted over a single fiber and demultiplexed at the other end of the data link. Our standard WDM configurations will perform either as multiplexers or demultiplexers.



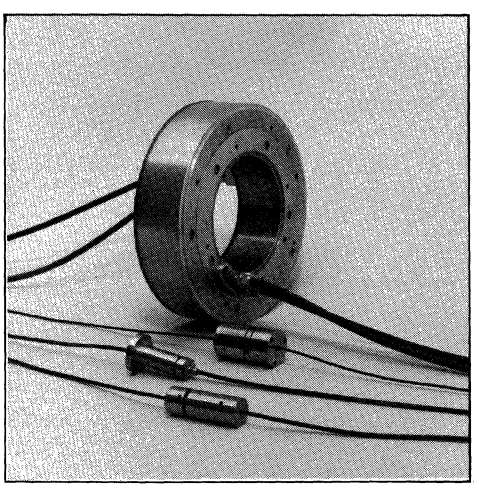
Part No.	Type	Fiber Size	Pigtail Length	Channel Capacity	Wave-length Range	Typical Insertion Loss	Crosstalk Isolation	Operating Temperature Range	Package Size		
									L	W	H
FO3650	Diffraction Grating	100/140 standard; others available	1 meter standard	15	400-1600nm	4dB	30dB	-55° to 125°C	3.01"	0.75"	0.75"
FO3655	Dichroic Filter	100/140 standard; others available	.5 meter standard	2	400/1600nm	1.5dB	≥30dB	-55° to 125°C	4.0"	Diameter .375"	

Fiber Optic Rotary Joints (FORJ)

A FORJ provides the same unlimited rotational freedom for fiber optic systems that the slip ring has long provided for electrical systems. Custom built and standard FORJs are available in two distinct types:

On-Axis FORJ: a compact totally passive single fiber device which occupies the centerline of rotation.
Off-Axis FORJ: a multi-channel active/passive device with 4" bore. Our own special repeaters are required. Data rate up to 50 MBits/sec.

In addition to the standard parts below Poly-Scientific specializes in custom designs to meet your requirements in fiber size, wavelength, pigtail lengths, connectors and mounting requirements.



FORJ Type	Part No.	Outside Diameter	Length	Fiber Size (μm)	Wavelength (nm)	Pigtail Length Each End (m)	Connec-tion	Insertion Loss
On-Axis Multi-Mode	FO3585-1	.75"	2.16"	50/125	800 - 900	1	None	50/125 is 2.5 ± .5dB
	FO3585-2	.75"	2.16"	100/140	800 - 900	1	None	100/140 is 1.75 ± .25dB
	FO3585-23	.75"	2.16"	50/125	800 - 900	1	906 SMA	200/230 is 1.75 ± .25dB
	FO3585-24	.75"	2.16"	100/140	850, 1300, 1550	.1	906 SMA	
	FO3585-22	.75"	2.16"	200/230	800 - 900	1	906 SMA	
On-Axis Single-Mode	FO3588	1.26"	3.68"	10/125	1180 - 1580	10	None	10/125 is 2.5 ± .5dB
Off-Axis	FO3595 (1-5 Channels)	7.8"	1.5" to 3.0"	N/A	N/A	1 to 10m	906 SMA BNC	N/A

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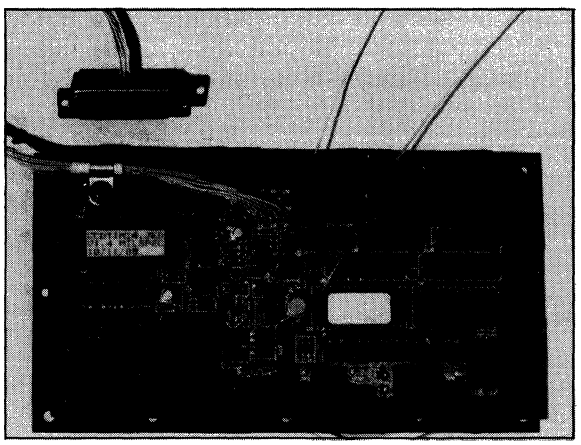
Fiber Optic Sensor Systems Using a Common Sensor Interface

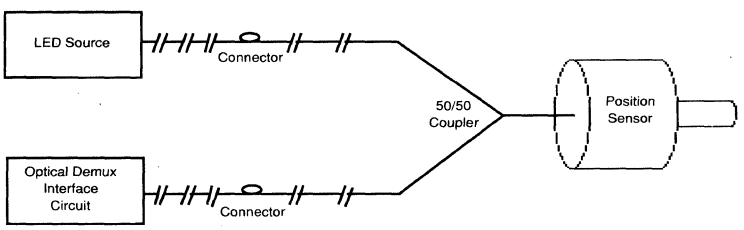
Our system uses passive fiber optic sensors based on the principle of wavelength division multiplexing. WDM sensors can be adapted to measure position, pressure, temperature and small displacements.

The system consists of a broadband source, power splitter, sensor, optical demultiplexer, and detection and decode electronics. Connected by dual fibers, the interface electronics may be located some distance from the sensor(s).

As much of our current development efforts focus on aircraft networks, we are familiar with harsh environment and MIL-SPEC system applications.

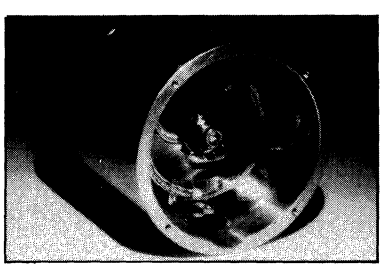


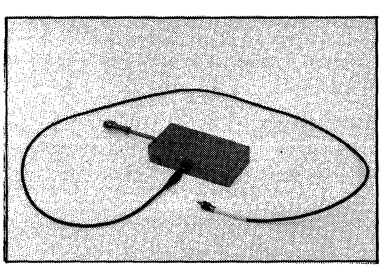
Fiber Optic Sensor System Block Diagram



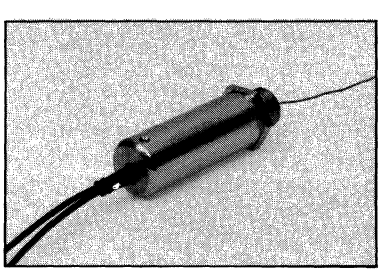
Optical Sensors

Environmental (pressure, temperature, etc.) and position (rotary and linear) sensors are available or can be designed and manufactured to meet your specific needs. Please contact us with your requirements for additional information on components or complete sensor systems.





Part No.	Type	Max Insertion Loss	Min On/Off Ratio	Light* Source Wavelength Range	* Channel Pitch Nominal	* Channel Width Nominal	* Fiber Type	Coding Type	Coding Format	* Resolution/ Travel	* Package Size
FO3571	Linear Position Transducer	11dB	10dB	750-900nm	5nm	2nm	50/125 step index NA .22	absolute	Gray Code	Up to 12 bits / Up to 7 inches stroke	2" x 4" x .87"
FO3577	Rotary Position Transducer	11dB	10dB	750-900nm	5nm	2nm	50/125 step index NA .22	absolute	Gray Code	Up to 12 bits / Up to 360°	1.4" x 1.86" (OD)



*** Note:** Values given for these parameters are application-dependent. Other values are possible. Consult factory for custom designs and latest improvements, and for custom pressure, temperature sensor systems.

Call us toll-free at **800-336-5917** (in Virginia, call 703-953-4751) for more information.

MINIGLOSSARY FIBER OPTICS

Acceptance Angle
The maximum angle within which light will be accepted by an element such as a detector or waveguide. In the latter, it is quantified as half the vertex angle of the cone within which optical power may be coupled into bound modes of a fiber.

Aligned Bundle
An assembly of fibers in which the coordinates of each fiber are the same at the two ends of the bundle, also called *Coherent Bundle.*

Bend Radius
The radius of curvature that an optical fiber can bend without breaking.

Bundle
Multiple optical fibers in a single housing used to transmit light or images.

Cladding
The low refractive index material that surrounds the core of the fiber to contain core light while protecting against surface contaminant scattering. In all-glass fibers, the cladding is glass.

Effective Numerical Aperture
The real numerical aperture of a fiber when the computed NA is not valid due to a change in the glass indices during the drawing and fusion process.

Fiber Bundle
A rigid, or flexible, concentrated assembly of glass or plastic fibers used to transmit optical images or light.

Fiber Optic Light Guide
A bundle of optical fibers arranged randomly for the purpose of transmitting energy, not images.

Fiber Optic Probe
A flexible optical probe having a bundle of glass fiber arranged to transmit an image

Gap Loss
The optical power loss caused by space between axially aligned fibers.

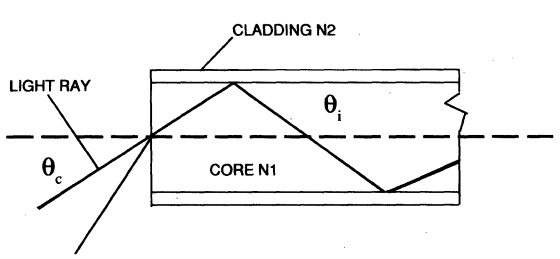
Image Transducer
Any arrangement of a bundle of optical fibers that alters the shape of the image. For example, by a systematic regulation of the spacing of the fibers from the entrance end to the exit end, a distortion of the image can occur that may be used to neutralize or compensate for the distortion introduced by the lens, prism or mirror components in an optical system.

Large-Core Fiber
Optical fiber with a large core, often a step-index fiber. "Large" is sometimes defined as greater than 85 μm.

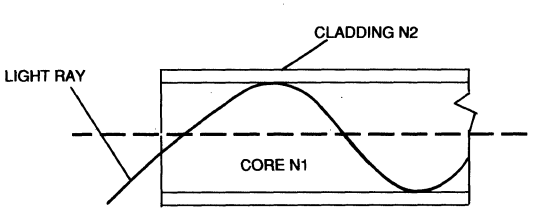
Multifibers
An array of optically distinct fibers that are fused into one strand. They are used to keep the resolution efficiency of the smaller single fibers and eliminate difficulty in handling. Their specific usage is determined by their flexibility or rigidity.

Packing Fraction
The ratio of the active core area of the fiber bundle to the total area at its light emitting or receiving end.

Plastic Fiber
Fiber in which both the core and cladding are made of plastic.



(a) Light propagation in a step index fiber.



(b) Path of light rays in a graded index fiber.

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The answer is . . . MERET.

Fiber optics are the clear choice for high performance communications with the absolute maximum in signal quality. For fiber optics to meet your most demanding applications today and tomorrow – the answer is Meret Optical Communications.

At Meret, we set the benchmark for performance in fiber optics. Our rugged, cost effective, dependable components and systems are found in over 2,000 government and commercial installations. A subsidiary of Amoco Technology, we have perfected fiber optic products for Government & Military, Digital, Analog, Closed Circuit TV, High Definition TV and High Resolution Imaging applications.

Meret has cost effective answers to your fiber optic communication needs.

CALL ON MERET FOR YOUR DEMANDING APPLICATIONS

CLOSED CIRCUIT TELEVISION

APPLICATION	KEY FEATURES
• Security • Access Control • Surveillance • Teleconferencing	• Short and Long Distances • Color or B&W • PTZ/Audio • 820 or 1300 nm Systems • Stand Alone or Rack Mount • Possible 24 Channels per 3U-High Chassis

HDTV BROADCAST

APPLICATION	KEY FEATURES
• Studio Production • Electronic News Gathering • Sporting Events • Electronic Field Production	• One Fiber for Three 30 MHz Channels of Video • CD Quality Audio and RS232 Data Planned • Bidirectional/Unidirectional • S/N 55 dB - 60 dB • Fits in 19" Rack (3 R/U Hgt.)

HIGH RESOLUTION IMAGING

APPLICATION	KEY FEATURES
• Remote Imaging For: CAD/CAM/CAE Medical Displays Flight Simulation Air Traffic Control Seismic Displays • Supercomputer Imaging • Military C³I	• 35-150 MHz RGB (LED) 0-500 MHz (Laser) • 820 or 1300 nm Systems • DC Restore/AGC • Up to 2048 x 2048 Pixels • Stand Alone or Rack Mount • RS232 and RS422 Options

GOVERNMENT & MILITARY

APPLICATION	KEY FEATURES
• Command and Control • Security, Surveillance and Access Control • Flight Simulation • Radar and Imaging Remoting • Tactical 2-Way Communications • Ship Communications • Air Traffic Control	• RGB, Monochrome, Digital Combinations • Video, Audio or Data • Complete Turnkey System Integration: Fiber Links, Switchers, PC's • High Bandwidth Laser • Automatic Switchover • Custom Packaging of Video Links

DIGITAL

APPLICATION	KEY FEATURES
• Supercomputer Interconnects • Data Communications	• Gbps Links • MUX Up to 96 Channels, Audio, TTL, RS232, RS422, RS485 & RS423

ANALOG

APPLICATION	KEY FEATURES
• Instrumentation • IF/RF Communications • EMP Testing • Timing/Delay Lines	• Remote Controlled Transmitters • Links with DC Response • Telemetry Remoting to 1.5 GHz • High Linearity Links

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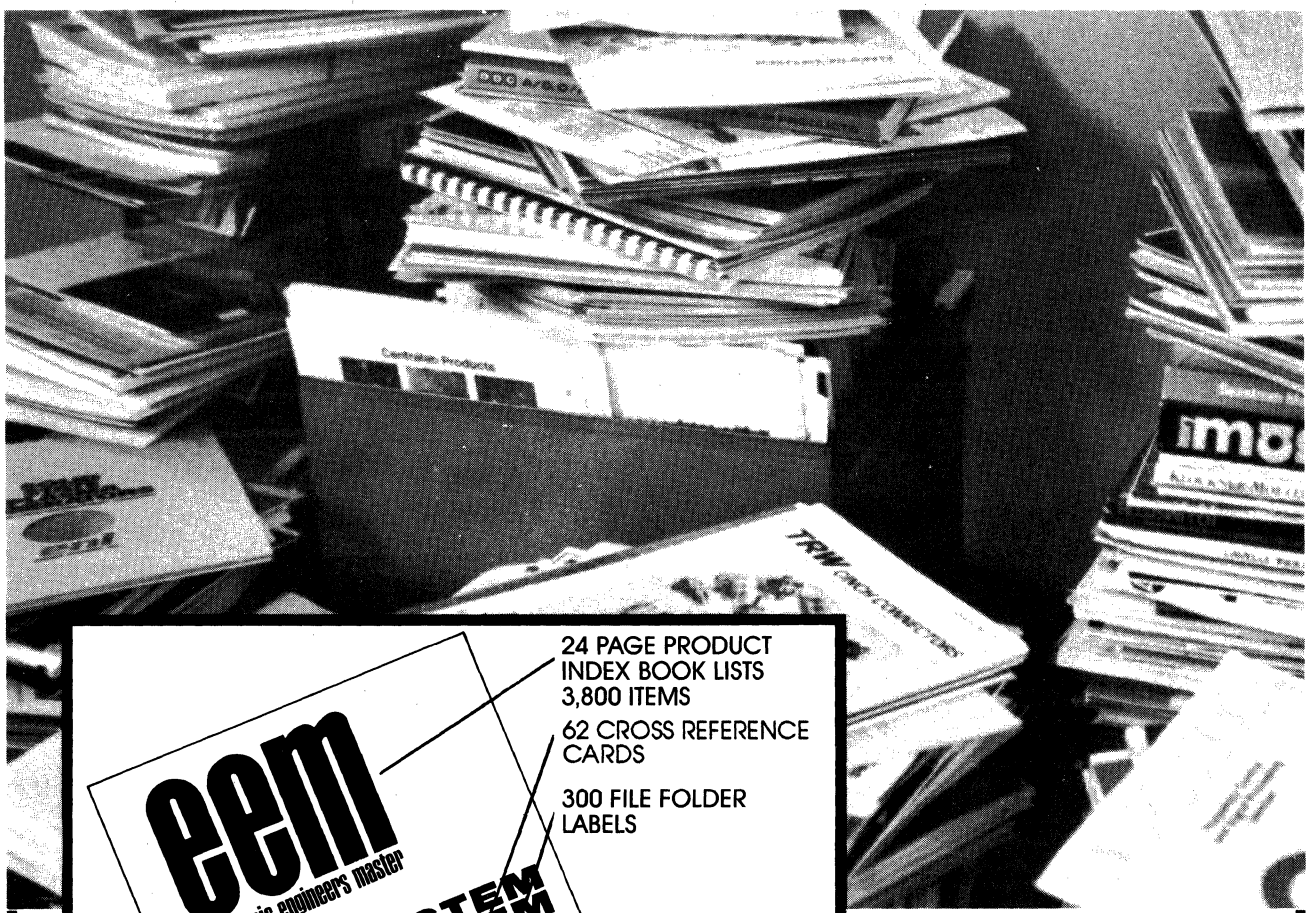

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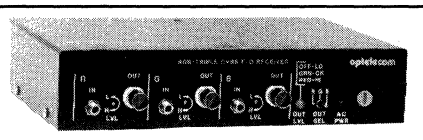
The Fiber Optics Company that Goes the Distance

Optelecom is the first stop engineers make for fiber optic communications products. That's because the first time engineers purchase products from Optelecom, they realize it's the last time they will ever have to search for a company that delivers reliable, durable and flexible products each and every time.

For nearly 20 years, Optelecom has consistently provided innovative, high performance fiber optic video, audio, and data communications products. Optelecom's extensive product line is available with a wide selection of options that deliver the benefits of customized products at off-the-shelf prices. And due to the benefits of fiber optics, all transmissions from Optelecom's Communications Products are free of EMI and RFI interference.

For fiber optic communications products with far reaching capabilities, look to Optelecom, the fiber optic company that goes the distance. For details contact: ***OPTELECOM, Inc., 15930 Luanne Drive, Gaithersburg, MD 20877, 301-840-2121, FAX 301-948-6357***

FIBER OPTIC HIGH RESOLUTION MONOCHROME & RGB VIDEO TRANSMITTERS AND RECEIVERS



3252RRR

EGA & VGA VERSIONS AVAILABLE

These fiber optic video communications products use AM techniques to cost effectively transmit flawless high resolution monochrome and RGB video. Images can be generated from a centrally located graphics controller or camera and transmitted to a remote monitor located up to 6km away, depending on the transmitter/receiver model selected. All models have built-in gain adjustment aid circuitry that takes the guesswork out of balancing colors. Options include 50 MHz or 75MHz bandwidth, external sync, and bi-directional data. The models with 75MHz bandwidth are able to support up to 115MHz pixel clock rates. Currently available models have the following features:

SERIES 3252/5052 Transmits 75MHz bandwidth RGB video over 3 optical fibers. 3252 is stand alone and 5052 is the System 5000 rack mount card.

SERIES 3650 Single channel, 50MHz or 75MHz bandwidth, stand alone model.

SERIES 5650 2 or 3 channels (3 channels for RGB video), 50MHz bandwidth, System 5000 rack mount card.

SERIES 3150T Mini 50MHz transmitter attaches directly to video source BNC. Low cost, easy to install. Ideal for camera mounting.

FIBER OPTIC RGB VIDEO AND DATA WORKSTATION EXTENDER


3453R

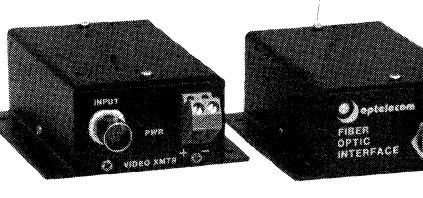
The Fiber Optic RGB Video and Data Workstation Extenders increase the video transmission distance capabilities of existing workstations so they can operate in process control, financial trading floor, and command center environments where the monitor is located up to 6km away from the central computing facility. Features include:

- Support for up to 115 MHz pixel clock rates.
- Multiple data channels up to 64kBps.
- Fast, easy and accurate color balancing initiated at the workstation end via built-in test circuitry.
- **SYNC and LOOP** indicators that provide continuous information on the status of the data multiplexer link
- Low profile (1-3/4") 19" rack mount package and desktop versions.

SERIES 3452 RGB video plus optional external sync, 2 multichannel RS232 data ports. Uses 5 to 7 fibers.

SERIES 3453 RGB video plus external composite sync, SUN Microsystems keyboard and mouse port, and 2 multichannel RS232 data ports. Uses 6 fibers.

FIBER OPTIC PFM VIDEO, AUDIO, AND DATA TRANSMITTERS AND RECEIVERS FOR MONOCHROME AND COLOR



3253T Front & Rear

Optelecom's FM video, audio, and data transmitters and receivers transmit over single mode or multi mode fiber using PFM (square wave FM) techniques. These products are designed for CCTV and broadcast applications. Depending on the version selected, units can transmit from 4km up to 25km with the output unaffected by LED variations and fiber attenuation changes. The models provide adjustment free operation and transmit the following:

SERIES 3253/5253* Video only, simplex.

SERIES 5054* Video only with visual and electric "loss of video" alarms. Rack mount only.

SERIES 3256/5056* High fidelity audio, full duplex, over 2 fibers.

SERIES 3257/5057* Video and audio in one direction over one fiber.

SERIES 3710/5710** Video in one direction and audio and data in both directions over one fiber. Supports PTZ and robotics applications

SERIES 3715/5715** Video in one direction and audio or data in the opposite direction over one fiber. Supports PTZ and robotics applications.

SERIES 3153T Mini PFM transmitter that attaches directly to video source BNC. Low cost, easy to install. Ideal for camera mounting.

* *System 5000 Rack Mount Version, 24 channels per chassis*
** *System 5000 Rack Mount Version, 12 channels per chassis*

OPTELECOM'S FIBER OPTIC COMMUNICATIONS PRODUCTS ARE THE FIRST CHOICE AMONG ENGINEERS.

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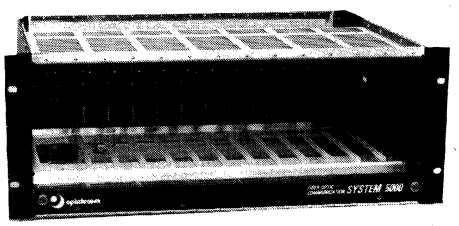
The Fiber Optics Company that Goes the Distance

SYSTEM 5000 CHASSIS

The Model 5000 chassis is the heart of the System 5000 line of rack mountable fiber optic video, audio, and data interface cards. The System 5000's unique design permits fast, easy installation and servicing of fiber and components. Features include:

- Dimensions that fit a standard 19" rack (19"wide, 13-1/2" deep, and 7" high).
- Optical cabling to the plug-in cards, accessible via a fold-down door on the front panel, lets operators totally service the unit from the front.
- Electrical cabling that remains attached at the chassis rear allows operators to quickly replace cards.
- An optional card extender that permits on-line servicing of a card.



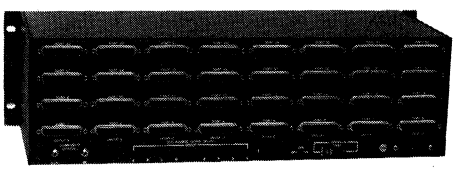
System 5000 Chassis

- Capacity for up to 12 cards and one Model 5031/4A power supply, or 10 cards and two Model 5031/4A power supplies (diode OR'ed for redundancy).

ECONOMUX

Optelecom's Economux models are top of the line fiber optic multiplexers designed to make your bottom line look good. These units are compact and can transmit up to distances that range from 3km to 25km, depending on the model. Proper two-way operation is continually monitored and verified via a front panel "LOOP-UP" indicator. Available versions include:

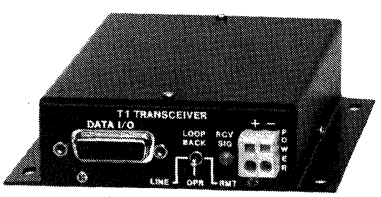
- RS232, 8 to 32 ports, 2 or 4 channels per port, asynchronous or synchronous.
- RS422, 8 ports, 8 channels per port.
- 20 milliamp current loop, 16 or 32 ports, one channel per port.
- Fiber optic subchannels, 8 or 16 full duplex fiber ports, compatible with Optelecom's Series 41XX modems.



4432/2A

FIBER OPTIC T-CARRIER INTERFACE

Optelecom's Fiber Optic T-Carrier Interface is a small, reliable, and inexpensive fiber optic transmitter/receiver set that transmits AMI or B8ZS data using analog techniques and does not alter or manipulate data. The Series 4231 is the stand alone unit and Series 5631 is a plug-in card compatible with the System 5000 chassis. These products transmit full duplex T-1 compatible signals via two optical fibers. And depending on the version, these units can transmit up to 12km via multi mode fiber and up to 9km via single mode fiber. Each unit contains built-in local (line) loopback and remote loopback test circuitry and visible LED signal indicators to verify proper operation.



4231

All **Optelecom's** Video, Audio, and Data Communications Products Are Available with These Options:

- ▼ Short or long distance capability,
- ▼ 850nm or 1300nm,
- ▼ Multi mode or single mode fiber operation,
- ▼ SMA or ST™ connectors.

Call Optelecom for all your data communications needs at 301-840-2121

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FIBER OPTIC DIGITAL COMMUNICATIONS MODEMS

Optelecom's modems go the distance with transmission capabilities that range from 1km to 25km. The selection includes, but is not limited to the following models, which have these features:

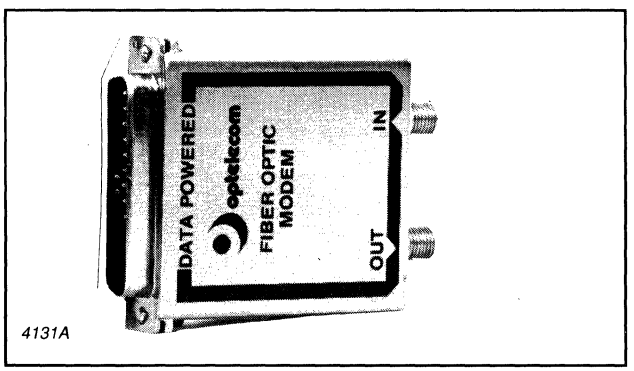
SERIES 4131A Asynchronous RS232, full duplex.
Extremely low power requirements, operates via existing RS232 data and control lines.
Small and light weight (2.1"W x 2.6"L x .6"D and 3.5oz).
DC to 56kBps.

SERIES 4131T TEMPEST version of 4131A.

SERIES 414X Externally powered, RS232, RS422 or current loop versions available.
DC to 56kBps.

SERIES 4245/5054* RS422 or TTL clock and data, full duplex over 2 fibers.
Transparent to data rate, no frequency tuning required.
Near DC to 5MBps.

SERIES 4260/5060* Multichannel asynchronous or synchronous RS232 or RS422, full duplex over 2 fibers.
DC to 64kBps.



4131A

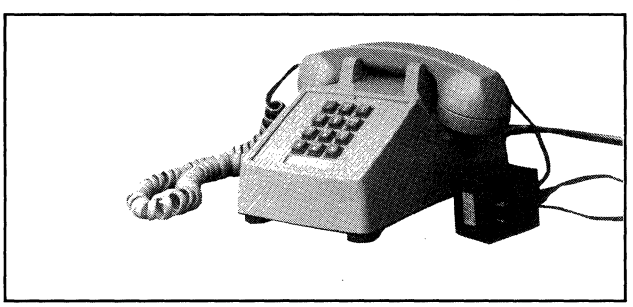
SERIES 4642/5642** High speed TTL or RS422, asynchronous.
Simplex or full duplex.
Ideal for continuous or burst mode operation.
Near DC to 20 MBps.

** System 5000 Rack Mount Version, 12 channels per chassis.*
*** System 5000 Rack Mount Version, 24 channels per chassis.*

FIBER OPTIC TELEPHONE SET AND ANALOG OPTICAL MODEM

When all lines need to be secure, Optelecom's Fiber Optic Telephone Set (FOTS), fitted with a small Analog Optical Modem (AOM), is designed to satisfy TEMPEST requirements. The telephone set can be either a modified industry standard type Model 2500 touch-tone telephone or Model 500 pulse-dial telephone with these features:

- Built-in rechargeable battery that permits 24-hour continuous operation.
- Connections via 2 optical fibers to either another FOTS for a hot ringdown dedicated line or to an AOM with an internal 2 or 4 wire Central Office Interface (COI) personality card for communicating with a PABX.



- Transmission distances, 3 or more kilometers.
- Support for full duplex audio and 4 data lines.

- *OPTELECOM's versatile System 5000 allows engineers to configure a system with countless combinations of video, audio, and data interfaces. The result is a clean, compact, high performance fiber optic communications system designed to your specifications.*
- *In addition, OPTELECOM manufactures fiber optic transmitters and receivers for local area networks including ETHERNET, Token Ring, Token Bus, Omninet, APOLLO, IBM 3270, and Mil-1553.*
- *Optelecom's commitment to providing innovative, high performance fiber optic communications products extends to designing and manufacturing customized high quality products for companies that have unique requirements and special needs.*

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FIBER OPTIC AMPLIFIERS AND TRANSMISSION SYSTEMS ANALOG WIDEBAND DC-1MHz & DC-10MHz

SPECIFICATIONS

INPUT VOLTAGE RANGES:
Switch selectable with 1 megohm 30 PF input.
0-±1VPK, ±10VPK, ±100VPK, ±1000VPK,
or ±0.1VPK, ±1VPK, ±10VPK, ±100VPK

OUTPUT VOLTAGE

DC-1MHz	DC-10MHz
0-±10VPKDC-1MHz into 10 Kohms or more	0-±10VPK into 50 ohms

BASIC ACCURACY:

DC-1MHz	DC-10MHz
0.3%DC	0.25%DC
0.5%1Hz-400Hz	0.5%1Hz-400Hz
3%400Hz-100KHz	3%400Hz-5MHz
10%100KHz-1MHz	-3db 10MHz

TRANSMISSION DISTANCE:

DC-1MHz	DC-10MHz
1Kilometer	Over1000feet

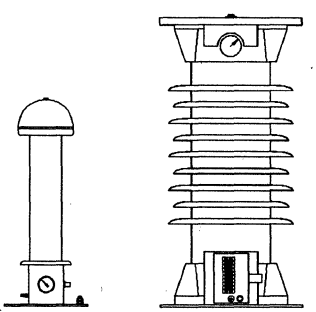
Signal transmission not affected by shock, vibration or change in light intensity.

POWER REQUIREMENTS:

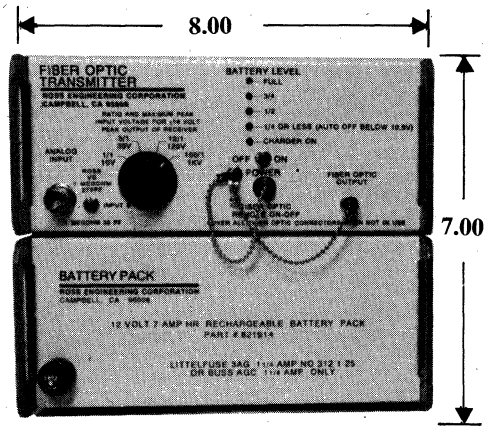
Transmitter:
115V/230V 50/60Hz and 12V DC powered, with integral charger. Optional remote on/off controlled by fiber optic cable.
Standard battery provides 8-15 hours of operation between charges, longer available.
Also isolated power source available for continuous operation without integral battery from power source at ground potential.

Receiver:
115V/230V 50/60Hz or 12V DC powered.

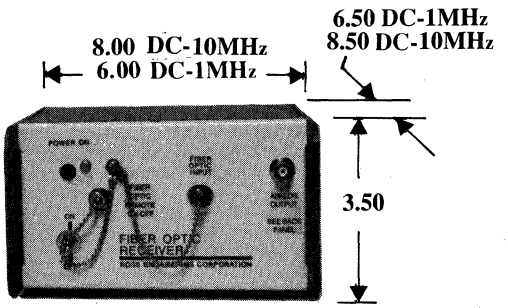
Voltage input range can be extended in 15KV increments to 900KV PK by Ross Engineering Corporation's wide band voltage dividers.



VD60 KV INDOOR **VD120 KV OUTDOOR**

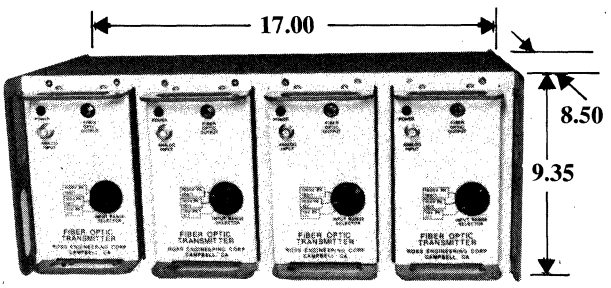


AC/DC POWERED TRANSMITTER WITH 12V DC 8-15HR. BATTERY PACK



AC POWERED RECEIVER

DIMENSIONS IN INCHES



4 CHANNEL FIBER OPTIC SYSTEM ALSO AVAILABLE :

Each channel is independent, self-contained, and removable for separate operation. Powered by 115V/230V 50/60Hz.

ROSS ENGINEERING CORP.
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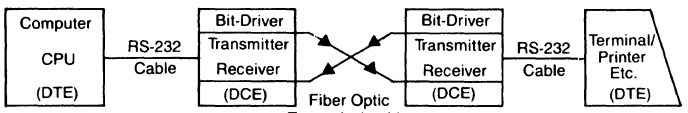
FAX(408)377-5182

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

S.I. TECH Fiber Optic Modems & Multiplexers

PO BOX 609, Geneva, IL 60134 • TEL: 708/232-8640 • FAX: 708/232-8677

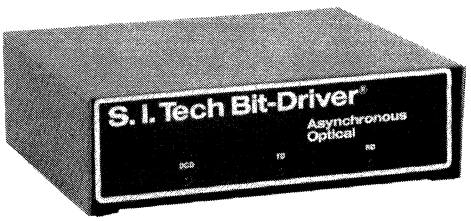
TYPICAL APPLICATION



DTE: Data Terminal Equipment
DCE: Data Communication Equipment

Designed to convert various computer interfaces to optical and reconvert at remote end. Typical applicaton shown in the diagram at left. Fiber optic communication is immune to EMI/RFI, lightning, ground loops and can be used for secure data. Cables are small, lightweight, lower loss over large transmission distances, and provide error free data communications. Glass fibers of various sizes such at 50/125, 62.5/125 & 100/140 can be used. Most have a range of 6600 ft. (2 Km), 15000 ft. (5Km) optional.

STAND ALONE FIBER OPTIC MODEMS



Bit Driver is a simplex or full duplex system capable of transmitting data up to 56K bps over fiber optic cable. Stand alone component with RS-232 interface and input/output transmision connection. LEDs indicate status. 6000 ft maximum distance capability. Operating temperature is from 0° to 50°C. AMP Optimate connector receptacles with SMA/ST connections optional. UL & CSA listed.

S.I. TECH #	Enclosure	Operating Mode	Price ea.
2001	Metal	Asynchronous	100
2004	Metal	Synchronous	400
2005	Metal	Asynchronous	300

*These modems can be obtained in card style to fit Model 3000 Card Cage.

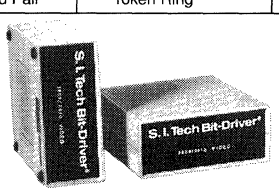
LOCAL AREA NETWORK - FIBER OPTIC MODEMS



Each modem is designed to operate with various networks (see table). Fiber optic bit drivers eliminate many disadvantages of standard transmission lines. All types are stand alone and allow easy change from existing lines to fiber optic line using 2 SMA (ST-option) connector fiber optic receptables. Also comes with power supply and status indicators. 2 KM standard, 5 KM & 1300 nm options.

S.I. TECH Number	Interface	Network	Data Rate/MBps
2105 mini	RS-232	RS-232 Ring	0.1
2836	Twinax	IBM 34/36/38 AS/400	1
2852	RS-485 Twisted Pair	OMNINET	1
2853	Coax	ARCNET	2.5
2870	Coax	IBM SNA	2.35
2875	IBM	IBM	4
2876	IBM Twisted Pair	IBM Token Ring	4

FIBER OPTIC VIDEO SYSTEM

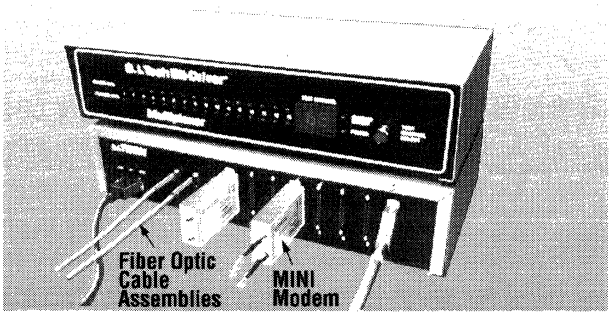


Designed for CCTV with color or black & white video. Can be applied to TV monitors, security system, surveilance and industrial applications. Has BNC bulkhead jack with 75 ohm impedance, with an input voltage of 1Vpp. SMA or ST connectors. Maximum operating distance to 5000 ft. in temperature range of 0° to 50°C. Plastic case is 6" x 6.5"

S.I. TECH Number
2809 Transmitter
2810 Receiver

Rack mounted, mini & card types available. 1300 nm option for long distance.

MINI OPTICAL BIT DRIVERS



Features simplex or full duplex operation, SMA (ST-option) receptacles, DTE, or DCE switch selectable, LED Indicator for transmit and receive data and RS-232C connectors (cable not required). 2505 is 0 to 56K bps asynchronous operation up to 5000 ft. maximum operating distance. Requires Type 2101 external transformer. 2507 is 50 to 19.2K bps asynchronous operation up to 3000 ft. maximum operating distance. Powered by DTE. See picture above.

S.I.TECH Number	Data Rate/MBps	Distance	Features
2320	19.2	5000	PC XT or AT bus-board level
2505M	56	5000	2101 or pin 9
2505F	56	5000	2101 or pin 9
2506	19.2	3000	2101, Hanshake Lines
2106	19.2	3000	2101, RS-422
2507M	19.2	3000	DTE powered
2507F	19.2	3000	DTE powered
2101	—	—	Power Transformer

FIBER OPTIC MULTIPLEXERS

Time division multiplexers with various interfaces. Status indicators show activity of each channel & the integrity of fiber link. Standard models 6600 ft. (2Km) with 5 Km optical, SMA connectors are standard with ST optional UL, CSA, FCC certified. See picture above.

FIBER OPTIC MULTIPLEXERS

S.I. TECH Number	Key Feature	No. of Channels
2006	RS-232, Async/Sync	Up to 8
2016	RS-232, Async	16
2017	RS-232, Async	4
1000	RS-232, Async/Sync	Up to 48
9304	IBM Twinax/AS 400	4
9308	IBM Twinax/AS 400	8
3700	IBM Coax 3174 & 3274	4 to 32

FIBER OPTIC CABLE, 1 & 2 FIBER, PRETERMINATED ASSEMBLIES

S.I. Tech Part #	Fiber Size* Micron	No. of Fibers	Connector** Type	Length Ft. (m)
5201-0003-8255	62.6/125	1	ST	3 (1)
5201-0003-8252	62.5/125	1	SMA	3 (1)
5201-0010-8255	62.5/125	1	ST	10 (1)
5201-0010-8252	62.5/125	1	SMA	10 (1)
5202-0003-8255	62.5/125	2	ST	3 (1)
5202-0003-8252	62.5/125	2	SMA	3 (1)
5202-0010-8255	62.5/125	2	ST	10 (3)
5202-0010-8252	62.5/125	2	SMA	10 (3)

*For 50/125 fiber, change part # to 7 from 5, e.g. 7201-003-8255.
**Other cable lengths and connector types available, such as Biconic, Mini BNC, FC, D4, and FDDI.

Micro Mo®

MINIATURE ELECTRIC DRIVE SYSTEMS AND ROTARY POWER TRANSMISSION COMPONENTS UP TO 1 H.P.

- Originators of Skew-Wound Coreless Micromotors.
- Patented and Licensed the World Over.

Coreless DC motors: (PG. **B**•1298)	.1-30 W continuous output power .01-7.09 oz -in. max. continuous torque Speeds up to 16,000 RPM.
PMDC motors: (PG. **B**•1299)	4-430 W continuous output power .91-415 oz-in. max. continuous torque Custom windings available up to 180 VDC. Speeds up to 6,000 RPM.
Precision gearheads: (PG. **B**•1300-1301)	Diameters from 10mm-120mm (.39-4.72 in.) Continuous output torque to 96 ft-lb. Bidirectional operation in ratios up to 1,000,000:1

ALSO AVAILABLE:

- Tacho-Generators ..... Call for Latest Data
- Optical Encoders ..... See **B**•1920
- Magnetic Encoders ..... See **B**•1920
- Precision Gearheads ..... See **B**•1300-1301
- Motor-Tachometers ..... Call for Latest Data
- Shaft Couplings ..... Call for Latest Data
- Zero Back Lash Gearing ..... See **B**•1300
- Brushless Motors ..... Call for Latest Data
- Control Systems ..... See **B**•1920, **D**•1140-1141, **D**• 2243
- Brakes & Clutches ..... Call for Latest Data

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eem selection guide motors/drives-3500

MOTORS AND DRIVES

Manufacturer	Starting EEM Page No.	DC Motors						AC Motors			Speed Reducers
		Brushless	Brush-Type	Torque	Servo	Stepper	Permanent Magnet	Induction	Synchronous	Torque	
Advanced Technologies	B•1235	√	√	√	√		√		√		√
Automotion Inc.	B•1245	√									
Bertsch U. S.	B•1246		√	√							√
Bodine Electric Co.	B•1248	√	√	√		√	√		√		
Burgess-SAIA, Inc.	B•1249					√	√		√		√
Clifton Precision	B•1251	√	√	√	√	√	√				
Crouzet Controls Inc.	B•1252		√	√		√	√		√		√
Eastern Air Devices	B•1254	√	√	√	√	√	√	√	√	√	√
Eltrol Corp.	B•1255	√	√	√	√		√				
ETI Systems	B•1256							√			
Hurst Manufacturing	B•1272	√				√	√		√		
Industrial Drives	B•1276	√	√	√	√		√		√		
Infranor	B•1279	√	√	√	√	√	√				√
Inland Motor	B•1280	√				√	√				
Mabuchi Motor America Corp.	B•1293		√						√		
Magtec Controls; Vernitron Corp.	B•1294	√	√	√	√		√				
MFM Technology Inc.	B•1297	√		√	√		√				
Micro Mo Electronics	B•1298	√	√		√		√				√
Modular Devices	B•1302				√						
Motor Technology	B•1303	√	√		√		√	√			
NMB Technologies	B•1306	√				√					
Pittman Corp.	B•1308	√	√		√		√				
Shinano Kenshi Corp.	B•1311	√	√		√	√	√	√			
Stock Drive Products	B•1312	√	√	√	√	√	√	√	√	√	√
Superior Electric Co.	B•1313	√				√	√		√		√
Synektron Corp.	B•1316	√		√	√						ß
Vernitech	B•1318	√	√	√	√	√	√	√	√	√	√

ROTATING COMPONENTS

Manufacturer	Starting EEM Page No.	Capsule Slip Rings	Power Slip Rings	Pancake Slip Rings	Power Capsule Slip Rings	General Purpose Slip Rings	Flat Slip Ring Assemblies	Vehicle Slip Rings
Airflyte Electronics Co.	B•1238	√	√	√	√	√	√	√
Fabricast	B•1262	√	√	√	√	√	√	√
Fifth Dimension	B•1268	√	√	√	√	√		√
Graphite Metallizing Corp.	B•1271	√	√	√	√	√	√	√
Litton Poly-Scientific	B•1283	√	√	√	√	√	√	√
Mercotac, Inc.	B•1295	√	√	√	√	√	√	

Manufacturer	Starting EEM Page No.	Rotary Switches	Separate Rotors & Brush Blocks	Encoders	Power Cartridge Type Brushes	Brush Holders	Tachometers	Motorized Potentiometers
Airflyte Electronics Co.	B•1238	√	√	√	√	√		
Clifton Precision	B•1251						√	
Eastern Air Devices	B•1254		√				√	
ETI Systems	B•1256							√
ETRI Inc	B•1261							√
Fabricast	B•1262		√		√	√		
Fifth Dimension	B•1268		√					
Graphite Metallizing Corp.	B•1271	√	√		√	√		
Infranor	B•1279			√			√	
Litton Poly-Scientific	B•1283		√			√		
Magtec Controls	B•1294			√			√	
Micro Mo Electronics	B•1298			√			√	
Motor Technology	B•1303						√	
Servo-Tek Products Co.	B•1306			√				
Stock Drive Products	B•1312			√			√	
Vernitech	B•1318			√			√	

Advanced Technology Company

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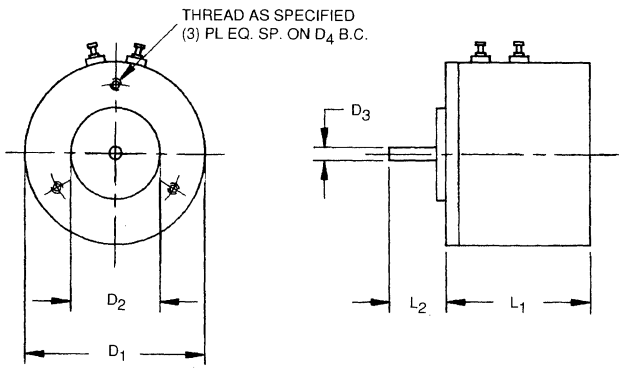
Advanced Technology Company's extensive experience and technical expertise in development and design of high performance electro-magnetic devices has been utilized to develop the products below. Our appreciation of the customer's system performance requirements, thermal constraints, mechanical interfaces, and cost factors allows Advanced Technology Company to offer unique solutions to your electro-magnetic device needs. Try us.

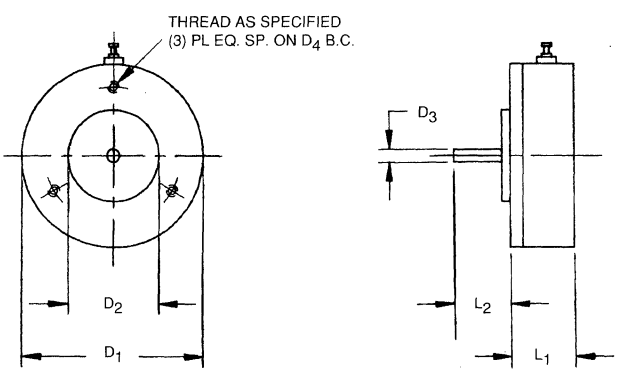
BRUSHLESS D.C. MOTORS — UNI DIRECTIONAL



PARAMETER	BME-1300 -090		BME-1500 -120		BME-1700 -145	
VOLTAGE	12	24	12	24	12	24
BACK EMF *	0.013	0.026	0.026	0.052	0.021	0.042
O.P. SPEED	5600	5600	2800	2800	3500	3500
DIMENSIONS						
D-1	1.3		1.5		1.70	
D-2	0.625		0.75		0.875	
D-3	0.79		0.118		0.118	
D-4	0.875		1.00		1.250	
L-1	0.9		1.20		1.45	
L-2	0.45		0.45		0.55	

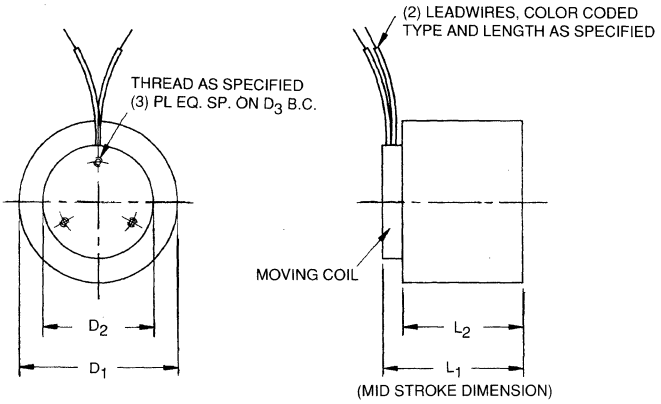
*VOLT SEC/RADIAN O.P. = OPERATING POWER SPEED

BRUSHLESS D.C. LIMITED ANGLE TORQUER



PARAMETER	UNITS	1125 -10	2000 -160	2500 -140	3500 -150	4000 -130
PEAK TORQUE	IN OZ	2.0	22.0	15.0	56.0	42.0
POWER @ Tp, 25 OZ	WATTS	23	150	24	62	68
ANGULAR ROTATION		60	60	45	60	40
DIMENSIONS						
D-1		1.125	2.000	2.500	3.500	4.000
D-2		0.600	0.875	1.000	1.500	2.000
D-3		0.125	0.187	0.250	0.250	0.250
D-4		0.750	1.250	1.500	2.000	3.000
L-1		1.00	1.60	1.40	1.50	1.30
L-2		0.50	0.50	0.50	0.50	0.50

LINEAR VOICE COIL ACTUATOR



PARAMETER	1500 -150	2000 -250	2500 -200	3000 -350	3500 -400	4000 -500
PEAK FORCE LBS.	3.0	6.0	7.0	15.0	18.0	22.0
POWER @ Fp WATTS	25.0	50.0	70.0	200.	200.	220.
STROKE IN.	0.05	0.08	0.08	0.10	0.10	0.10
DIMENSIONS						
D-1	1.50	2.00	2.50	3.00	3.50	3.50
D-2	PER CUSTOMER'S SPECIFICATIONS					
L-1	1.50	2.50	2.00	3.50	4.00	5.00
L-2	1.25	2.20	1.60	3.00	3.50	4.40

Advanced Technology Company

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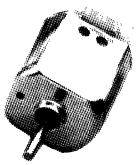
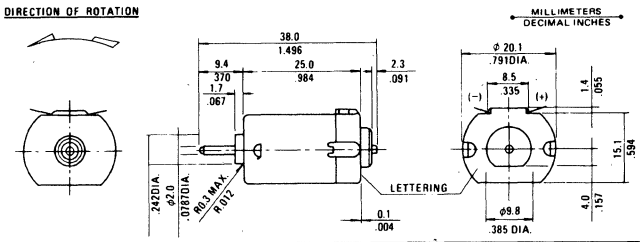
Advanced Technology's Sun Series of D.C. motors utilize self-aligning sinter bearings and copper graphite brushes for low noise and long operating life. Dynamically balanced armatures result in low vibration motor operation. Special designs available for volume applications. Try us.

SUN-10



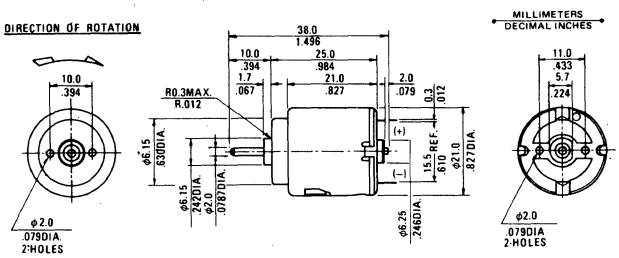


WEIGH: 17g (APPROX.)

MODEL	VOLTAGE		NO LOAD		AT MAXIMUM EFFICIENCY						STALL TORQUE	
	OPERATING RANGE	NOMINAL	SPEED	CURRENT	SPEED	CURRENT	TORQUE		OUTPUT	EFF.		
			rpm	A	rpm	A	ozin	g-cm	W	%	ozin	g-cm
SUN-10-2270	1.5 ~ 3.0	1.5 CONSTANT	8700	0.3	6500	0.81	0.086	6.2	0.41	33.9	0.33	24
SUN-10-2270	1.5 ~ 3.0	3.0 CONSTANT	16300	0.38	12000	1.15	0.138	10	1.23	35.6	0.61	44
SUN-10-3460	1.5 ~ 3.0	1.5 CONSTANT	10200	0.34	7750	0.93	0.072	6.6	0.52	37.6	0.36	26
SUN-10-3460	1.5 ~ 3.0	3.0 CONSTANT	18500	0.43	14100	1.42	0.159	11.5	1.66	38.7	0.66	48
SUN-10-38120	1.5 ~ 3.0	1.5 CONSTANT	4900	0.14	3375	0.29	0.048	3.5	0.12	27.5	0.16	12
SUN-10-38120	1.5 ~ 3.0	3.0 CONSTANT	10300	0.17	7350	0.44	0.104	7.5	0.56	42.3	0.34	25

SUN-12



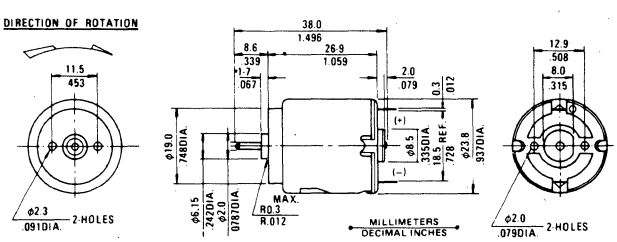


WEIGH: 19g (APPROX.)

MODEL	VOLTAGE		NO LOAD		AT MAXIMUM EFFICIENCY						STALL TORQUE	
	OPERATING RANGE	NOMINAL	SPEED	CURRENT	SPEED	CURRENT	TORQUE		OUTPUT	EFF.		
			rpm	A	rpm	A	ozin	g-cm	W	%	ozin	g-cm
SUN-12-2270	1.5 ~ 3.0	1.5 CONSTANT	7800	0.27	5800	0.77	0.096	6.9	0.41	35.5	0.36	26
SUN-12-2270	1.5 ~ 3.0	3.0 CONSTANT	14000	0.35	10000	1.183	0.174	12.5	1.28	36.1	0.72	52
SUN-12-3460	1.5 ~ 3.0	1.5 CONSTANT	8200	0.30	6000	0.84	0.104	7.5	0.46	38.0	0.37	27
SUN-12-3460	1.5 ~ 3.0	3.0 CONSTANT	14500	0.4	9750	1.29	0.213	15.4	15.4	39.7	0.76	55
SUN-12-37100	1.5 ~ 3.0	1.5 CONSTANT	5200	0.18	3750	0.44	0.083	6	0.23	34.9	0.26	19
SUN-12-37100	1.5 ~ 3.0	3.0 CONSTANT	9900	0.22	7500	0.68	0.138	10	0.71	37.7	0.55	40

SUN-18





WEIGH: 28g (APPROX.)

MODEL	VOLTAGE		NO LOAD		AT MAXIMUM EFFICIENCY						STALL TORQUE	
	OPERATING RANGE	NOMINAL	SPEED	CURRENT	SPEED	CURRENT	TORQUE		OUTPUT	EFF.		
			rpm	A	rpm	A	ozin	g-cm	W	%	ozin	g-cm
SUN-18-2760	1.5 ~ 3.0	1.5V CONSTANT	6900	0.25	4800	0.84	0.163	11.75	0.59	46.8	0.64	46
SUN-18-2760	1.5 ~ 3.0	3.0V CONSTANT	13800	0.32	10000	0.28	0.264	19	1.95	50	1.22	88
SUN-18-22100	1.5 ~ 3.0	1.5V CONSTANT	4100	0.15	3200	0.44	0.131	9.5	0.31	47.2	0.44	32
SUN-18-22100	1.5 ~ 3.0	3.0V CONSTANT	8500	0.19	7000	0.683	0.206	14.9	1.06	51.7	0.94	68
SUN-18-19100	1.5 ~ 3.0	1.5V CONSTANT	4200	0.14	2700	0.37	0.121	8.7	0.24	43	0.33	24
SUN-18-19100	1.5 ~ 3.0	3.0V CONSTANT	8500	0.18	6000	0.59	0.201	14.5	0.9	50	0.69	50

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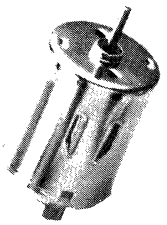
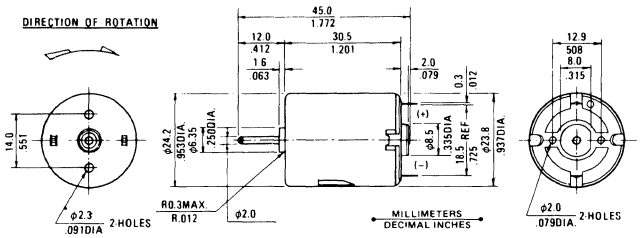
SUN-28

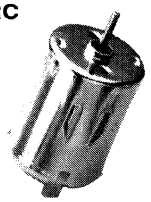


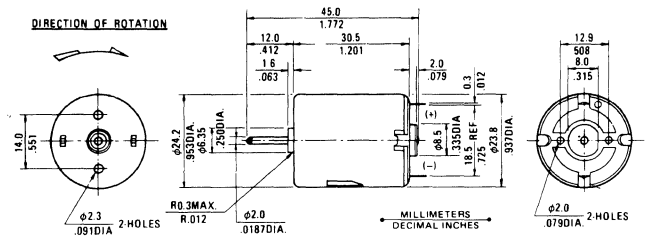


WEIGH: 42g (APPROX.)

MODEL	VOLTAGE		NO LOAD		AT MAXIMUM EFFICIENCY					STALL TORQUE	
	OPERATING RANGE	NOMINAL	SPEED	CURRENT	SPEED	CURRENT	TORQUE		OUTPUT	EFF.	
			rpm	A	rpm	A	ozin	g-cm	W	%	ozin	g-cm
SUN-28-2865	1.5 ~ 3.0	1.5 CONSTANT	4800	0.17	3300	0.64	0.208	15	0.51	53.1	0.79	56
SUN-28-2865	1.5 ~ 3.0	3.0 CONSTANT	9600	0.22	8000	0.99	0.278	20	1.64	55.2	1.56	112
SUN-28-2570	1.5 ~ 3.0	1.5 CONSTANT	4200	0.16	3050	0.55	0.168	12	0.39	46.1	0.65	47
SUN-28-2570	1.5 ~ 3.0	3.0 CONSTANT	8900	0.20	6980	0.84	0.250	18	1.29	51.1	1.35	97
SUN-28-19120	1.5 ~ 3.0	1.5 CONSTANT	5300	0.10	4250	0.36	0.180	13	0.57	52.8	0.85	61
SUN-28-19120	1.5 ~ 3.0	3.0 CONSTANT	8000	0.12	6000	0.48	0.292	21	1.29	59.7	1.26	91

SUN-28, 28(S)RC



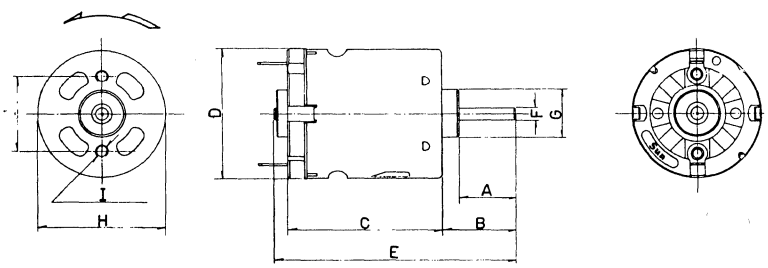


WEIGH: 42g (APPROX.)

MODEL	VOLTAGE		NO LOAD		AT MAXIMUM EFFICIENCY					STALL TORQUE	
	OPERATING RANGE	NOMINAL	SPEED	CURRENT	SPEED	CURRENT	TORQUE		OUTPUT	EFF.	
			rpm	A	rpm	A	ozin	g-cm	W	%	ozin	g-cm
SUN-28-2570	4.5 ~ 6.0	4.5 CONSTANT	11300	0.30	9000	1.19	0.417	30	2.77	51.9	1.703	137
SUN-28-2570	4.5 ~ 6.0	6.0 CONSTANT	15000	0.34	12500	1.45	0.50	36	4.67	53.7	2.496	179
SUN-28(S)-2865	4.5 ~ 6.0	4.5 CONSTANT	11000	0.29	9000	1.29	0.444	35	3.23	55.6	2.625	189
SUN-28(S)-2865	4.5 ~ 6.0	6.0 CONSTANT	14400	0.32	11000	1.56	0.667	48	5.42	57.9	3.277	236

SUN-363





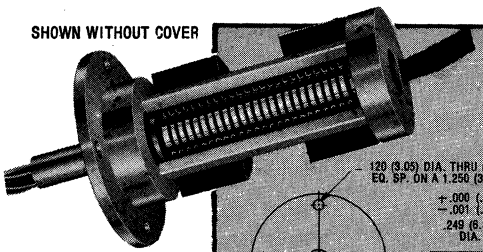
LETTER	A	B	C	D	E	F	G	H	I	J
MILLIMETER	12.0	15.5	32.6	∅27.7	51.0	∅2.3	∅10.0	∅27.5	M2.6×0.45	16.0
DECIMAL INCHES	0.472	0.610	1.283	1.091 Dia.	2.008 Dia.	0.091 Dia.	0.394 Dia.	1.083 Dia.	— — —	0.630

MODEL	VOLTAGE		FREE LOAD		AT MAX. EFFICIENCY						STALL TORQUE	
	OPERATING RANGE	NOMINAL	CURRENT (A)	SPEED (RPM)	TORQUE (GM-CM)	TORQUE (OZ-IN)	CURRENT (A)	SPEED (RPM)	OUTPUT (WATT)	EFFICIENCY (%)	(GM-CM)	(OZ-IN)
SUN 363-A	6 ~ 24	6	0.10	5800	31.63	0.439	0.469	4780	1.551	55.11	180	2.50
SUN 363-B	6 ~ 24	12	0.20	13500	55.39	0.769	0.883	11000	6.25	59.01	300	4.166
SUN 363-D	12 ~ 24	24	0.07	11000	52.17	0.725	0.333	9090	4.86	60.92	300	4.166
SUN 363-F	12 ~ 24	18	0.09	8100	48.87	0.679	0.39	6580	3.30	47.10	260	3.611
SUN 363-G	12 ~ 36	18	0.05	6100	31.18	0.433	0.23	4990	1.60	39.29	192	2.666
SUN 363-H	6 ~ 12	12	0.30	18400	69.2	0.961	1.53	15380	10.92	59.47	422	5.860
SUN 365-A	6 ~ 12	6	0.45	12500	42.89	0.596	1.44	9520	4.19	48.52	180	2.50
SUN 365-B	12 ~ 24	12	0.20	13500	41.32	0.574	0.768	10710	4.54	49.24	200	2.777
SUN 365-G	12 ~ 24	12	0.20	10000	51.65	0.717	0.63	8050	4.27	56.22	215	2.986

Airflyte ELECTRONICS CO.

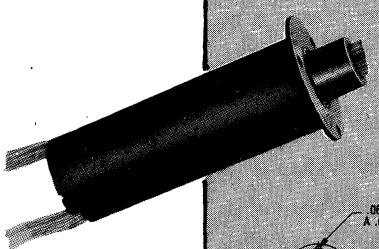
CAPSULE SLIP RING ASSEMBLIES

SHOWN WITHOUT COVER

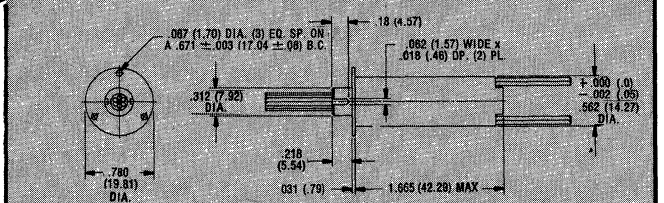


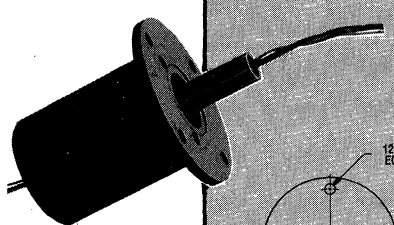
CAY-110
UP TO **30** RINGS

No. of Rings	Inches "A"	Milli-Meters
4-12	1.48	37.6
13-24	2.20	55.9
25-30	2.56	65.0

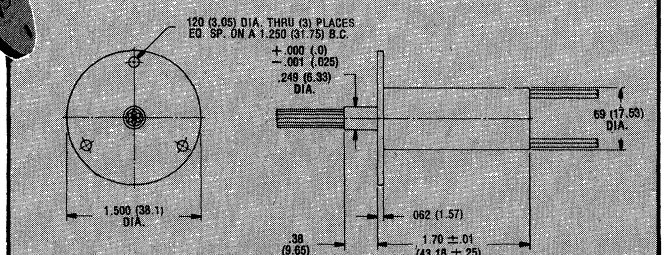


CAY-604
UP TO **40** RINGS





CAY-245
UP TO **20** RINGS



These Slip Ring Assemblies have found wide use in gyro gimbal and instrument applications. The fully enclosed and tested assemblies feature fine diameter gold alloy brushes mated to compatible gold alloy rings for excellent noise characteristics at low torque levels. Although miniature in size, the assemblies are surprisingly rugged and are able to withstand most military environmental specifications.

Units have been fully tested to the environmental parameters listed below, proving their ruggedness and reliability. All units are factory tested before shipment and a copy of the test data is available with each unit upon request.

The units shown here are only a sample of those available which include a 50 ring capsule of .685 diameter.

SPECIFICATIONS

MECHANICAL

1. Rings: Gold alloy
2. Brushes: Gold alloy wire, spring temper
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Stainless steel
5. Housing: Anodized aluminum
6. Rotation: Bi-directional

ELECTRICAL

1. Current: Signal level to 1 amp maximum
2. Voltage: Micro-volts to 110 volts rms
3. Dielectric Strength: 500 volts rms (all combinations)
4. Leadwire: #30 AWG teflon insulated, 15″ long minimum
5. Noise: ±5 micro-volts per ma

ENVIRONMENTAL

1. Temperature Shock: +85°C for 1 hour and immediately transferred to −55°C for 1 hour
2. Shock: 18 shocks, 20 "g" with duration of 11 ±1 ms (MIL-E-5272C, Procedure V)
3. Vibration: MIL-STD-202B, Method 204, test condition B
4. Altitude: 50,000 ft. and −55°C
5. Humidity: MIL-E-5272C, Procedure III (95% R.H. @ 120°F for 360 hours)

ORDERING INFORMATION

CAY-□□□ □□

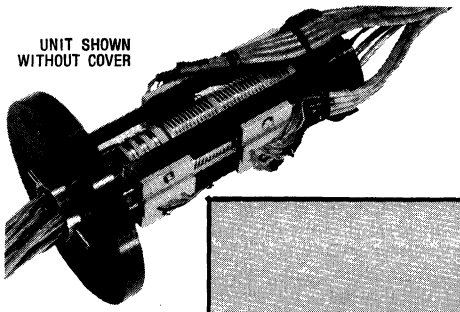
- No. of Rings
- Model

	CAY-110	CAY-604	CAY-245
MECHANICAL			
Torque	1.0 in.-oz. max. (24 rings)	1.0 in.-oz. max.	0.5 in.-oz. max. (20 ring assembly)
Speed	500 rpm max.	200 rpm max.	200 rpm max.
Life	10^8 revs. min.	5 x 10^6 revs. min.	10^7 revs. min.
ELECTRICAL			
Contact Resistance Variation	5 milliohms max. at max. speed	20 milliohms max. at max. speed	5 milliohms max. at max. speed
No. of Rings	30 max.	40 max.	20 max.

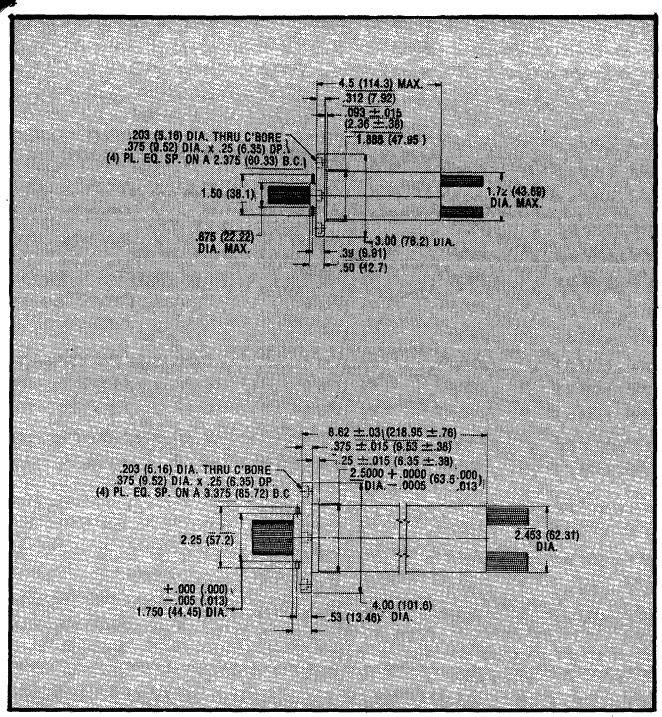
NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 FAX 201-436-6024

Airflyte ELECTRONICS CO.

CAPSULE SLIP RING ASSEMBLIES



CAY-150
UP TO **48** RINGS



CAY-1120
UP TO **90** RINGS

These assemblies, specially designed for gyro-rate table and centrifuge applications, have found wide use because of their versatility and compact size. The standard assembly, can be supplied (at slight extra cost) with internally shorted rings for double and triple current ratings, and with single, double and triple shielded wire. Featuring gold alloy wire brushes and compatible gold alloy rings, these assemblies are manufactured from proven production tooling at a very nominal cost. Special assemblies with switching circuits and others with non-standard materials for use in severe environments are available.

SPECIFICATIONS

MECHANICAL

1. Rings: Gold alloy
2. Brushes: Gold alloy wire, spring temper
3. Ball Bearings: Stainless steel
4. Shaft: Stainless steel, type 303
5. Housing: Anodized aluminum
6. Rotation: Bi-directional

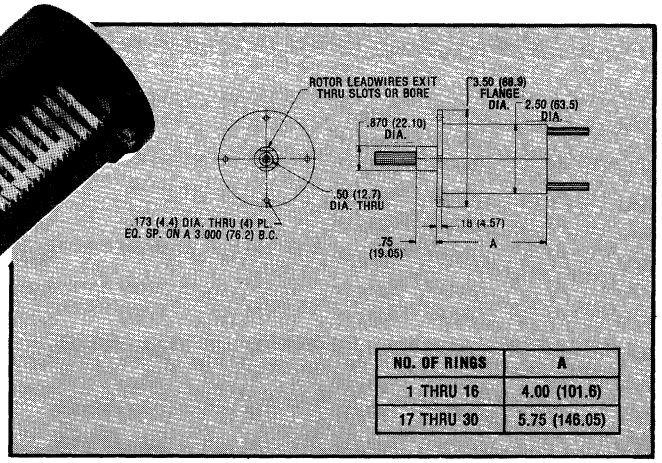
ELECTRICAL

1. Current: Signal level to 2.0 amps
2. Voltage: 400 vdc maximum
3. Dielectric Strength: 1000 Volts rms (all combinations)
4. Contact Resistance:
   A. Less than 8 milliohms @ 200 rpm
   B. Less than 2 milliohms @ 10 rpm
5. Leadwire: #28 awg 18″ long

	CAY-150	CAY-1120
Torque	.125 in.-oz. per ring	.18 in.-oz. per ring
Speed	600 rpm max. — intermittent	100 rpm max.
Life	2000 hrs. @ 100 rpm	1000 hrs. @ 100 rpm



CAY-1030
UP TO **30** RINGS



NO. OF RINGS	A
1 THRU 16	4.00 (101.6)
17 THRU 30	5.75 (146.05)

- **LONG LIFE**
- **HIGH SPEED**

SPECIFICATIONS

1. Rings: Coin silver
2. Brushes: Silver graphite, two per ring
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Anodized aluminum
5. Housing: Anodized aluminum
6. Torque: .03 in.-lb. per ckt. approx.
7. Speed: Up to 5000 rpm
8. Life: 5000 hrs. at 100 rpm
9. Rotation: Bi-directional
10. Current: 5 amps max. per ring
11. Voltage: 250 Volts DC max.
12. Dielectric Strengths: 500 VRMS (all combinations)
13. Contact Resistance: 10 milliohms max. (excluding wires)
14. Noise: 10 milliohms max.
15. No. of Rings: 30 max.
16. Leadwire: #22 AWG, 24″ lg., both ends

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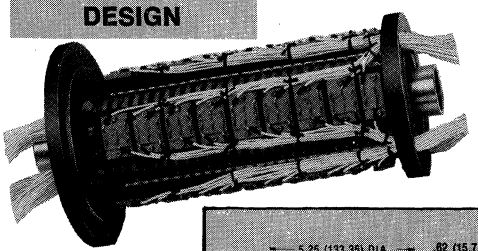
Airflyte ELECTRONICS CO.

POWER CAPSULE SLIP RING ASSEMBLIES

"THROUGH-BORE" DESIGN

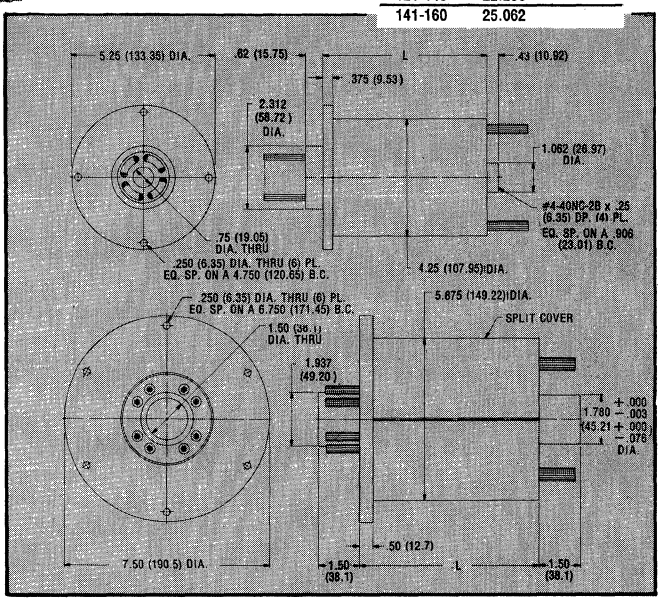


UNIT SHOWN WITHOUT COVER

No. of Rings	DAY-705 "L" ±.025"	DAY-710 "L"
10-20	5.375	4.725
21-40	8.187	6.700
41-60	11.000	8.675
61-80	13.812	10.650
81-100	16.625	12.625
101-120	19.437	14.600
121-140	22.250	
141-160	25.062	

DAY-705
UP TO **160** RINGS

DAY-710
UP TO **120** RINGS



DAY-705

These slip-rings are built to your order using many standard components which have proven themselves over many years of reliable operation. The "platter-type" design includes one coin silver ring on each side of each molded sub-assembly; and, leaf type silver graphite brushes which are molded in an insulating block and perfectly matched to the face of each ring. Inasmuch as the assemblies are the stack-up type, we are able to custom build them to your specifications—using our standard components—with a very minimum lead time required.

DAY-710

Similar in construction to our DAY-705, this platter type unit features two coin silver rings on each side of each platter for greater package density, and a "through bore" design which can be used for the passage of fluid or gas lines.

SPECIFICATIONS

MECHANICAL

1. Rings: Coin silver
2. Brushes: Silver graphite
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Anodized aluminum
5. Housing: Anodized aluminum
6. Speed: 500 rpm maximum
7. Rotation: Bi-directional

ELECTRICAL

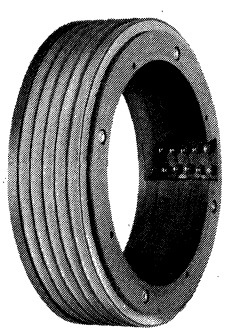
1. Voltage: 0 to 150 Volts AC or DC
2. Dielectric Strength: 500 Volts rms (all combinations)

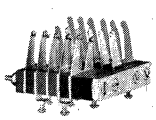
	DAY-705	DAY-710
Torque	½ in.-oz. per circuit	¾ in.-oz. per circuit
Life	3000 hrs. @ 100 rpm	2500 hrs. @ 100 rpm
Current	5 amps max. per circuit	5 amps max. per circuit
Contact Resistance Variation	8 milliohms peak @ max. speed	10 milliohms max.

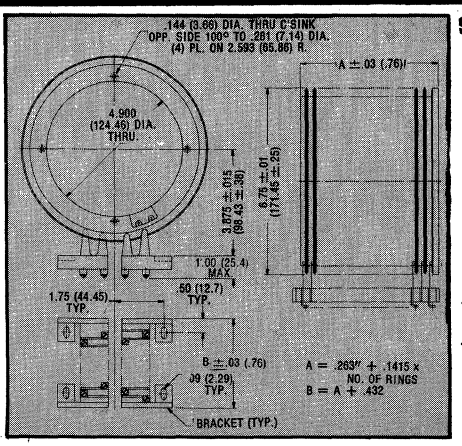
FLAT RING ASSEMBLIES & MATCHING BRUSH BLOCKS

CAY 94

- General purpose
- "Stack-up capability (up to 200 rings or more
- Low noise
- Long life







SPECIFICATIONS

1. Rings: Coin silver
2. Brushes: Silver graphite (two per ring)
3. Brush Leafs: Beryllium copper
4. Insulation: Phenolic
5. Leadwire: Available upon request
6. Speed: 750 rpm max.
7. Life: 1000 hours @ 100 rpm
8. Current: 5 amps per rings; 10 amps per ring when 4 brushes are used
9. Voltage: 300 VRMS
10. Dielectric Strength: 500 Volts rms (all combinations)
11. Insulation Resistance: 10 megohms minimum at 500 VDC
12. Noise: The contact resistance change in each circuit shall be less than .005 ohms at maximum speed
13. Units with less than 11 rings have one bracket per brush block

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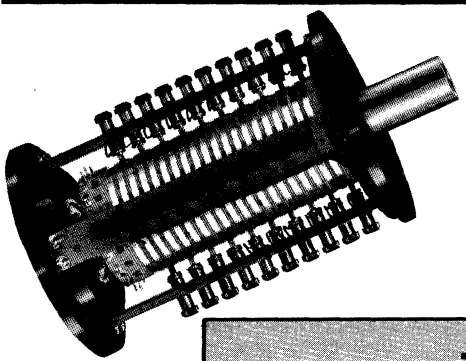
Airflyte ELECTRONICS CO.

POWER CAPSULE SLIP RING ASSEMBLIES



CAY-125

A general purpose, off-the-shelf slip ring assembly especially applicable for strain gage and thermocouple measurements where rotating detector circuits must be brought out to stationary measuring equipment.

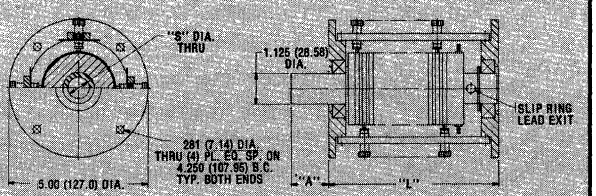
CAY-755

The standard cartridge, (AHW-16), has been used for many years on our CAY-125 assembly and is now available with the CAY-755 which is also drawn, or individually, for use on any ring which is a minimum of 1/8" wide. The silver graphite brushes, coil springs, caps and holders may be purchased individually or as an assembly and are all available from stock.

CAY-125
UP TO **30** RINGS

CAY-755
UP TO **30** RINGS

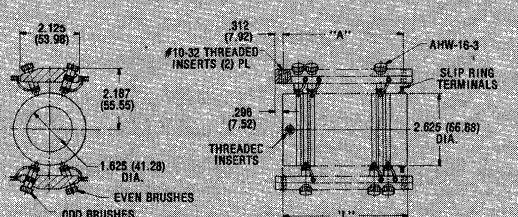
. . . AS AN ASSEMBLY



NOTES:
To determine "L" dimension use the following formula:
"L" = 2.62 (66.55) + $\frac{\text{(NO. OF RINGS)}}{4}$

"S" = .750 (19.05) or 1.000 (25.4)
"A" = .750 (19.05) or 1.000 (25.4)

. . . OR AS SEPARATES



NOTES:
To determine the "L" and "A" dimensions, use the following formulas:
"L" = 1.093 (27.76) + $\frac{\text{(NO. OF CIRCUITS)}}{4}$

"A" = "L" − .218 (5.54)
†Two identical brush blocks are supplied with each CAY-755 assembly.
†REPLACEMENT PARTS
Cartridge Assembly: AHW-16
Spring: AHW-15
Holder: AHW-14
Cap: AHW-13
Silver Graphite Brush: ABR-12-1

SPECIFICATIONS

MECHANICAL

1. Rings: Coin silver
2. Brushes: Spring loaded silver graphite, two per ring
3. Torque: 0.2 in-lbs. per ring
4. Speed: 5000 rpm maximum
5. Life: 1000 hours minimum @ 500 rpm
6. Rotation: Bi-directional

ELECTRICAL

1. Current: 10 amps per circuit with two brushes per ring
2. Voltage: 0-250 Volts AC or DC
3. Dielectric Strength: 500 Volts rms (all combinations)
4. Contact Resistance Variation: 10 milliohms maximum at maximum speed
5. No. of Rings: 30 maximum

ENVIRONMENTAL

1. Operating Temperature: 0° to 200°F
2. Humidity: 85%

ORDERING INFORMATION

CAY- □□□ □□ □

Model
No. of Rings
Special Variations

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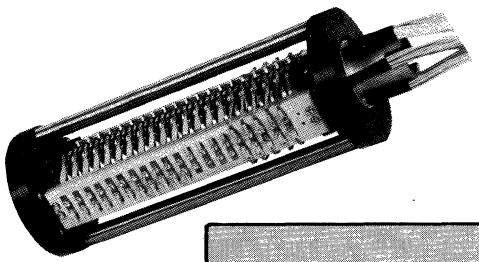
Airflyte ELECTRONICS CO.

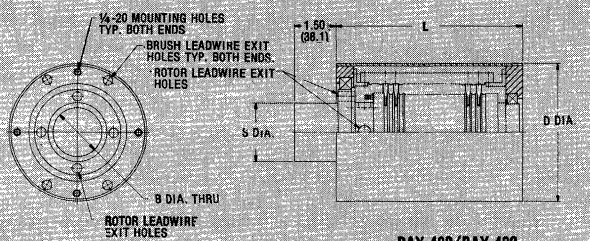
MULTI-PURPOSE SLIP RING ASSEMBLIES



These assemblies, designed for use in commercial equipment, have been used in applications ranging from thermocouples to the transmission of medium power. They feature coin silver rings, silver graphite brushes, convenient terminals on both the slip ring and brush blocks, and a rotor design which allows the leadwires to be exited through the shaft bore, or under the bearing when a shaft clearance hole is required. The wide variety of sizes and configurations available, including "in-between" shaft diameters, allows the designer to select a standard assembly for his application, eliminating time consuming and costly design charges.

DAY-490/499
UP TO **50** RINGS

...AS AN ASSEMBLY

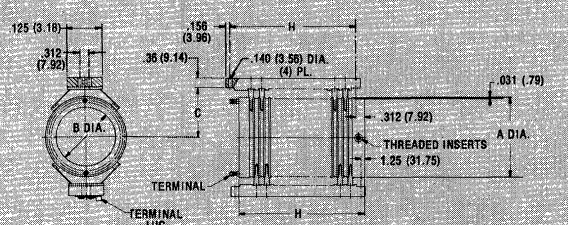


DAY-490/DAY-499

No. of Rings	Inches "L"	Milli-Meters
6-10	4.88	123.95
11-20	6.75	171.45
21-30	8.63	219.2
31-40	10.50	266.7
41-50	12.38	314.45

...OR AS SEPARATES

CAY-731/740
UP TO **50** RINGS



To determine "H" dimension use the following formula:
"H" = .750 + .1875 x (No. of Rings)

SPECIFICATIONS

MECHANICAL

1. Frame: Anodized aluminum (DAY-490/DAY-499 only)
2. Rings: Coin silver
3. Brushes: Silver graphite, two per ring
4. Leafs: Beryllium copper
5. Insulation: Epoy or laminated plastic

ELECTRICAL

1. Current: 10 amperes per circuit (20 amperes available at extra cost)
2. Voltage: 250 Volts maximum AC or DC
3. Dielectric Strength: 750 Volts rms (all combinations)
4. Insulation Resistance: 50 megohms minimum at 500 VDC
5. Contact Resistance Variation: 10 milliohms maximum at maximum speed
6. No. of rings: 50 maximum

ENVIRONMENTAL

1. Operating Temperature: 0 to 250°F
2. Humidity: 95% maximum

For use when bearing mounted assemblies are not practical, the CAY-731/CAY-740 should be specified.

Part No.	Max. Speed, RPM	Min. LIFE 10^6 Rev.	Max. Torque Per Ring		DAY-490/DAY-499 "B" Dia.		"D" Dia.		"S" Dia.		CAY-731/CAY-740 "A" Dia.		"B" Dia.		"C" Dia.	
			lb.-in.	gm-cm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
DAY-490/CAY-731	5000	50	.21	240	1.00	25.4	4.00	101.6	1.250	31.75	1.875	47.63	1.250	31.75	1.447	36.75
DAY-491/CAY-732	4000	40	.30	350	1.75	44.45	5.00	127.0	2.125	53.98	2.750	69.85	2.125	53.98	1.829	46.46
DAY-492/CAY-733	3000	30	.40	460	2.75	69.85	6.50	165.1	3.125	79.38	3.750	95.25	3.125	79.38	2.281	57.94
DAY-493/CAY-734	2500	25	.50	580	3.75	95.25	7.50	190.5	4.125	104.8	4.875	123.8	4.125	104.8	2.822	71.68
DAY-494/CAY-735	2000	20	.61	700	4.75	120.7	8.50	215.9	5.125	130.2	5.875	149.2	5.250	133.4	3.307	84.00
DAY-495/CAY-736	1500	15	.71	820	5.75	146.1	9.50	241.3	6.125	155.6	7.000	177.8	6.250	158.8	3.857	97.97
DAY-496/CAY-737	1500	15	.82	950	6.75	171.5	10.50	266.7	7.125	181.0	8.000	203.2	7.250	184.2	4.342	110.3
DAY-497/CAY-738	1000	10	.92	1060	7.75	196.9	11.50	292.1	8.125	206.4	9.000	228.6	8.250	209.6	4.837	122.9
DAY-498/CAY-739	1000	10	1.02	1180	8.75	222.3	13.00	330.2	9.125	231.8	10.000	254.0	9.250	235.0	5.332	135.4
DAY-499/CAY-740	750	7.5	1.12	1290	9.75	247.7	14.00	355.6	10.125	257.2	11.000	279.4	10.250	260.4	5.827	148.0

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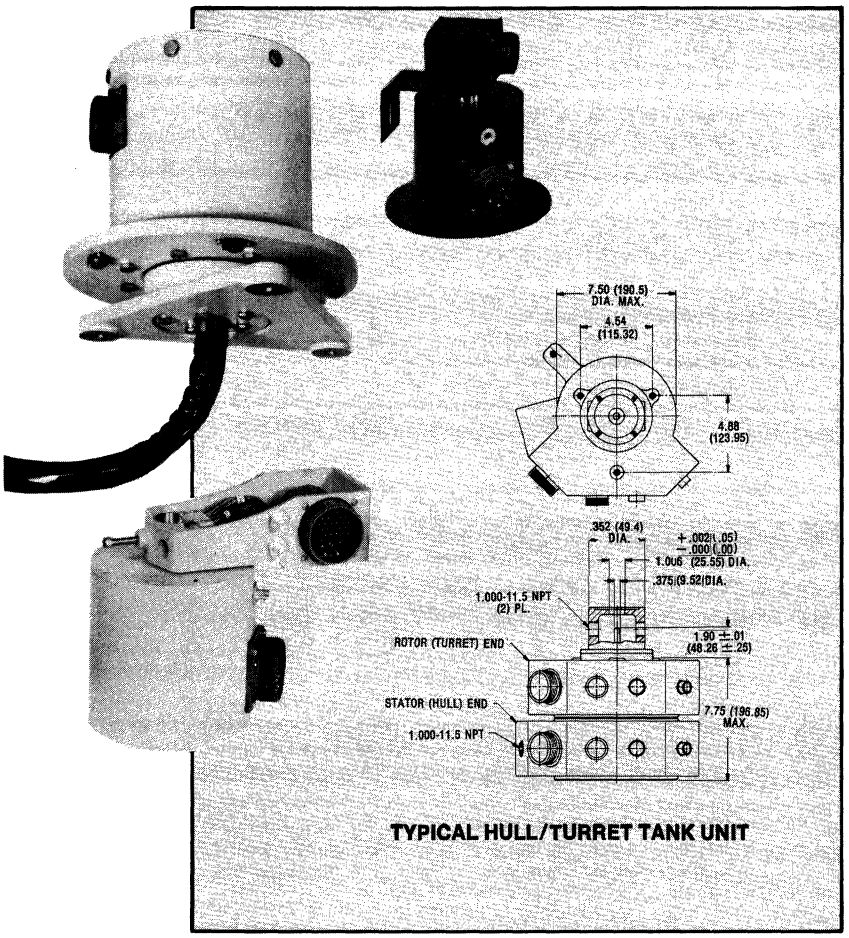
Airflyte ELECTRONICS CO.

VEHICLE SLIP RING ASSEMBLIES



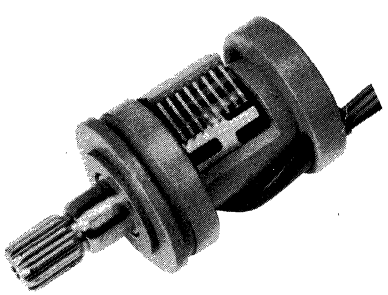
TYPICAL HULL/TURRET TANK UNIT

Airflyte Electronics has experience in the design and manufacture of assemblies for personnel carriers, tanks and other military vehicles. We have built slip rings for periscopes, turrets and commander stations. These assemblies range in size from 6″ or less in outside diameter to slip rings with clearance holes larger than 28″. This type of assembly is characterized by its rugged construction, usually has two high power rings, several low power and up to 50 signal rings. Illustrated are several of the configurations we have built in production quantities.

SPECIFICATIONS

1. Voltage: from 28 VDC to 208 VAC
2. Current: from 1 amp to 600 amps
3. Frequency: DC to 100 MHz
4. Speed: Usually about 20 rpm
5. Noise: Less than 10 mΩ peak to peak
6. Hydraulics: 3000 psi operating
7. Pneumatics: 1500 psi operating
8. Torque: 15 ft.-lb. max. (no hydraulics)
9. Life: 3000 hrs.
10. Environmental: Vibration, shock, etc. per MIL SPEC
11. Terminations: Connectors & fittings customer compatible

ENCODERS & SWITCHES



Airflyte encoders and rotary switches feature drum construction with solid gold alloy conducting segments embedded in epoxy and machined flush. Brushes are multi-strand, spring-temper gold-alloy. As small as ½″ diameter.

ENCODERS

Special encoders with BCD, Gray, True Binary or non-standard codes are available. Units supplied with or without logic circuitry.

SWITCHES

When close accuracy, repeatability and size are important, specify Airflyte rotary switches for timing and positioning applications. Successfully replaces snap action switches and cams. Pre-set to eliminate installation time. Zero hysteresis.

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SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Tecnicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States (ANSI) American National Standards Institute

United States (NEMA) National Electrical Manufacturers Association

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

AUTOMOTION

Brushless DC Motors & Controls

313 / 662-7771
Fax: 313/662-3707

AFFORDABLE BRUSHLESS DC SOLUTIONS



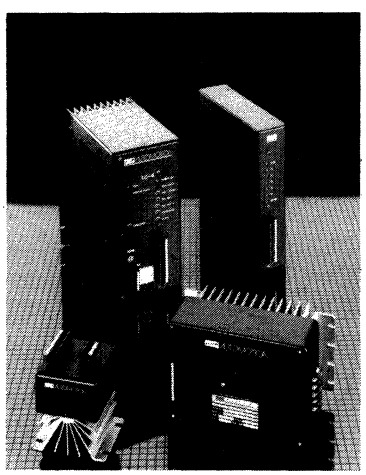
Everything from off-the-shelf packaged motors and controls to ground-up OEM custom solutions. All at affordable prices.

At Automotion, we research, engineer, design, and manufacture DC brushless motor controls. And that's it. Because of our focus, we believe we can provide the best DC brushless motor control available anywhere. And, because of our focus, we can provide these controllers at affordable prices.

Not only is our price tag small, our product is small. The LC family of controllers provides more power and function, in a compact package, because of our advanced design. That means your motor application need not suffer from an oversized or overpriced control.

We are also happy to work with you on a custom basis to design a specific control for your specific needs. And even help you find the right motor for your application.

Because at Automotion, only two things count: our customers and meeting their DC brushless motor control needs.

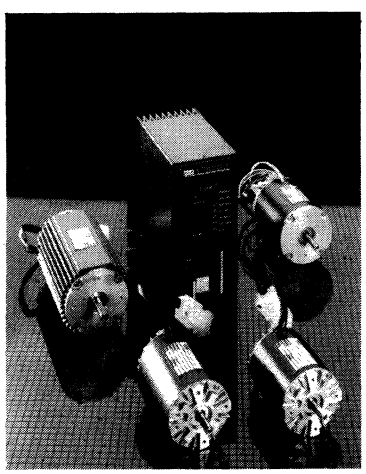


STANDARD PRODUCT

Consider the LC family of controllers from Automotion. They are compatible with any 3-phase WYE or DELTA wound DC brushless motor, and are efficiently designed to fit the tightest space requirements. And they offer some pretty impressive advantages, like instantaneous start/stop and forward/reverse, dynamic braking, and analog or digital PWM speed control in voltage ranges from +7 to 320 DC. At prices starting under $200.

Packaged low voltage versions feature a protective cover, heat sink, and quick disconnect wiring terminations that conform to NEMA type 1 requirements.

Each high voltage model is available as either an open frame unit for OEM use, or packaged in a NEMA 1 rated metal enclosure with integral heat sink, diagnostic LEDs, and quick disconnect terminlals.

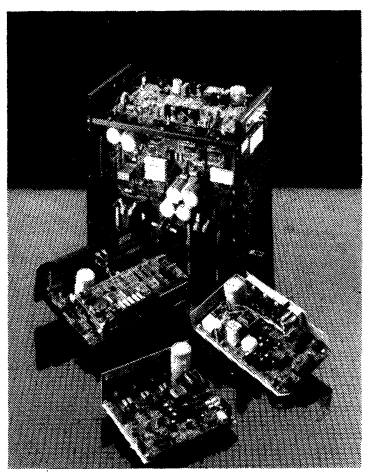


AUTOPAC™ PACKAGE.

The "AUTOPAC", a general purpose industrial grade DC brushless motor and control package, is available in standard, "off-the-shelf" ratings beginning at 1/10 HP @ 1800 RPM. Most units are rated up to 5000 RPM, maximum, with optional higher RPM designs available upon request.

The AUTOPAC family uses our advanced design of PWM drive technology coupled to a precision fractional horsepower PM DC brushless motor to produce a highly efficient, powerful, and very versatile package that is surprisingly affordable.

The DC brushless motors offered, built to Automotion's demanding standards, feature: dynamically balanced rotors, built-in, high-temperature Hall Effect sensors, Class H insulation system, and precision ground shafts.



CUSTOM

Based upon the same proven reliable, advanced PWM drive technology as our standard family, our custom series demonstrates the significant flexibility of Automotion in the design and manufacturing of cost effective custom driver solutions for our OEM customers.

Starting with the basic four quadrant H bridge driver, OEM's can select from a long list of Automotion I/O, operating and protection options to build just as much of a driver solution as the application requires. As a result, OEM customers get the brushless DC control capability they need, at a price and size that their application can justify.

Made with pride in the USA.

P.O.Box 7746 • Ann Arbor, Michigan 48107-7746

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BERTSCH U.S. 2142 F INDUSTRIAL COURT, VISTA, CA 92083
PHONE (619) 727-7420 FAX (619) 727-4436

Series 20–08 • 0.2 Watts • 6500 RPM

Dimensions — mm 1mm = 0.0394 in

Rotor	3 Flat Coils
Magnet	SeCo5
Commutator	AgCu3, 6 segments
Brushes	Gold alloy
Bearings	Oilite

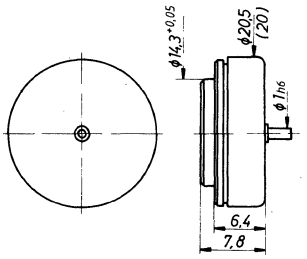
Efficiency	up to 85%
Rotor Moment of Inertia	3 x 10^{-3} oz-in^2
Mechanical Time Const. appr.	25 ms
Weight	0.35 oz.

Recommended Operational Data

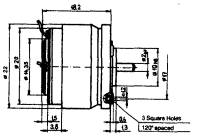
Speed	max. 6500 rpm
Torque	0.06 oz in
Temperature	−4° +140°F

Gear Head

Max. Torque	
GBR = 43:1	1.5 oz-in
GBR = 139:1	3.0 oz-in
GBR = 449:1	5.0 oz-in
GBR = 1443:1	7.0 oz-in
Max. Motor Speed	7000 rpm
Max. Power	0.1 W
Max. Radial Load	6 oz
Max. Axial Load	2 oz
Weight with motor	0.5 oz

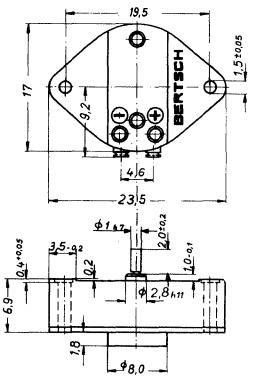


Type	20-08-10	20-08-07	20-08-05	
Voltage	3	6	12	V
No load speed	7200	8500	8500	rpm
Resistance	7.7	26.5	94	Ohms
Stall torque	0.19	0.20	0.18	oz-in
No load current appr.	20	13	8	mA
Recommended current	100	50	30	mA
Torque constant	0.5	0.9	1.85	oz-in/A
Counter-EMF	0.24	0.65	1.3	mV/rpm
Speed/Torque Gradient	40,000	42,000	47,000	rpm/oz-in



Series 00–30 • 0.05 Watts • 10,000 RPM

Dimensions — mm 1 mm = 0.0394 in



Rotor	3 Flat Coils
Magnet	Ferrite
Commutator	Flat, 3 Segments Gold Plated
Brushes	AgCu3
Bearings	Brass
Weight	0.3 oz

Recommended Operational Data

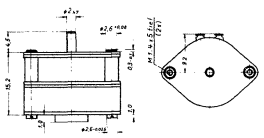
Speed	10,000 rpm
Torque	0.005 oz-in
Temperature	−4° to +140°F

Gear Head

Max. Torque	3 oz-in
Max Motor Speed	10,000 rpm
Max. Power	0.04W
Weight with motor	0.55 oz

Standard Gear Ratios

16.6:1	96.4:1	176:1
249 :1	487:1	916:1
	4629:1	



Type	00-30-07	00-30-06	00-30-05	00-30-04	
Voltage	2	2,5	4	6	V
No load speed	11,500	11,500	13,500	13,500	rpm
Resistance	16	26	54	133	Ohms
Stall torque	0.018	0.018	0.018	0.016	oz-in
No load current appr.	28	23	13	10	mA
Recommended current	50	40	30	22	mA
Counter-EMF	0.15	0.20	0.25	0.40	mV/rpm
Speed/Torque Gradient	624,000	624,000	733,000	834,000	rpm/oz-in

Series 16–24 • 0.4 Watts • 7500 RPM

Dimensions — mm 1 mm = 0.0394 in

Magnet	AlNiCo
Commutator	AgCu5, 5 segments
Brushes	Gold alloy
Bearings	Oilite

Possible Combinations
Gear Head M20

Efficiency	up to 75%
Rotor Moment of Inertia appr.	3 x 10^{-3} oz-in^2
Mechanical Time Const. appr.	25 ms
Weight	0.7 oz

Recommended Operational Data

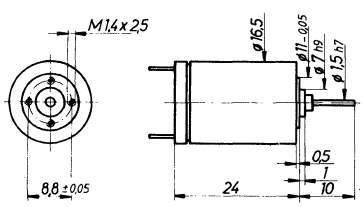
Speed	max. 7500 rpm
Torque	0.07 oz-in
Temperature	−4° to +148°F

Gear Head

Max. short time torque	12 oz-in
Max. Motor Speed	6000 rpm
Max. Power	0.4 W
Weight with motor 16-34	1.3 oz

Standard Gear Ratios

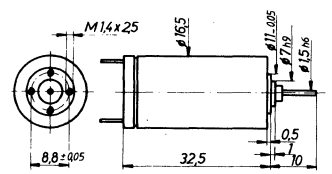
10.2:1	32.7:1	105:1
20.5:1	65.5:1	210:1
335:1	1073:1	
671:1	2147:1	



Type	16-24-12	16-24-08	16-24-06	
Voltage	3	6	12	V
No load speed	10,000	8,000	9,000	rpm
Resistance	4.0	22	60	Ohms
Stall torque	0.30	0.25	0.34	oz-in
No load current appr.	35	20	15	mA
Recommended current	200	90	50	mA
Torque constant	0.38	0.93	1.87	0z-in/A
Counter-EMF	0.3	0.7	1.4	mV/rpm
Speed/Torque Gradient	32,100	31,400	21,700	rpm/oz-in

Series 16–34 and 16–35 • 0.8 Watts • 8000 RPM

Dimensions — mm 1 mm = 0.0394 in



Magnet	AlNiCo
Commutator	AgCu3, 5 segments
Brushes	Gold alloy
Bearings	Oilite

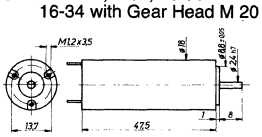
Recommended Operational Data

Speed	max. 8000 rpm
Torque	0.15 oz-in
Temperature	−4° to +175°F

Efficiency	up to 75%
Rotor Moment of Inertia appr.	4 x 10^{-3} oz-in^2
Mechanical Time Const. appr.	25 ms
Weight	1 oz.

Possible Combinations
Gear Head M20

Gear Head M 20
G Series 16-24, 6-34, 16-35
16-34 with Gear Head M 20



Type	16-35-14	16-35-12	16-34-10	16-34-09	16-34-08	16-34-07	
Voltage	3	4	6	9	12	15	V
No load speed	8100	8800	7000	8000	8500	9200	rpm
Resistance	2.5	3.9	11	19.5	31	47	Ohms
Stall torque	0.55	0.58	0.62	0.62	0.64	0.64	oz-in
No load current appr.	50	40	30	25	20	15	mA
Recommended current	300	250	175	125	100	75	mA
Torque constant	0.48	0.59	1.09	1.43	1.73	2.10	pz-in/A
Counter-EMF	0.33	0.41	0.85	1.0	1.2	1.5	mV/rpm
Speed/torque Gradient	14,700	15,100	11,200	12,800	14,000	14,000	rpm/oz-in
Mechanical Time	16	17	15	17	18	18	ms

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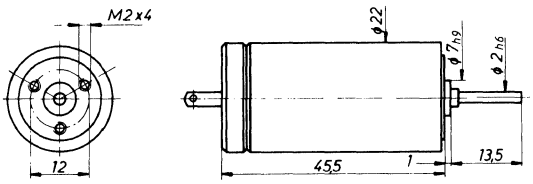
Series 22–45 • 6 Watts • 10,000 RPM

Dimensions — mm 1 mm = 0.0394 in

Magnet	AlNiCo	Efficiency	up to 85%
Commutator	CuAg 0.1, 5 segments	Rotor Moment of Inertia	20 x 10^{-3} oz-in^2
Brushes	Graphite	Mechanical Time Const. appr	20 ms
Bearings	Oilite	Weight	2.7 oz



Possible Combinations

Gear Heads	H 30, H 40, P 24
Tacho	20-08
Encoder	HEDS-5500

Recommended Operational Data

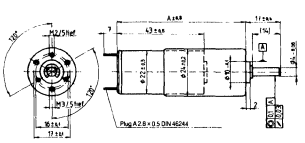
Speed	max. 10,000 rpm
Torque	0.7 oz-in
Temperature	−4° to +175°F

Torque 1 stage	7 oz-in
2 stages	25 oz-in
3 stages	50 oz-in
Max. Motor Speed	7000 rpm
Max. Radial Load	2.5 lbs
Max. Axial load	1 lb
Axial Play max.	0.012 in
Max. Gear Play	3°

Standard Gear Ratios

6:1		1-stage
19:1	46:1	2-stages
81:1	199:1	353:1 3-stages

Planetary Gear Head P 24
Series 22-45

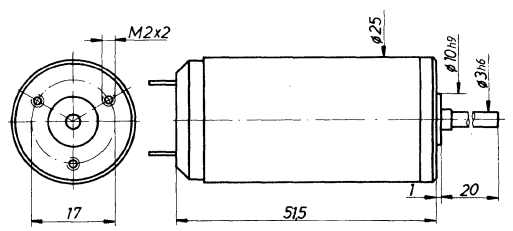


Type	22-45-30	22-45-20	22-45-16	22-45-14	22-45-12	22-45-10	22-45-08	
Voltage	3	6	9	12	18	24	36	V
No load speed	7,500	10,000	10,100	10,000	9,700	9,900	9,700	rpm
Resistance	0.8	2.5	4.5	6	14	28	65	Ohms
Stall torque	1.89	1.80	2.19	3.07	2.95	2.63	2.12	oz-in
No load current appr.	65	55	45	35	25	20	18	mA
Recommended current	1000	800	600	450	300	250	150	mA
Counter-EMF	0.51	0.77	1.15	1.56	2.34	3.15	4.78	mV/rpm
Speed/Torque Gradient	3980	5560	4510	3270	3420	3780	4740	rpm/oz-in

Series 25–51 • 25 Watts • 25,000 RPM

Dimensions — mm 1 mm = 0.0394 in

Magnet	SeCo5	Efficiency	up to 85%
Commutator	CuAg 0.1, 5 segments	Rotor Moment of Inertia	20 x 10^{-3}oz-in^2
Brushes	Graphite	Mechanical Time Const.	8.5 ms
Bearings	Ball Bearings	Weight	4.4 oz



Recommended Operational Data

Speed	25,000 rpm
Torque	2 oz-in
Temperature	−4° to +140°F
Max. Rotor Temperature	250°F

Recommended Operational Data

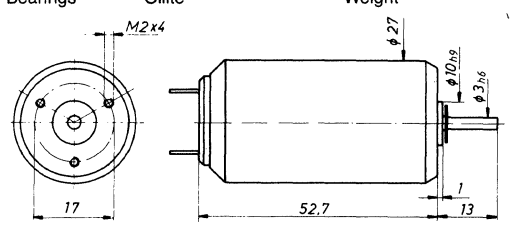
Speed	10,000 rpm
short time operation	20,000 rpm
Torque	1.5 oz-in
Temperature	−4° to +250°F
Max. Rotor Temperature	250°F

Type	25-51-24	25-50-30	25-50-20	25-50-16	25-50-14	
Voltage	24	6	12	15	24	V
No load speed	30,000	8,800	11,800	13,100	11,700	rpm
Resistance	1.5	0.8	2.5	3.5	6	Ohms
Stall torque	19	6.7	6.7	6.6	11.1	oz-in
No load current appr.	200	100	60	50	30	mA
Recommended current	1.2	1.5	1.0	0.8	0.5	mA
Torque constant	1.04	0.87	1.39	1.50	2.80	oz-in/A
Counter-EMF	1.2	0.65	0.95	1.1	1.9	mV/rpm
Speed/Torque Gradient	1610	1320	1770	2050	1060	rpm/oz-in

Series 28–52 • 15 Watts • 4000 RPM

Dimensions — mm 1 mm = 0.0394 in

Magnet	SeCo5	Efficiency	up to 85%
Commutator	CuAg 0.1, 7 segments	Rotor Moment of Inertia	0.14 oz-in^2
Brushes	Graphite	Mechanical Time Const. appr.	20 ms
Bearings	Oilite	Weight	5.8 oz



Recommended Operational Data

Speed	4000 rpm
Torque	4.5 oz-in
Temperature	−4° to +175°F
Max. Rotor Temp.	250°F

Standard Gear Ratios

4:1	7:1		1-stage
25:1	46:1		2-stage
93:1	169:1	308:1	3-stage

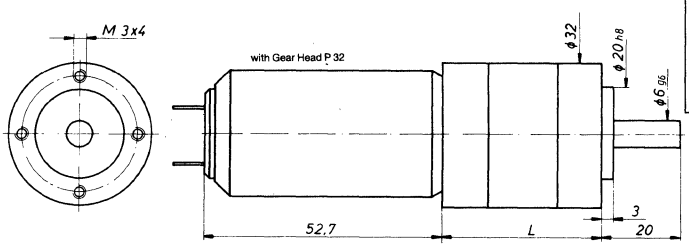
Possible Combinations:

Gear Head	P 32
Encoder	HEDS-5500

Max. Torque oz-in	Efficiency	Stages	Length in
100	0.8	1	1.3
300	0.75	2	1.7
600	0.7	3	2.0

Planetary Gear Head P 32 for
Series 28-52

Max Motor Speed	5000 rpm
Temperature	5°F to 140°F
Life at specified torque appr. 3000 hrs	



Type	28-52-30	28-52-20	
Voltage	12	24	V
No load speed	5600	5800	rpm
Resistance	2.3	10	Ohms
Stall torque	16.2	13.9	oz-in
No load current appr.	120	80	mA
Recommended current	1.2	0.6	mA
Torque constant	3.18	6.0	oz-in/A
Counter-EMF	2.0	4.0	mV/rpm
Speed/Torque Gradient	347	417	rpm/oz-in

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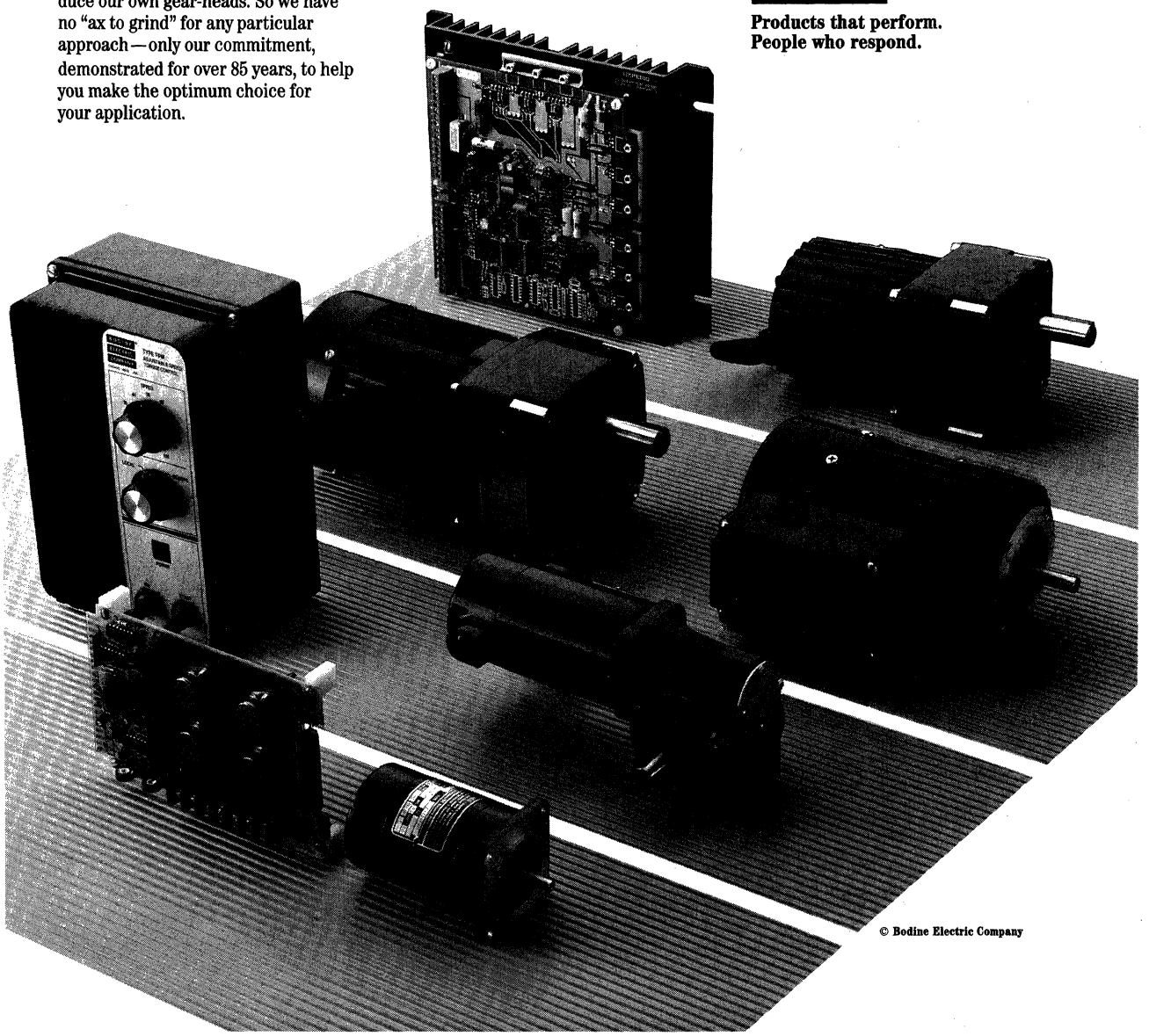

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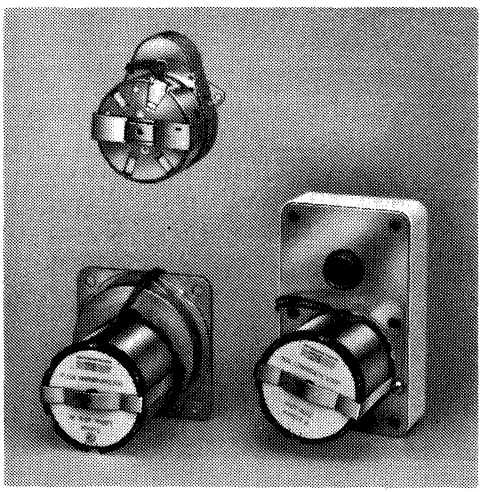
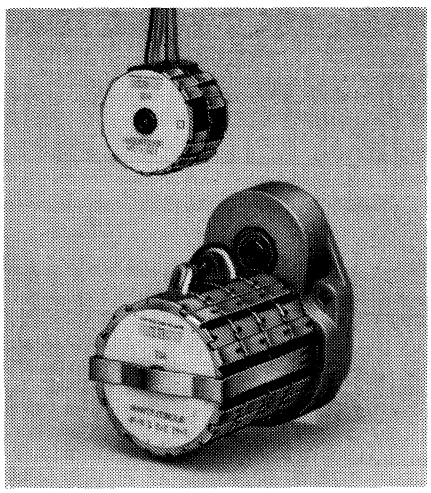
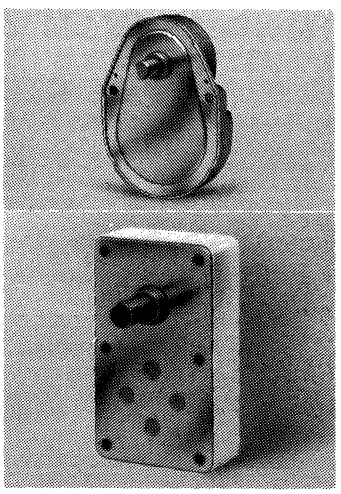

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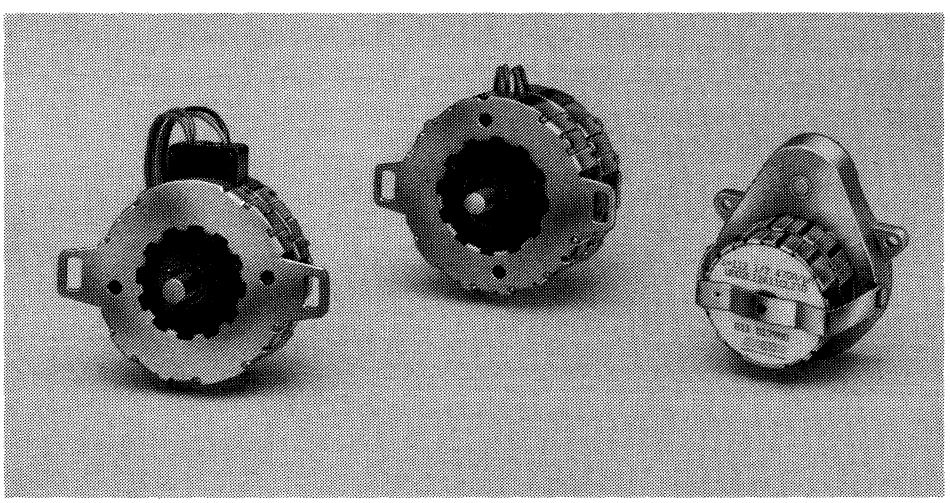
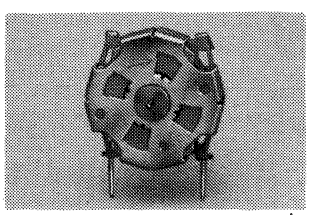
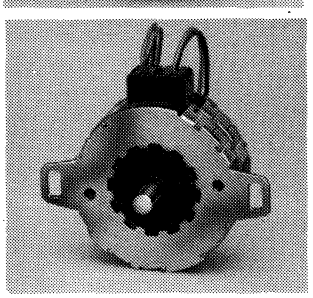

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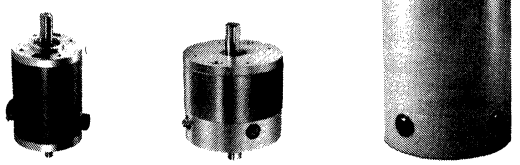

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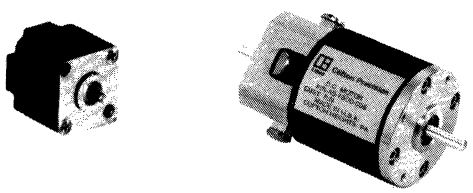
MINIATURE HIGH-TORQUE DC SERVOMOTORS

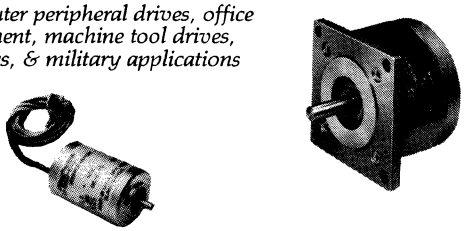
Computer peripheral drives, instrument recorders, laboratory instruments, medical equipment, robotics



...with peak torques from 2 to 50 oz-in., up to 8 oz-in. continuous torque; .75 inch cube to 1.32 inch O.D. Cartridge brushes, Alnico or rare earth magnets

PM, HYBRID, AND VR STEPPER MOTORS

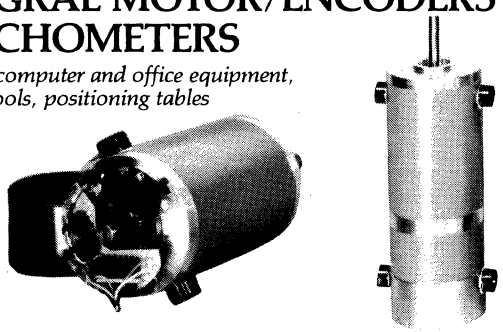
Computer peripheral drives, office equipment, machine tool drives, avionics, & military applications



...with step angles 1.8°, 1.875°, 15°, 30°, 45° 90°, 120°; .75 inch to 2.3 inch O.D. Ceramic Alnico or rare earth magnets. Available with integral encoders.

INTEGRAL MOTOR/ENCODERS & TACHOMETERS

Robotics, computer and office equipment, machine tools, positioning tables



...for closed loop feedback: optical encoder resolution to 1024 cycles. Analog tachometers integral to motor. No assembly or alignment necessary.

BRUSH & BRUSHLESS DC PM HOLLOW SHAFT TORQUE MOTORS

Inertial navigation platforms, aircraft instruments, aircraft controls



...with torques from 6 oz.-in. to 1000 lb. ft., 1.1 inch to 40 inch O.D. Precision tolerances, gold commutators, high reliability

Clifton specializes in custom designed products.

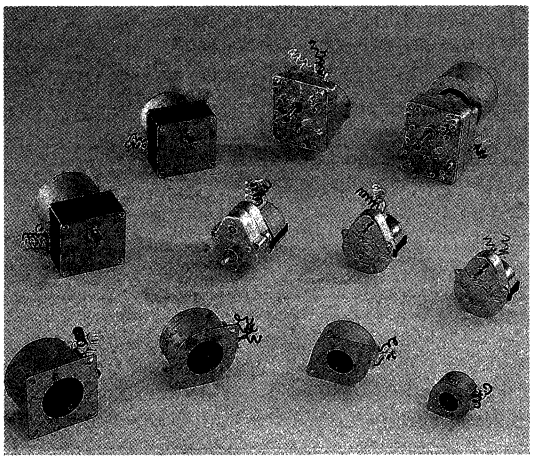
Litton

Clifton Precision

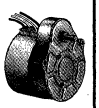
For information on Stepper Motors and Brushless DC Motors, contact Clifton Precision-South, Murphy, NC (704) 837-5115; for all other motor information call Marketing Department, Clifton Precision-North, Marple at Broadway, Clifton Heights, PA 19018-2495 (215) 622-1000 FAX (215) 623-6344.

Crouzet® Sub-Fractional Motors

Synchronous Motors and Gear Motors



STANDARD PEAR-SHAPED GEAR MOTORS

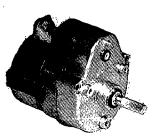
Rotation	Uni-Directional		Reversible	
Torque	Standard Torque	High Torque	Standard Torque	High Torque
Part Number	82 344	82 334	82 514	82 524
Synchronous Gear Motors				
Static Torque Dynamic Torque Running Torque @ 1 RPM	300 in.oz. 75 in.oz. 155 in.oz.	300 in.oz. 75 in.oz. 580 in.oz.	300 in.oz. 75 in.oz. 420 in.oz.	300 in.oz. 75 in.oz. 1200 in.oz.
Power Input	2.7 w	2.8 w	2.7 w	3.5 w
Range of Speed	1/24 RPH - 150 RPM		1/24 RPH - 96 RPM	

- High Torque, instant stop
- Uni-directional or reversible
- Precision double bushing
- Standard round, flatted, or knurled shaft
- UL, CSA, VDE, and other European approvals
- Optional: Dual Voltage, friction or one-way clutch, low-temperature lubrication, etc.

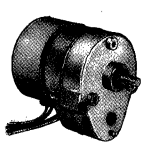
Typical applications include medical and office automation equipment, instrumentation, peristaltic pumps, displays, and export items.
(See "Assembly Capabilities" at bottom of next page.)

OTHER GEAR MOTOR CONFIGURATIONS

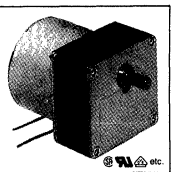
Heavy-Duty Unidirectional Gear Motors
Gear Train
Dynamic Torque: 300 in. oz.
Types
82 304 Std. Torque
82 305 Hi-Torque



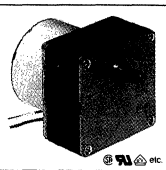
Heavy-Duty Reversible Gear Motors
Gear Train
Dynamic Torque: 300 in. oz.
Types
82 519
82 529



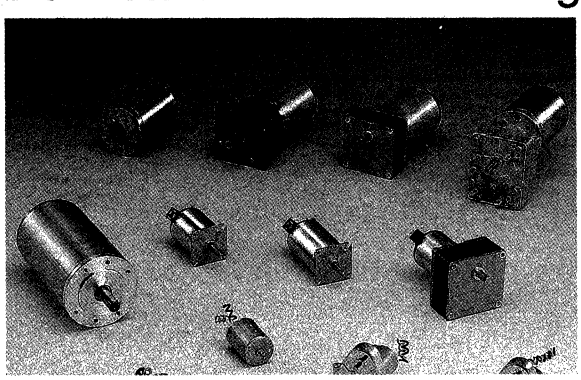
High-Torque Reversible Gear Motors
Gear Train
Dynamic Torque 45 in. lbs.
Types
80 537
80 547



High-Torque Reversible Gear Motors
Gear Train
Dynamic Torque: 25 in. lbs.
Types
80 536
80 546

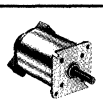
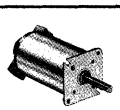
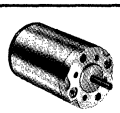


DC Motors - Permanent Magnet



Permanent magnet DC motors feature interchangeable brushes. Series 82 810 and 82 800 are built with sintered bronze sleeve bearings as standard. Front ball bearing is optional on the fore-mentioned series and standard on the 82 830 series.

DIRECT-DRIVE MOTORS

	 82 810 Series 12/24/48V	 82 800 Series 12/24/48V	 82 830 Series 12/24/48V
Diameter	1.65 in.	1.65 in.	2.45 in.
Nominal Output Pwr.	9 w	15 w	27 w
No Load Speed	3100RPM	3100 RPM	2100 RPM

GEAR MOTORS

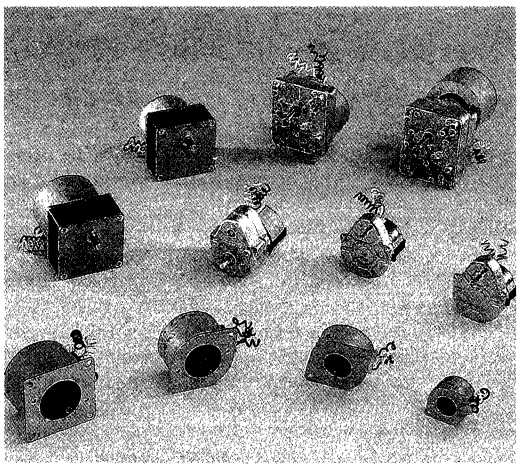
Geartrain Dynamic Torque: 45 in.lb.	Geartrain Dynamic Torque: 45 in.lb.	Geartrain Dynamic Torque: 45 in.lb.
 Mounted with 82 810motor 80 817 Series	 Mounted with 82 800motor 80 807 Series	 Mounted with 82 830motor 80 837 Series
Speed Range	.6 RPH to 620 RPM		

Crouzet Motors - Switches - Timers - Counters - Pneumatic Controls

Crouzet Corporation 2445 Midway Road, Carrollton, TX 75006-2503 • Tel: 214-250-1647 • 1-800-527-5311 • Fax: 214-250-3865

Crouzet® Sub-Fractional Motors (cont.)

Stepping Motors



STEPPING MOTORS
7.5° - 2 PHASE AND 4 PHASE

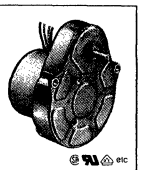
PART NUMBER	82 910.0	82 920.0	82 930.0	82 940.0
STEPPING MOTORS				
Diameter	1.4" (35.5mm)	2" (51mm)	2.25" (57.5mm)	2.55" (65mm)

All Crouzet direct-drive stepping motors are available with an optional gearhead, as shown in examples below.
Custom modifications are available upon request for quantity orders.
Typical applications include medical equipment, printers, card readers, chart recorders and export items.
(See "Assembly Capabilities" below.)

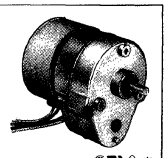
Motor	Holding Torque In. oz. (mN.m) 2 Phase	Holding Torque In. oz. (mN.m) 4 Phase	Step Angle	Steps/ Turn	Operating Voltage	Resistance Per Phase 2 Phase 5V DC	2 Phase 12V DC	2 Phase 24V DC	4 Phase 5V DC	4 Phase 12V DC	4 Phase 24V DC	Specs Page
82 910	3.5 (25)	2.8 (20)	7.5	48	5, 12, 24	12.9	66	286	15.5	66	286	10
82 920	9.9 (70)	8.07 (57)	7.5	48	5, 12, 24	10.7	46	198	10.7	46	238	12
82 930	25.5 (180)	21.9 (155)	7.5	48	5, 12, 24	9	22.3	115	7.4	32	138	14
82 940	42.5 (300)	42.5 (300)	7.5	48	5, 12, 24	5.2	26.7	96	7.4	26.7	115	16

GEARHEAD OPTIONS

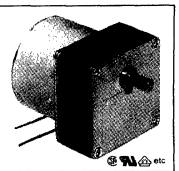
Pear-Shaped Gear Motors
Gear Train
Dynamic Torque:
75 in. oz.
Types
82 914
82 924



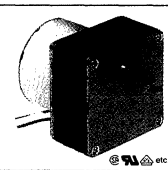
Heavy-Duty Gear Motors
Gear Train
Dynamic Torque:
300 in. oz.
Types
82 919
82 929



High-Torque Gear Motors
Gear Train
Dynamic Torque
45 in. lbs.
Types
80 936
80 946



High-Torque Gear Motors
Gear Train
Dynamic Torque:
25 in. lbs.
Types
80 937
80 947

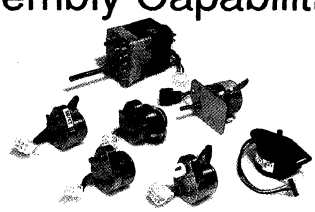


Shaded Pole Gearmotors



Instrument-grade shaded pole gearmotors are designed for exceptionally low noise operation and long life. Features of this high quality line include rugged die-cast gear case, optional fast stopping brake, and choice of metal or delrin gears. Output speeds range from 5 to 120 RPM and dynamic torque ratings range from 5 to 50 in.lbs.

Assembly Capabilities



One of Crouzet's specialties is creating and supplying motor "packages". Our ability to supply motors complete with connectors, capacitors, protective sleeves, various shaft attachments, special mounting plates, and even switches, allows us to meet virtually any application requirement.
Crouzet will help you save time, money, and aggravation, with a complete motor package.

Crouzet *Motors - Switches - Timers - Counters - Pneumatic Controls*

Crouzet Corporation 2445 Midway Road, Carrollton, TX 75006-2503 • Tel: 214-250-1647 • 1-800-527-5311 • Fax: 214-250-3865

The more demanding your motion application, the more you need to talk to us.

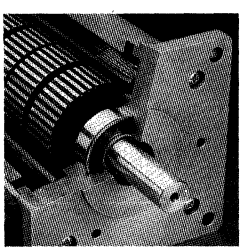
EAD
EASTERN AIR DEVICES, INC.
1E Progress Drive, Dover, NH 03820
TEL: 603-742-3330 · FAX: 603-742-9080

STEPPING MOTORS

These permanent magnet and variable reluctance motors are made in a broad range of configurations and step angles from 1.8° to 90°, with high positioning accuracy of ±3% noncumulative.

These units will produce exceptionally high torque/size ratios, are easily controlled by digital commands and operate at slewing rates of 20,000 steps/second and higher.

Sizes: 8, 11, 15, 18, 20, 23, 34, and 42 bidirectional.



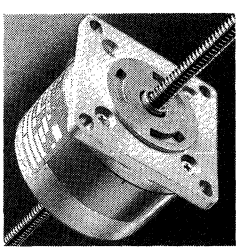
LINEAR ACTUATORS

Based on our 1.8° permanent magnet stepping motors, these linear actuators transform rotary motion of the rotor into linear motion of the lead screw.

Units operate over a wide temperature range and offer extremely fine resolution and high linear force up to 1 ton.

The threaded shaft does not rotate, therefore critical speed problems associated with rotating a long shaft are eliminated. Standard units feature a CRS rolled thread shaft and a bronze rotating nut.

Sizes: 23, 34, and 42.

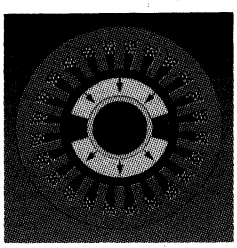


BRUSHLESS DC MOTORS

When life, EMI generation, maintenance costs, efficiency, and output-per-cubic-inch are important factors, brushless DC motors offer an attractive solution. New electronic components and rare earth magnets increase the growing popularity of these motors.

Sizes: 8, 10, 15, 18, 23, 31, 34, and 39.

Drives: Unipolar and bipolar to 20 amps and 350 VDC.



SYNCHRONOUS MOTORS

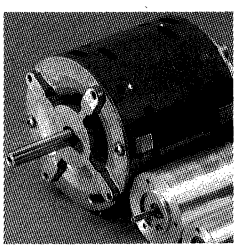
EAD is the North American leader in the design and manufacture of hysteresis/synchronous motors.

Sizes: 10 to 56, to ½ HP.

Synchronous (hysteresis and reluctance) motors produce smooth operation and precise speed which will not vary with load or voltage.

Hysteresis-synchronous motors develop smooth, constant starting and accelerating torque. They synchronize any load within their torque rating regardless of inertia.

Available in 1-, 2- and 3-speed designs.



BLOWERS, FANS

Move air from 3 to 2000 cfm quietly. From 1½″ to 10″ in diameter.

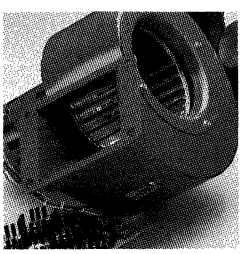
Centrifugal blowers: Deliver air at relatively high static pressure.

Tubeaxial fans: Move air through a wide range of volumes at medium pressure.

Vaneaxial fans: Move air axially over a wide range of volumes at relatively high pressure.

Propeller fans: Move air in large volumes at low pressure.

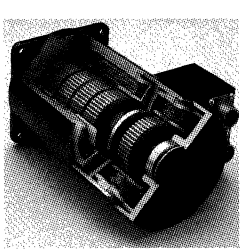
Mixed flow fans: Move air where it needs to be dispersed radially.



CLOSED-LOOP STEPPING MOTORS

When improved performance and load varying requirements are beyond the range of a standard stepping motor, the closed-loop stepping motor will supply the extra control, power, and performance needed to meet the requirements.

Sizes: 23, 34, and 42 bidirectional. Maximum speeds 3000 RPM continuous, 4500 peak.

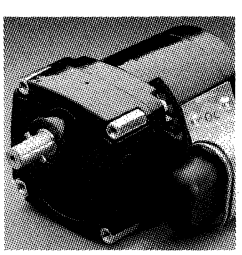


INSTRUMENT MOTORS AND GEARMOTORS

Our compact, permanent split capacitor motors and gearmotors are made in induction, torque, and synchronous versions.

Sizes: 25 and 29.

Available with 2, 4, or 8 poles, single or 2-phase, 50 and 60 Hz, gear ratios to 1800:1, output to 150 oz. in. Motors up to 1/100 HP.



SERVO MOTORS AND GEARMOTORS

Servo motors are 2-phase AC induction motors with permanently lubricated and shielded ball bearings. They can be controlled by solid state amplifiers, offer precise control, fast response, and are inherently impedance protected. Servo gearmotors have a high torque-to-inertia ratio. Reductions from 3:1 to 3600:1.

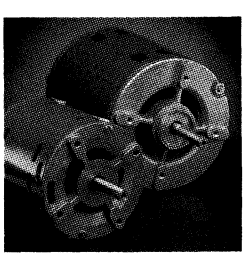
Sizes: 8 thru 23 for 50/60 or 400 Hz operation.

Gearmotors offer smooth, low-speed operation at moderate output torques. Lubricated motor ball bearings for maintenance-free operation. Outputs 1/500 to 1/20 HP AC.

TORQUE MOTORS

Torque motors offer smooth, moderate accelerating torque and low speed, with speed ranges from near zero to near synchronous. Options include shaft styles and extensions, nonstandard voltage and frequency, various mounting styles.

Sizes: 25, 34, and 44 open or totally-enclosed construction.



INDUCTION MOTORS

1-phase and 3-phase models and both high and low slip.

Single-phase motors available in permanent split capacitor and capacitor start versions.

Sizes: 10, 18, 25, 31, 34, 39, and 44.

Outputs to ½ HP. Available in both 50/60 Hz and 400 Hz versions.

OTHER PRODUCTS

Alternators, all frame sizes.

Precision military motor tachometers, sizes 11, 15, 18.

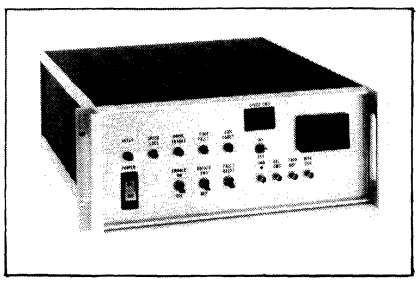
Rotor/stator sets, all frame sizes.

ELTROL
ELTROL CORPORATION

DC SERVO SYSTEMS

For applications requiring closed servo loop performance

MODEL 7-300-030-00
BRUSHLESS D.C. VELOCITY SERVO SYSTEM

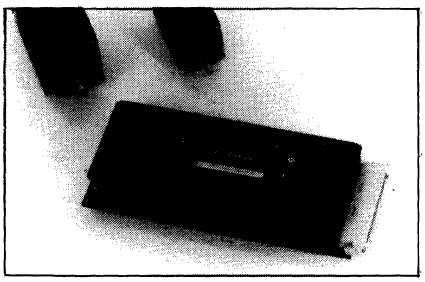


The basic system includes the following:
- Brushless DC servo controller
- Brushless DC motor
- Commutation position encoder
- Incremental optical encoder

The system provides precise velocity control in a complete package: Internal D.C. power supplies, crystal reference, controls for bidirectional rotation and variable speed, digital speed readout, operating controls and status indicators.
Instantaneous speed regulation to ±.001%
Fault protection: Overtemperature, shorts to ground, shorts across motor
Current loop: High bandwidth with current limiting
Input power: 115/220VAC, 1 ϕ, 50–60 Hz

The Eurocard Phase Lock Servo Controller included in Model 7-300-030-00 is available as a separate item.

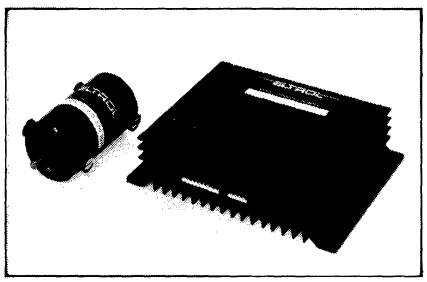
MODEL 5-156-028-00
BRUSH OR BRUSHLESS D.C. SERVO CONTROLLER



This EUROCARD provides closed loop four quadrant PWM control of motor velocity or torque. It offers maximum flexibility. Many operating features are set by pluggable jumpers. Variable compensation and gain by plug-in component carrier and trim pots simplify set up of closed loop operation.

FEATURES
- Single 24–60 volt P.S.
- Adjustable current 5–15 amps
- High efficiency 24KHZ PWM drive scheme minimizes EMI in noise sensitive applications
- Fault protection for excess temperature, speed, voltage, current, and motor stall
- Digital inputs command enable/reset, brake, and ± travel limits
- Differential amplifier for ± 10V input command
- Velocity F/B from commutation sensors, encoder, or DC tachometer

MODEL 6-120-024-00
BRUSH-TYPE LINEAR D.C. SERVO CONTROLLER



Motion control of position, velocity, or torque.
Simple adjustments for application adaptation
Peak output current: 2–10 amps
Linear operating mode: No switching EMI, high servo stiffness, no torque dead zone
Fault protection: Shorts across motor, shorts to ground, peak and time dependent continuous foldback current limits, external fault indication and reset.

The Eltrol motor-tach shown above is ideally suited to take full advantage of the servo controller's capabilities.

Eltrol Corporation is an engineering oriented firm specializing in D.C. servo systems. We provide standard, modified standard or custom designed systems to your electrical and mechanical specifications.

Write or call us today for additional information.

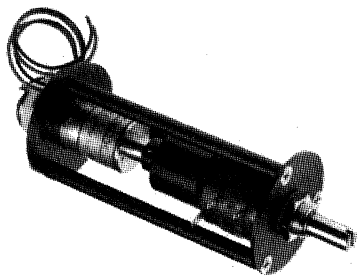
ELTROL
ELTROL CORPORATION

20942 Osborne Street
Canoga Park, CA 91304-1846
(818) 709-0131 FAX # (818) 709-0132

ETI SYSTEMS

D.C. MOTORIZED POTENTIOMETERS

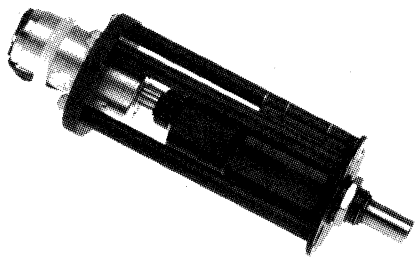
MOTORIZED MULTI - TURNS - 6 or 12 VDC



MC2W WIREWOUND (1-1/4" dia) 10 turn

RPMS AVAILABLE:	0.06 to 210
RESISTANCE RANGE:	100 to 100KΩ
POWER RATING:	2.0 watt

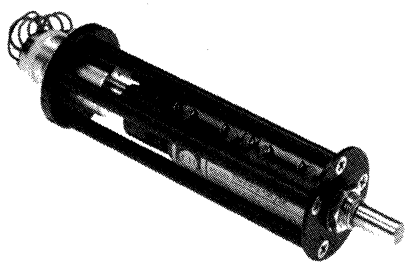
LOW COST Industrial grade general purpose for process control, speed control adjustors and remote control.



MC20A WIREWOUND (1-1/4" dia) 10 turn

RPMS AVAILABLE:	0.06 to 210
RESISTANCE RANGE:	100 to 100k Ω
POWER RATING:	3.0 watt

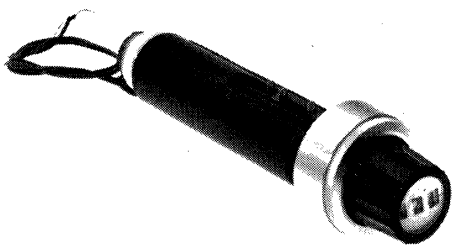
Mil-Spec type general purpose control.



MC20 - 2 WIREWOUND dual gang (1- 1/4 dia) 10 turn

RPMS AVAILABLE:	0.06 to 210
RESISTANCE RANGE:	100 to 100k Ω
POWER RATING:	3.0 watt

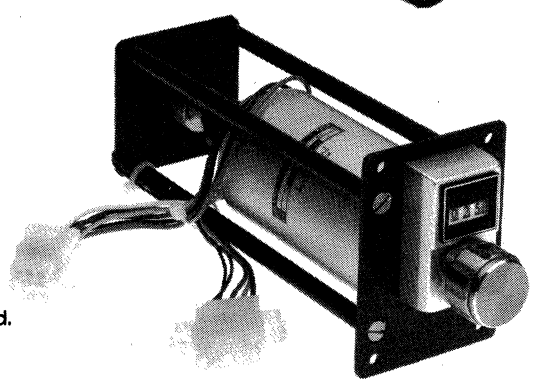
Dual Gang For Fully Fed-Back Systems.



MC20 -3 WIREWOUND (1- 3/8 dia) 10 turn

RPMS AVAILABLE:	0.06 to 50
RESISTANCE RANGE:	100 to 100k Ω
POWER RATING:	3.0 watt

Digital Turns Counting Dial is pre-assembled and calibrated to motorpot at factory.



MC4RS WIREWOUND (2.00" sq.) 10 turn

RPMS AVAILABLE:	0.06 to 50
RESISTANCE RANGE:	0.5 to 100KΩ
POWER RATING:	5.0 watt

High Resolution. Limit Switches at one or both ends of travel. 20 or 30 turns available.

All Resistance Ranges shown are standard.
Other resistance values are available.

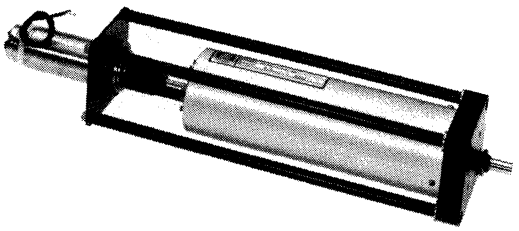
FOR SERVO POSITIONING CONTROL CIRCUITRY, SEE OUR AD IN EEM (Control Systems & Components).
SEE OUR POTENTIOMETERS IN EEM (Potentiometers, Trimmers, Controls & Rheostats)

ETI SYSTEMS · 215 Via Del Norte · Oceanside, CA 92054 · TEL: (619) 757-7770 · FAX: (619) 757-2305
Division: Polaris Industrial Enterprises, Inc.

ETI SYSTEMS

D.C. MOTORIZED POTENTIOMETERS

HEAVY DUTY MOTOR & GEAR - 6, 12 or 24 VDC



MC46 - 4 WIREWOUND dual gang (2" sq) 10 turn
MC46 - 5 WIREWOUND single gang

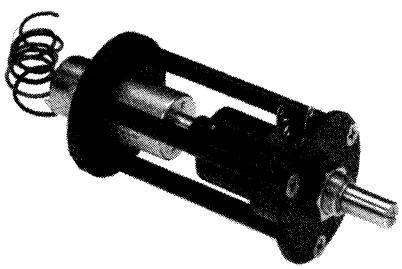
RPMS AVAILABLE: ..... 0.46 to 276
RESISTANCE RANGE: ..... 0.5 to 100k Ω
POWER RATING: ..... 5.0 watt

18 to 25 oz. in. torque. Required when attaching the potentiometer output shaft to another gear or mechanism.

MOTORIZED SINGLE TURNS - 6 or 12 VDC

MC2E - WIREWOUND (1-1/4" dia)

RPMS AVAILABLE: ..... 0.06 to 210
RESISTANCE RANGE: ..... 50 to 10k Ω
POWER RATING: ..... 0.5 watt

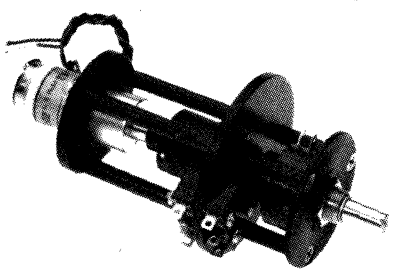


General purpose. Potentiometer terminals allow *Plug on Connectors, Simplifying Harnessing.*

MC2P CONDUCTIVE PLASTIC (2" dia)

RPMS AVAILABLE: ..... 0.06 to 210
RESISTANCE RANGE: ..... 1K to 10k Ω
POWER RATING: ..... 1.0 watt

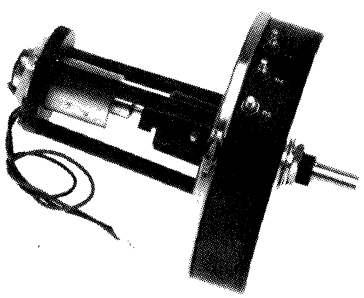
Same as MC2E, but with *Conductive Plastic* element for essentially infinite resolution and longer life.



MC2P - 2 CONDUCTIVE PLASTIC (2" dia)

RPMS AVAILABLE: ..... 0.06 to 210
RESISTANCE RANGE: ..... 1K to 10k Ω
POWER RATING: ..... 1.0 watt

Unit has *5 Amp Snap Action Switches* at both ends of travel.



MC4P - CONDUCTIVE PLASTIC (1-1/2" dia)

RPMS AVAILABLE: ..... 0.06 to 210
RESISTANCE RANGE: ..... 1K to 10KΩ
POWER RATING: ..... 2.0 watts

Conductive Plastic element for essentially infinite resolution and 50,000,000 turns life.

All resistance ranges shown are standard. Other resistance values are available.

FEATURES of ETI SYSTEMS D.C. Motorized Potentiometers: Slip clutch between gearmotor and potentiometer allows manual adjustment when power is off. Operating temperature range -30°C to +65°C. Driver boards for self-contained closed loop servo positioning available. Motor speeds up to 18000 RPMs are extremely responsive and may be pulsed similar to stepper motors.

FOR SERVO POSITIONING CONTROL CIRCUITRY, SEE OUR AD IN EEM (Control Systems & Components).
SEE OUR POTENTIOMETERS IN EEM (Potentiometers,Trimmers, Controls & Rheostats)

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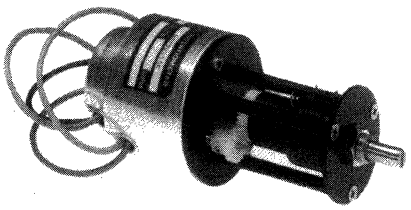
ETI SYSTEMS

A.C. MOTORIZED POTENTIOMETERS

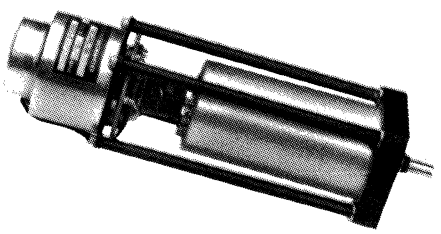
MOTORIZED MULTI - TURNS - 24 or 115 VAC

MAC2W - WIREWOUND (2" dia x 4-1/4" max)
RPMS AVAILABLE: ..... 1, 2, 5, 10 & 15
RESISTANCE RANGE: ..... 100 to 100k Ω
POWER RATING: ..... 2.0 watt



General Purpose 10 turn Wirewound element for excellent output stability.

MAC46 - WIREWOUND (2" sq. x 6" max)
RPMS AVAILABLE: ..... 1, 2, 5, 10 & 15
RESISTANCE RANGE: ..... 0.5 to 100k Ω
POWER RATING: ..... 5.0 watt

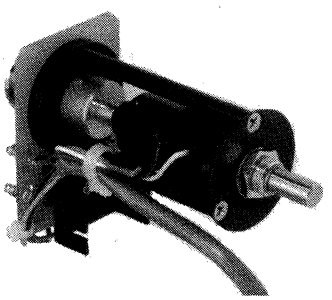


High Wattage, high resolution. Now uses MR46 potentiometer.

MAC4RC - WIREWOUND (2" sq x 6-13/16" max) (pictured)
RPMS AVAILABLE: ..... 1, 2, 5, 10 & 15
RESISTANCE RANGE: ..... 0.5 to 100k Ω
POWER RATING: ..... 5.0 watt

Limit Switches at one or both ends of travel. High Wattage. *With Circuit Board.*

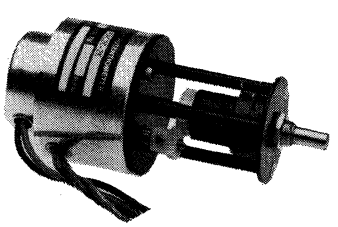
MA2W - WIREWOUND (2-3/8" high x 1-1/2" wide x 4.175" long max.)
RPMS AVAILABLE: ..... 0.06 to 210
RESISTANCE RANGE: ..... 100 to 100k Ω
POWER RATING: ..... 2 watts



High RPM with AC input - uses DC motor. General purpose.

MOTORIZED SINGLE TURNS - 24 or 115 VAC

MAC2E - WIREWOUND (2" dia. x 3-1/2" max)
RPMS AVAILABLE: ..... 1, 2, 5, 10 & 15
RESISTANCE RANGE: ..... 50 to 10k Ω
POWER RATING: ..... 0.5 watt



General Purpose. Wirewound element for excellent output stability.

MAC2P - CONDUCTIVE PLASTIC (2" dia. x 3-1/2" max.)
RPMS AVAILABLE: ..... 1, 2, 5, 10 & 15
RESISTANCE RANGE: ..... 1K to 10k Ω
POWER RATING: ..... 1.0 watt

Conductive Plastic for long life and essentially infinite resolution.

FEATURES of ETI SYSTEMS Motorized Potentiometers. Slip clutch allows manual adjustment when power is off. Operating Temperature range: -30°C to +65°C. A.C. motors are UL approved, reversible. Circuit board (optional), packages the starting capacitor, balancing resistor and braking diode. Braking diode prevents motor coasting.

FOR SERVO POSITIONING CONTROL CIRCUITRY, SEE OUR AD IN EEM (Control Systems & Components).
SEE OUR POTENTIOMETERS IN EEM (Potentiometers,Trimmers, Controls & Rheostats)

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ETI SYSTEMS

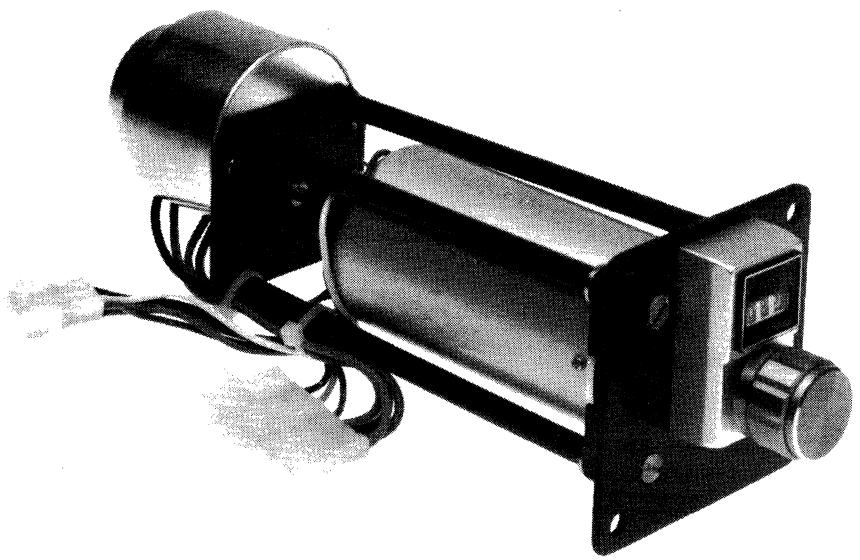
A.C. MOTORIZED POTENTIOMETERS \ MOTORIZED COMPONENTS

MOTORIZED MULTI - TURN - 115 VAC

MAC4RS - WIREWOUND (2.25" dia x 9" max)

RPMS AVAILABLE:	1, 2, 5, 10
RESISTANCE RANGE:	0.5 to 100KΩ
POWER RATING:	5.0 watt
LIMIT SWITCHES	5 Amp Snap Action

Pre-assembled with dial and connectors for convenience in harnessing. We can also offer color-coordinated panels.



Resistance Range shown is standard. Other resistance values available.

MOTORIZED RHEOSTATS & VARIABLE TRANSFORMERS

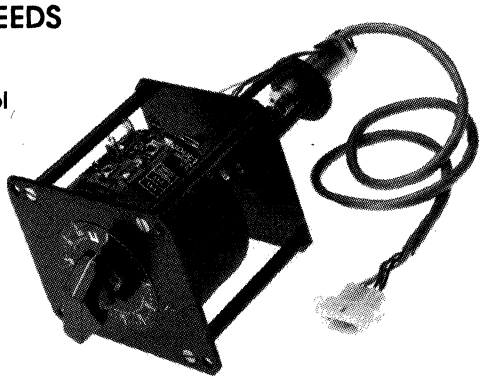
CONTROL YOUR POWER NEEDS



MOTORIZED RHEOSTAT

- Automatically or Remotely control power needs with a Motorized Rheostat or Variable Transformer from ETI Systems.
- Single or Multi gangs available
- 6, 12 or 24 VDC
- 24 or 115 VAC
- Many RPM Selections

POSITIONING CIRCUITRY AVAILABLE



MOTORIZED VARIABLE TRANSFORMER

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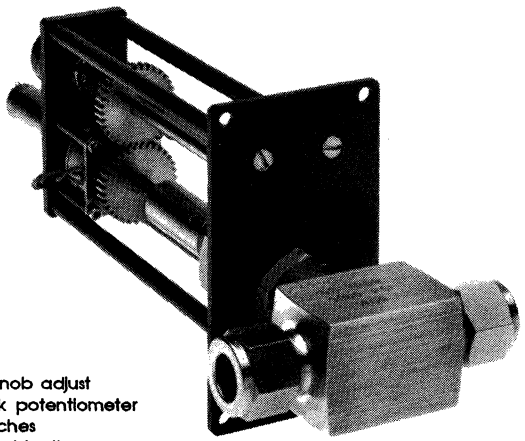
ETI SYSTEMS

ROTARY ACTUATORS

VALVE POSITIONERS

Patented design addresses safety and downtime, torque concerns, and perhaps most critical, *"styction"*. From 10-turn needle valves to regulators requiring 200 in.lbs. of torque, ETI Systems offers the precision functioning and feedback devices that fit your requirements.

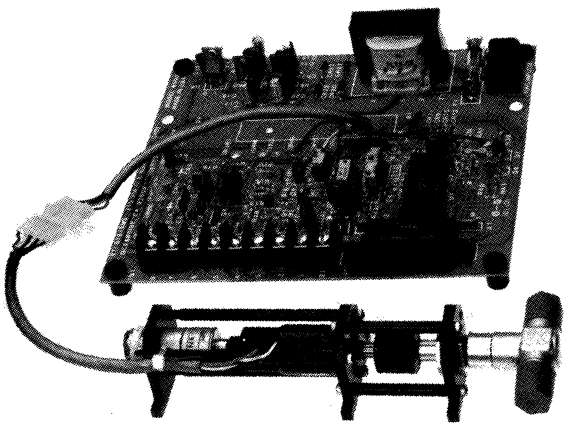
MODEL VA7003 VALVE ACTUATOR CHASSIS MOUNT



OPTIONS: Manual knob adjust
Feedback potentiometer
Limit Switches
Color combinations
Enclosures

VALVE ACTUATOR DRIVER BOARD Model VC6500

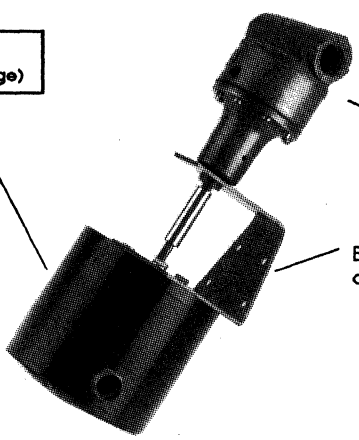
- Servo Control with feedback.
- Inputs to position valves are:
  0 to 10VDC,
  4 to 20 MA or
  16 Bit binary.
- Non-Standards available.



For quotation: Specify valve torque, number of turns, type of liquid or gas. Or, send us your valve to be motorized. Actuators can be panel or chassis mounted, or we will place actuator in an enclosure.

WATER REGULATOR ADJUSTOR Model VM100 (D.C. or A.C. Motor Voltage)

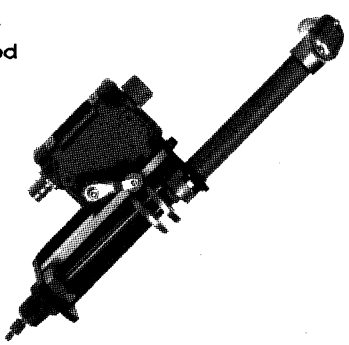
Housing is 5" in Dia. and contains:
- End travel limit switches.
- Feedback position potentiometer.
- Multiple motors (patented), provides higher torque, better load distribution and prevents catastrophic motor failure.
- Energy absorbers (patented) reduces sticking.



Valve or regulator (customer provided or designated).

Bracket is detachable or custom made.

WATER REGULATOR FEEDBACK Model VL2350S



FOR MOTORIZED POTENTIOMETERS SEE OUR AD IN EEM (Motors, Drives & Rotating Components). FOR SERVO POSITIONING CONTROL CIRCUITRY, SEE OUR AD IN EEM (Control Systems & Components). SEE OUR POTENTIOMETERS IN EEM (Potentiometers,Trimmers, Controls & Rheostats)

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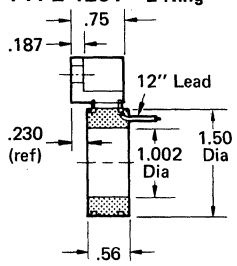
Monroe, N. C. 28110

SLIP RING ASSEMBLIES

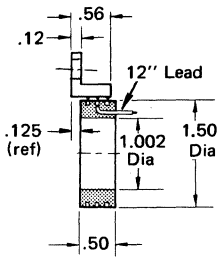
BEST DELIVERY **1**

SEPARATE ROTOR AND BRUSH BLOCK ASSEMBLY — STOCK DELIVERY

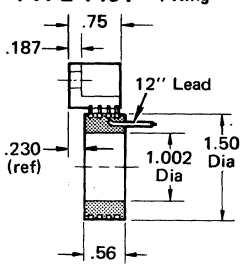
TYPE 1201 – 2 Ring



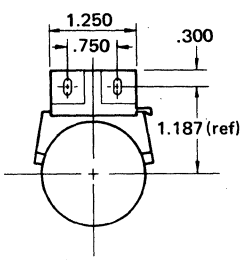
TYPE 1301 – 3 Ring



TYPE 1401 – 4 Ring

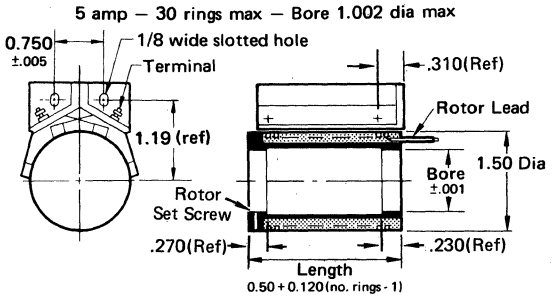


TYPICAL END VIEW



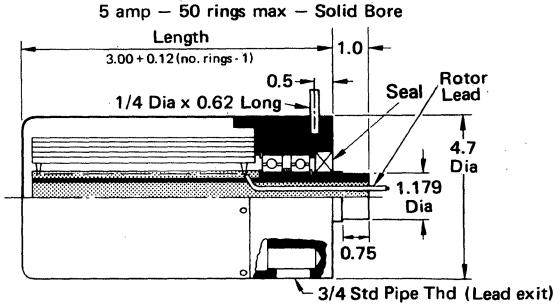
Slip Ring Assembly Type **1057**
Separate Rotor and Brush Block

5 amp — 30 rings max — Bore 1.002 dia max



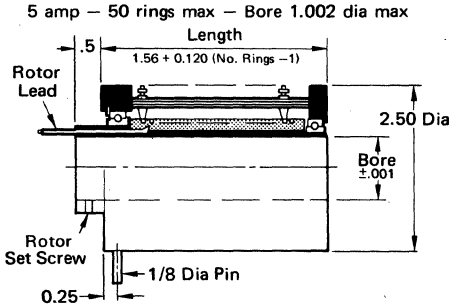
Slip Ring Assembly Type **1302**
Sealed Housing

5 amp — 50 rings max — Solid Bore



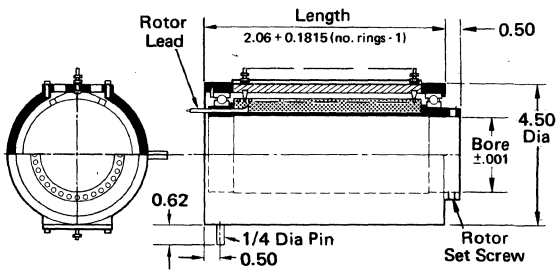
Slip Ring Assembly Type **1186**
Rigid Tube Housing — Exposed Stator Terminals

5 amp — 50 rings max — Bore 1.002 dia max



Slip Ring Assembly Type **1067**
Rigid Tube Housing — Exposed Stator Terminals

5 amp — 100 rings max — Bore 2.252 dia max



CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems

RINGS: Coin Silver 5 AMP Rings

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG — 20% C)
Two brushes per ring
Brushes individually removable and replaceable

NOISE: 10 Milliohms dynamic resistance MAX
5 Milliohms MAX with 4 brushes per CKT

HI-POT: 1000 VAC 60 CYCLE for 15 seconds.

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric

COVER: Easily removable for brush and ring inspection

BEARINGS: Shielded or sealed ball bearings

PART NUMBER CODING — Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

WRITE OR PHONE FOR THE FABRICAST CATALOG

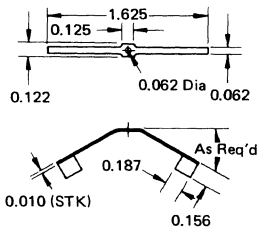
Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 FAX (818) 443-5594

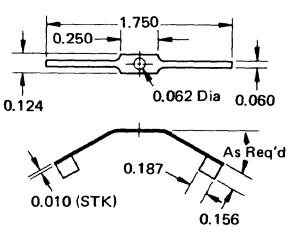
BRUSH ASSEMBLIES 2

LEAF TYPE (BRUSH MATERIAL - FAG 180 LEAF MATERIAL - BeCu) STOCK DELIVERY

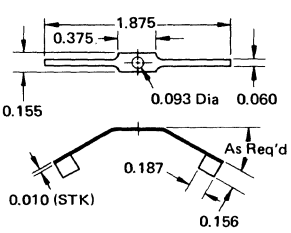
5.0 AMP DOUBLE BRUSH
P/N 1103004 BRUSH .040 WIDE



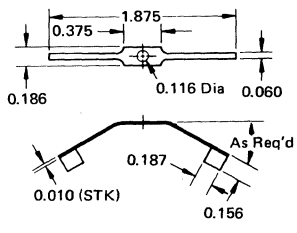
5.0 AMP DOUBLE BRUSH
P/N 1050006-13 BRUSH .040 WIDE



5.0 AMP DOUBLE BRUSH
P/N 1050006-5 BRUSH .040 WIDE

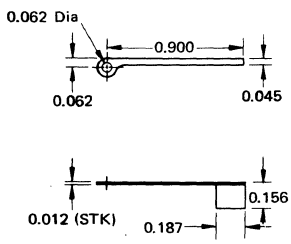


5.0 AMP DOUBLE BRUSH
P/N 1050006-2 BRUSH .040 WIDE

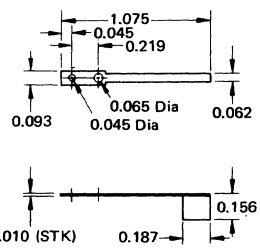


"AS REQ'D" ANGLE IN FREE STATE – LEAF WITHOUT BRUSH WOULD TOUCH RING SURFACE

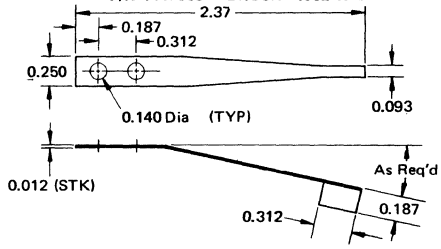
2.0 AMP SINGLE BRUSH
P/N 1113007 BRUSH - .040 WIDE



2.0 AMP SINGLE BRUSH
P/N 1120051 BRUSH - .040 WIDE



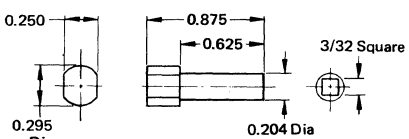
5.0 AMP SINGLE BRUSH
P/N 1117003 BRUSH - .062 WIDE



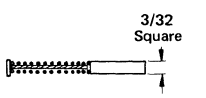
PLUNGER TYPE (BRUSH MATERIAL - FAG 180 HOLDER - BRASS) STOCK DELIVERY



2.5 AMP CAPACITY
3/32" SQUARE BRUSH

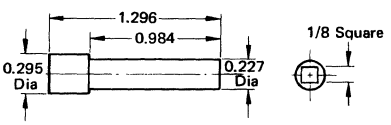


HOLDER ASSY P/N 1070004-1
CAP ASSY P/N 1070004-2

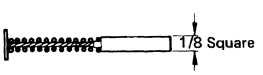


BRUSH ASSY P/N 1072-1

4.0 AMP CAPACITY
1/8" SQUARE BRUSH

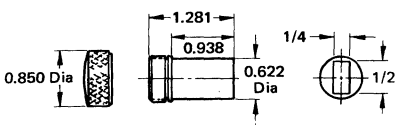


HOLDER ASSY P/N 1051032-1
CAP ASSY P/N 1051032-2

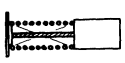


BRUSH ASSY P/N 1072-2

25 AMP CAPACITY
1/4" x 1/2" RECTANGULAR BRUSH



HOLDER ASSY P/N 1092006-1
CAP ASSY P/N 1092006-2



BRUSH ASSY P/N 1092003

BRUSH MATERIAL

- Fabricast grade Fag 180, the universal low noise level grade used for all standard brush assembles.
- Fabricast grade FAG 193, the lowest noise level grade, however, the ring surface speed is limited to 250 SFM.
- Fabricast grade FAG 150, the highest surface speed grade, however, noise levels are compromised.

Grade No.	Composition	Recommended Surface Speed	Carrying Capacity
FAG150	50% silver, 50% graphite	Over 3500 ft. per min.	100 Amps per sq. in.
FAG180	80% silver, 20% graphite	Up to 3500 ft. per min.	250 Amps per sq. in.
FAG193	93% silver, 7% graphite	Up to 250 ft. per min.	300 Amps per sq. in.

WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 FAX (818) 443-5594

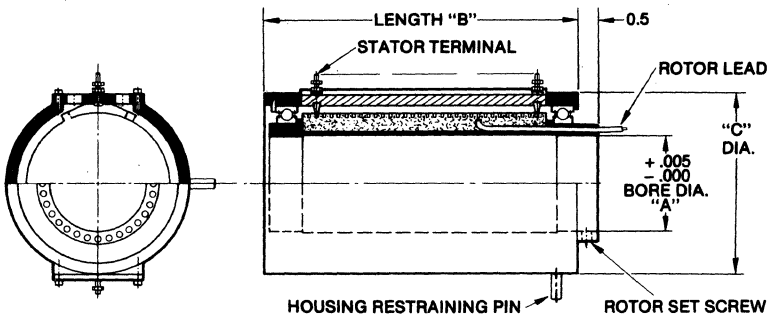
SLIP RING ASSEMBLIES

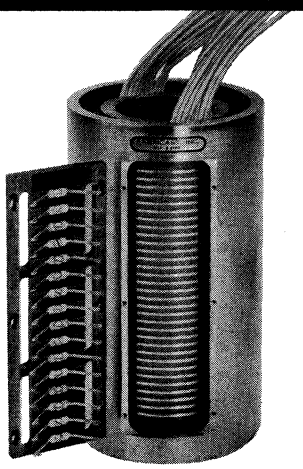
SELF—CONTAINED RIGID TUBE HOUSING

3

DISTINGUISHING CHARACTERISTICS

Rigid one piece housing eliminates bearing alignment problems. Larger section bearings are generally used in these units for a more rugged unit.





TYPE	BORE DIA "A" INCHES		NO. RINGS MAX.	CURRENT AMPS	LENGTH "B" INCHES	HOUSING DIA "C"
	NOMINAL	RANGE				
1230	Solid	—	100		3.50 + .120 (no. rings -1)	2.50
1186	1.000	0 - 1.002	100	5 amp std 2 brushes per ring	1.56 + .120 (no. rings -1)	2.50
1197	1.250	1.0 - 1.252	70		1.56 + .130 (no. rings -1)	3.50
1289	1.500	1.25 - 1.502	100		1.56 + .150 (no. rings -1)	4.00
1067	2.000	1.5 - 2.252	100	10 amp std or lo noise 4 brushes per ring	2.06 + .181 (no. rings -1)	4.50
1420	3.000	2.25 - 3.002	100		1.38 + .181 (no. rings -1)	4.75
1506	3.500	3.0 - 3.502	100		2.88 + .200 (no. rings -1)	6.50
1390	4.000	3.5 - 4.252	100		2.00 + .187 (no. rings -1)	5.75

* RING COMPLEMENT MAY BE LIMITED BY ABILITY TO PASS ROTOR LEADS UNDER BEARINGS.
* FOR 50 AMP STANDARD POWER ASSEMBLIES SEE POWER ASSEMBLY SECTION.
* INSTRUMENT AND 50 AMP POWER CIRCUITS MAY BE CAST ON COMMON SLEEVE.

CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems

RINGS: Coin Silver 5 AMP Rings

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring
Brushes individually removable and replaceable

NOISE: 10 Milliohms dynamic resistance MAX
5 Milliohms MAX with 4 brushes per CKT

CURRENT: Noted in tabulated block
Rating may be doubled with 4 brushes per CKT

HI-POT: 1000 VAC 60 CYCLE for 15 seconds

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric

ROTOR LEADS: 5 AMP Leads – 20 GA per MIL-W-16878 TYPE "E"
Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends.

HOUSING: One piece tube construction

COVER: Easily removable for brush and ring inspection

BEARINGS: Shielded or sealed ball bearings

PART NUMBER CODING – Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

WRITE OR PHONE FOR THE FABRICAST CATALOG

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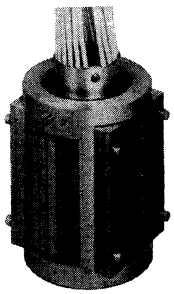
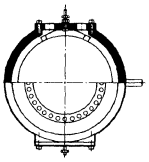
SLIP RING ASSEMBLIES

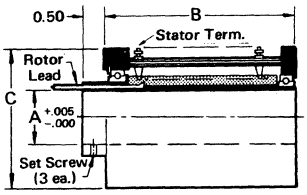
SELF-CONTAINED 4

SELF CONTAINED RIGID HOUSING SLIP RING ASSEMBLIES



DISTINGUISHING CHARACTERISTICS
Rigid one piece housing eliminates bearing alignment problems. Bearings are thin section aircraft torque tube type or Kaydon KA series.





REPLACEABLE BRUSH ASSEMBLIES —1000 VAC HYPOT

TYPE	BORE DIA "A", inches		NO. RINGS MAX	CURRENT	LENGTH "B", inches	Housing Dia "C"
	Nominal	Range				
4100	.500	.250 - .502	48		1.19 + .125 (no. rings - 1)	2.00
4150	1.000	.000 - 1.002	64	5 amp std	1.19 + .120 (no. rings - 1)	2.50
4200	1.312	1.000 - 1.312	100	2 brushes	1.19 + .125 (no. rings - 1)	3.00
4237	1.750	1.312 - 1.752	78	per ring	1.19 + .130 (no. rings - 1)	3.37
4268	2.000	1.750 - 2.002	100		1.28 + .150 (no. rings - 1)	3.62
4350	2.750	2.250 - 2.752	100	10 amp std	1.75 + .150 (no. rings - 1)	4.50
4400	3.250	2.750 - 3.252	100	or lo noise	1.75 + .187 (no. rings - 1)	5.00
4462	3.750	3.250 - 3.752	100	4 brushes	1.75 + .160 (no. rings - 1)	5.50
4500	4.250	3.750 - 4.252	100	per ring	1.75 + .187 (no. rings - 1)	6.00
4600	5.250	4.250 - 5.252	79		1.75 + .186 (no. rings - 1)	7.00
4700	6.250	5.250 - 6.252	63		1.75 + .186 (no. rings - 1)	8.00
4800	7.250	6.250 - 7.252	58		1.75 + .187 (no. rings - 1)	9.00
4900	8.750	7.250 - 8.750	58		1.75 + .187 (no. rings - 1)	11.00
1271	1.000	.000 - 2.000	15	50 amp std	3.50 + 1.050 (no. rings - 1)	4.50
1291	3.000	2.000 - 3.252	9	50 amp std	4.50 + 1.120 (no. rings - 1)	6.50

NON-REPLACEABLE BRUSH ASSEMBLIES — 500 VAC HYPOT

4087	.250	.250 - .502	50	3 amp std	.875 + .080 (no. rings - 1)	1.56
4125	.500	.250 - .752	50	2 brushes	.875 + .100 (no. rings - 1)	2.00
4230	2.000	1.500 - 2.002	50	per ring	.875 + .080 (no. rings - 1)	3.50

PART NUMBER CODING — Specify fully when ordering

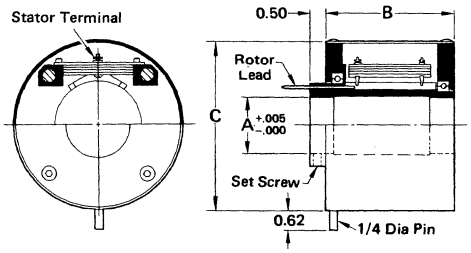
Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

CHARACTERISTICS

RPM: **Rigid one piece housing eliminates bearing alignment problems.**
RINGS: Coin Silver 5 amp rings. Copper 50 amp rings.
BRUSHES: Silver Graphite. Fabricast Grade FAG 180 (80% AG — 20% C). Two brushes per ring. Brushes individually removable and replaceable.
NOISE: 10 Milliohms dynamic resistance max. 5 Milliohms max with 4 brushes per ckt.
CURRENT: Noted in tabulated block. Rating may be doubled with 4 brushes per ckt.
HI-POT: See table on left.
ROTOR: One piece steel sleeve. Ring complement vacuum cast on sleeve as unit with epoxy dielectric.
ROTOR LEADS: 5 amp Leads — 20 ga per MIL-W-16878 type "E". 50 amp Leads — 8 ga — Teflon.
HOUSING: One piece tube construction.
COVER: Easily removable for brush and ring inspection.
BEARINGS: Shielded or sealed ball bearings.

SELF CONTAINED COVERED STATOR TERMINAL SLIP RING ASSEMBLIES

DISTINGUISHING CHARACTERISTICS
Bearing Bell and space bar type units best suited for larger bore assemblies.



TYPE	BORE DIA "A", inches		NO. RINGS MAX	CURRENT	LENGTH "B", inches	Housing Dia "C"
	Nominal	Range				
1296	.250	.250 - .377	48		1.25 + .110 (no. rings -1)	2.25
1297	.500	.378 - .565	100	5 amp std	1.25 + .120 (no. rings -1)	2.75
1298	1.000	.566 - 1.002	100	2 brushes	1.25 + .120 (no. rings -1)	3.00
1272	1.000	1.000 - 1.750	100	per ring	2.00 + .150 (no. rings -1)	5.25
1273	2.000	1.750 - 2.625	100		2.00 + .150 (no. rings -1)	6.25
1274	3.000	2.625 - 3.750	100		2.00 + .160 (no. rings -1)	7.50
1275	4.000	3.750 - 4.750	48	10 amp or	2.00 + .186 (no. rings -1)	9.00
1276	5.000	4.750 - 5.750	63	lo noise	2.00 + .186 (no. rings -1)	10.50
1277	6.000	5.750 - 6.750	58	4 brushes	2.00 + .187 (no. rings -1)	12.00
1278	8.000	6.750 - 8.750	58	per ring	2.00 + .187 (no. rings -1)	15.00
1282	1.000	1.000 - 1.250	16		3.00 + 1.050 (no. rings -1)	8.00
1283	2.000	1.250 - 2.000	16		3.00 + 1.050 (no. rings -1)	9.00
1284	3.000	2.000 - 3.125	9	50 amp std	3.00 + 1.120 (no. rings -1)	10.00
1285	4.000	3.125 - 4.375	8	100 amp	3.00 + 1.116 (no. rings -1)	11.50
1286	5.000	4.375 - 5.375	10	4 brushes	3.00 + 1.116 (no. rings -1)	12.50
1287	6.000	5.375 - 6.375	10	per ring	3.00 + 1.125 (no. rings -1)	13.50
1288	8.000	6.375 - 8.375	10		3.00 + 1.125 (no. rings -1)	16.00

* RING COMPLEMENT MAY BE LIMITED BY ABILITY TO PASS ROTOR LEADS UNDER BEARINGS.
* 10 AMP OR LOW NOISE CKT ON TYPES 1296, 1297, 1298, REQUIRE 2 PARALLEL RINGS PER CIRCUIT.
* INSTRUMENT AND 50 AMP POWER CIRCUITS MAY BE CAST ON COMMON SLEEVE.

PART NUMBER CODING — Specify fully when ordering

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

CHARACTERISTICS **HOUSING:** Bell, Bell Spacer and Cover type construction. All other characteristics same as for Self Contained Rigid Housing Slip Ring Assembly.

WRITE OR PHONE FOR THE FABRICAST CATALOG

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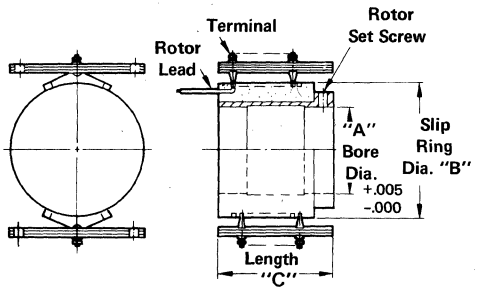
SLIP RING ASSEMBLIES

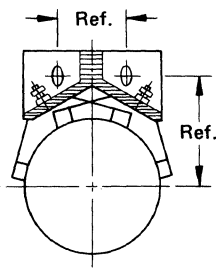
SEPARATE ROTOR & BRUSH BLOCK

5

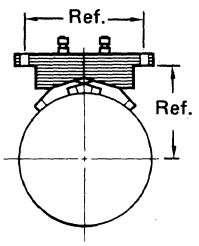
Brush Block Assy
5 AMP STD



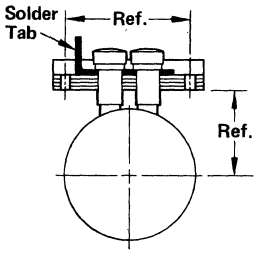
Brush Block Assy
TYPE "A"



Brush Block Assy
TYPE "E"



Brush Block Assy
50 AMP STD



TYPE	BORE DIA "A" INCHES		NO. RINGS MAX.	CURRENT AMPS	SLIP RING DIA "B"	LENGTH "C" INCHES
	NOMINAL	RANGE				
2050	SOLID	000 - .127	18	5 amp std 2 brushes per ring	.500	.625 + .125 (no. rings -1)
2087	SOLID	000 - .377	48		.875	.625 + .110 (no. rings -1)
2112	.375	000 - .627	52		1.125	.625 + .125 (no. rings -1)
2150	.750	.625 - 1.002	52		1.500	.625 + .120 (no. rings -1)
2187	1.000	.750 - 1.250	48		1.875	.625 + .125 (no. rings -1)
2200	1.125	.750 - 1.375	80	10 amp std or lo noise 4 brushes per ring	2.000	.750 + .125 (no. rings -1)
2237	1.250	1.000 - 1.502	78		2.375	.750 + .130 (no. rings -1)
2268	1.500	1.250 - 1.752	107		2.687	1.000 + .150 (no. rings -1)
2350	2.000	1.750 - 2.502	78		3.500	1.000 + .181 (no. rings -1)
2375	2.500	2.370 - 2.875	48		3.750	1.000 + .200 (no. rings -1)
2462	3.000	2.750 - 3.752	100		4.652	1.250 + .160 (no. rings -1)
2500	4.000	3.250 - 4.002	40		5.000	1.250 + .250 (no. rings -1)
2600	5.000	4.000 - 5.002	80		6.000	1.250 + .186 (no. rings -1)
2700	6.000	5.000 - 6.002	63		7.000	1.250 + .186 (no. rings -1)
2800	7.000	6.000 - 7.002	58		8.000	1.250 + .187 (no. rings -1)
2900	8.000	7.000 - 9.002	58		10.000	1.250 + .187 (no. rings -1)
3268	1.000	.750 - 1.187	16	50 amp std 2 brushes per ring	2.687	2.000 + 1.050 (no. rings -1)
3300	1.500	1.187 - 1.500	6		3.000	2.000 + 1.000 (no. rings -1)
3350	2.000	1.500 - 2.000	16		3.500	2.000 + 1.050 (no. rings -1)
3462	3.000	2.000 - 3.125	9		4.625	2.000 + 1.120 (no. rings -1)
3600	4.000	3.125 - 4.500	8		6.000	2.000 + 1.116 (no. rings -1)
3700	5.000	4.500 - 5.500	10		7.000	2.000 + 1.116 (no. rings -1)
3800	6.000	5.500 - 6.500	10		8.000	2.000 + 1.125 (no. rings -1)
3900	7.000	6.500 - 8.500	10		10.000	2.000 + 1.125 (no. rings -1)

CHARACTERISTICS

RINGS: Coin Silver AMP Rings.
Copper 50 AMP Rings.

BRUSHES: Silver Graphite.
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring
Brushes individually removable and replaceable.

NOISE: 10 Milliohms dynamic resistance MAX.
5 Milliohms max with 4 brushes per CKT.

CURRENT: Noted in tabulated block.
Rating may be doubled with 4 brushes per ckt.

HI-POT: 1000 VAC 60 cycle for 15 seconds.

ROTOR: One piece steel sleeve.
Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

ROTOR LEADS: 5 AMP Leads – 20 GA per MIL-W-16878 TYPE "E"
50 AMP Leads – 8 GA – Teflon
Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends.

BRUSH BLOCK: Glass epoxy laminate.
Optional mounting methods shown.

PART NUMBER CODING – Specify fully when ordering.

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S / Unshielded - U)
X	X	X	X	X

WRITE OR PHONE FOR THE FABRICAST CATALOG

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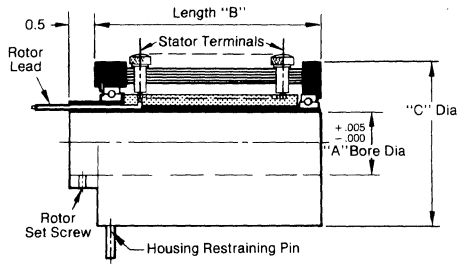
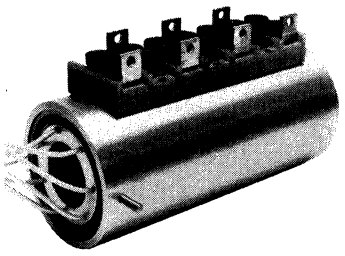
SLIP RING ASSEMBLIES 6

POWER ASSEMBLIES





CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems

RINGS: Copper 50 AMP Rings

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG—20% C)
Two brushes per ring
Brushes individually removable and replaceable

CURRENT: Noted in tabulated block
Rating may be doubled with 4 brushes per CKT

HI-POT: 1000 VAC 60 CYCLE for 15 seconds

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric

ROTOR LEADS: 50 AMP Leads — 8 GA — Teflon
Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends

BEARINGS: Shielded or sealed ball bearings

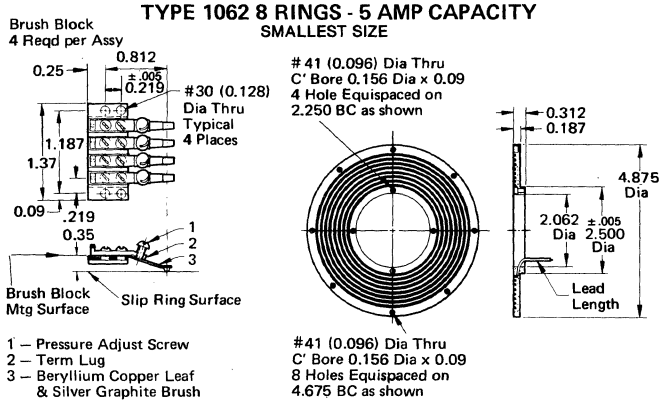
TYPE	BORE DIA "A" INCHES		NO. RINGS MAX	CURRENT	LENGTH "B" INCHES	HOUSING DIA "C"
	NOMINAL	RANGE				
5035	1.625	1.125 - 2.125	15	50 amp std 2 brushes per ring	3.25 + 1.089 (no. rings-1)	4.50
5043	2.625	2.000 - 3.250	8		3.25 + 1.100 (no. rings-1)	5.50
5050	3.375	2.750 - 4.000	10		3.25 + 1.125 (no. rings-1)	6.12
5060	4.062	3.125 - 5.000	10		3.25 + 1.116 (no. rings-1)	7.25
5070	5.250	4.500 - 6.000	8	100 amp 4 brushes per ring	3.25 + 1.116 (no. rings-1)	8.00
5080	6.000	5.500 - 6.500	8		3.25 + 1.125 (no. rings-1)	9.00
5100	7.625	6.750 - 8.500	8		3.25 + 1.125 (no. rings-1)	11.00
5140	9.500	8.500 - 10.500	6		3.75 + 1.250 (no. rings-1)	15.75

PART NUMBER CODING — Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)
X	X	X	X

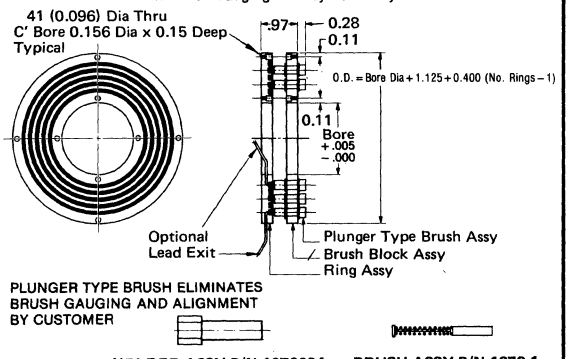
PANCAKE TYPE SLIP RING ASSEMBLIES

TYPE 1062 8 RINGS - 5 AMP CAPACITY
SMALLEST SIZE



1 — Pressure Adjust Screw
2 — Term Lug
3 — Beryllium Copper Leaf & Silver Graphite Brush

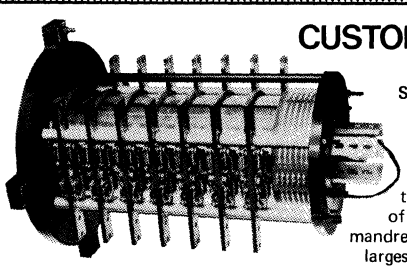
TYPE 1650 - 5 AMP CAPACITY
NO. OF RINGS PER CUSTOMER REQ'TS
No Brush Gauging — Easy Assembly



PLUNGER TYPE BRUSH ELIMINATES BRUSH GAUGING AND ALIGNMENT BY CUSTOMER

HOLDER ASSY P/N 1070004 **BRUSH ASSY P/N 1072-1**

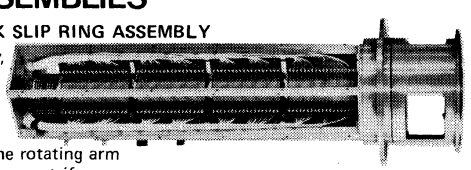
CUSTOM DESIGNED SLIP RING ASSEMBLIES



CUSTOM 7000 AMP SLIP RING ASSEMBLY

This slip ring assembly, as designed and manufactured by Fabricast, Inc., is used to supply 7000 amperes of current to the rotating mandrel of the world's second largest spin forging machine.

CUSTOM 222 TRACK SLIP RING ASSEMBLY



This slip ring assembly, as designed and manufactured by Fabricast, Inc. was used to complete the electrical circuits to the rotating arm of an astronaut carrying centrifuge.

The unit consists of 50 amp. power, 5 amp. instrumentation and 50 megacycle coaxial modules.

FABRICAST WILL ALSO CUSTOM DESIGN SPLIT RING ASSEMBLIES AND SEGMENTED SLIP RING ASSEMBLIES

WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

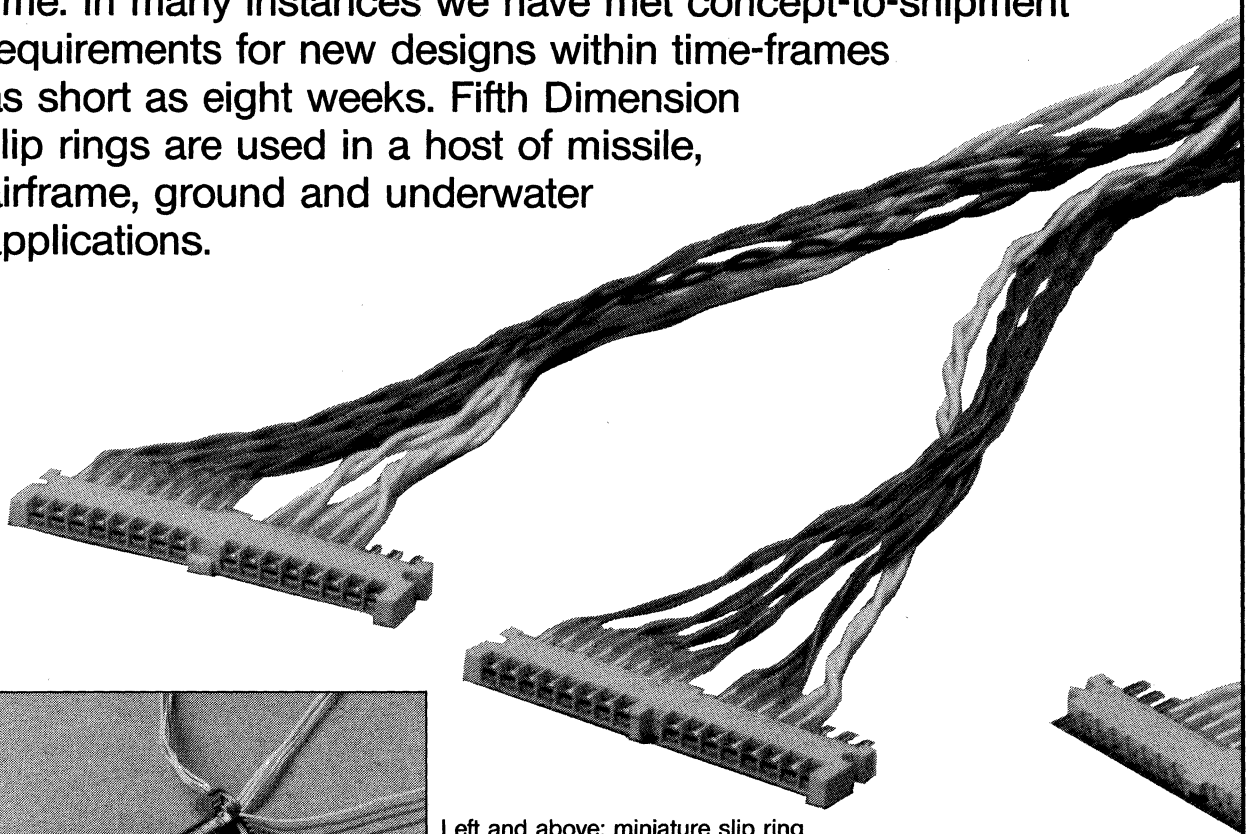
P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 FAX (818) 443-559

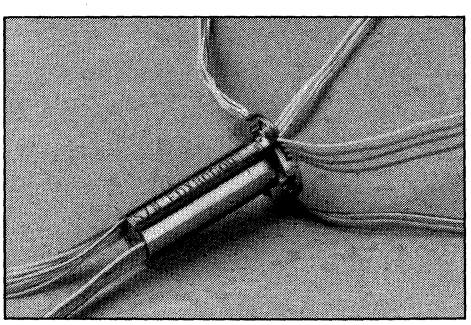
FIFTH DIMENSION INC.

Slip Rings

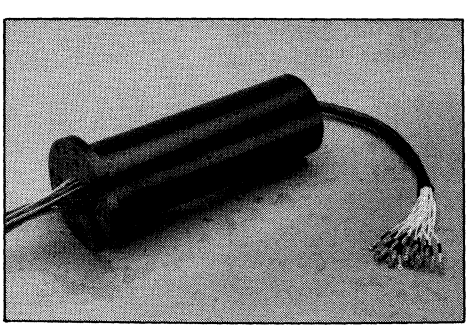
High-Precision, Short Delivery Cycle

Look to Fifth Dimension Inc. for the development and production of high-precision, high reliability slip rings in remarkably short time. In many instances we have met concept-to-shipment requirements for new designs within time-frames as short as eight weeks. Fifth Dimension slip rings are used in a host of missile, airframe, ground and underwater applications.





Left and above: miniature slip ring capsules used in the gimballed pitch, roll and azimuth axes of the Trident II Mark VI Inertial Guidance System. Their small size has been achieved without sacrificing reliability.



Submersible slip ring assembly.

Fifth Dimension slip ring capabilities include:

- Miniature
- Helicopter
- Vehicular
- Pedestal
- Cable Reel
- Robotic
- Twist Capsules

FIFTH DIMENSION INC.

801 New York Avenue, Trenton, NJ 08638-3982 • Tel: (609) 393-8350 • FAX: (609) 599-9508

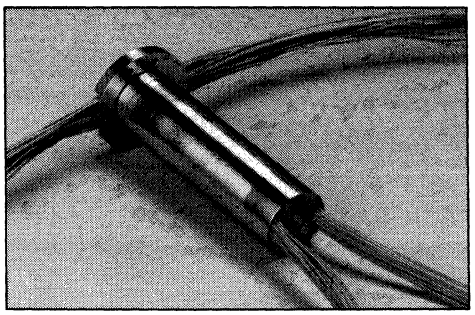
FIFTH DIMENSION INC.

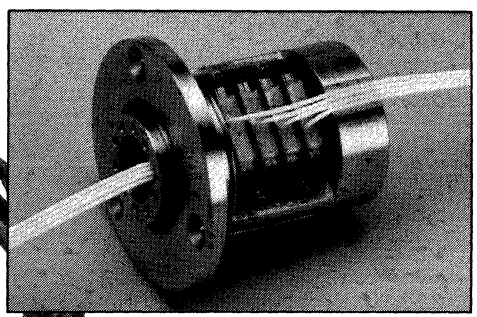
Slip Rings

High-Precision, Short Delivery Cycle



Aircraft slip ring assemblies are supplied for rotary and fixed-wing applications.





Cable reel slip ring for applications such as submarine antennas and underwater towed vehicles.

Facilities

- Clean rooms for slip rings manufacturing certified to meet Class 100,000. Critical final assembly takes place on laminar flow benches certified to Class 1.
- Complete machine shop
- Mold tool and die fabrication
- Extensive precious metal plating capabilities with laboratory-type control
- Epoxy casting and molding
- Automatic noise and torque test stations
- Comprehensive electrical, mechanical and environmental testing laboratory

Documentation

Where required, documentation can be as comprehensive as Class 1 wherein each manufacturing step requires operator sign-off and complete traceability of all component parts is maintained.

Short Delivery Cycle

At Fifth Dimension, project management is geared to short delivery cycles without compromising high quality. We invite you to write or call to discuss your slip ring requirements.

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MINIGLOSSARY SERVO COMPONENTS

SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

Impedance: Specified as R + jX, where R is the AC resistive component and X is the reactive component. Important impedances are: (a) Z_{po} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with the secondary open; (b) Z_{so}, which is the impedance of the secondary winding with the primary open; and (c) Z_{ss}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

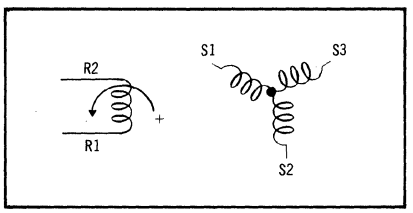
Accuracy: The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

Loads: For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

Operation Temperature: The ambient temperature range over which the unit performs its primary function.

FUNCTIONS

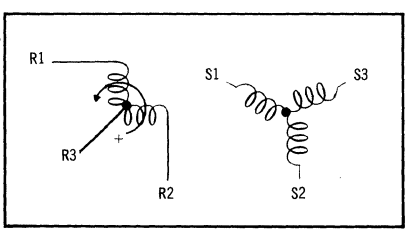
Transmitter: A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

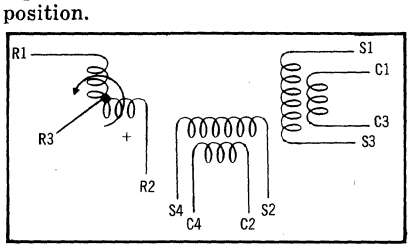
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to overrotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

GRAPHALLOY® SILVER GRAPHALLOY BRUSHES and BRUSH & SLIP-RING ASSEMBLIES...

USED IN MICROWAVE EQUIPMENT • SERVO SYSTEMS • SYNCHROS • INVERTERS • THERMOCOUPLE and STRAIN GAGE CIRCUITS • PULSE SYSTEMS • COMPUTER GROUNDING CONTACTS • TORQUE INDICATORS • MEDICAL EQUIPMENT • PACKING MACHINERY

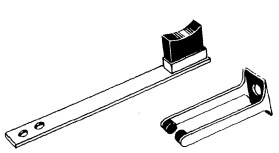
GRAPHALLOY® BRUSHES

Silver-Graphalloy Brushes have been widely used because of low *and* constant contact drop, extremely low electrical noise, *and* long life. Over 100 grades are now serving in a wide variety of applications. Silver-Graphalloy Brushes on ½-inch-diameter coin silver slip rings have operated successfully in highly critical electrical circuits at speeds up to 100,000 r.p.m.

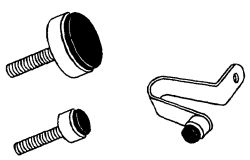


Standard sizes from ⅛"-square to ¾"-square. Many sizes in stock.

Our Engineering Department will assist you in determining the exact grade of GRAPHALLOY for your needs. *Ask for our Brush Inquiry Form 109.*



LEAF SPRINGS



CUP CONTACTS

GRAPHALLOY® SLIP RINGS

We supply Coin Silver and Bronze Slip Rings, both *cylindrical* and *flat* types ...and recommend three brushes per ring...spaced at 120°...for best contact. The cylindrical type are designed for press fitting over standard steel shafting. The flat type rings are designed for nesting either on an insulated plate or for molding into insulation. Insulated slip rings of either type, or slip-ring assemblies, can be furnished with leads attached.

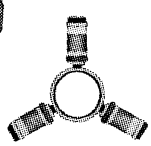


No. 168 Series FLAT TYPE to 20" O.D.

Standard FLAT Rings have ¼" radial contact surface and ⅛" radial spacing between adjacent rings.

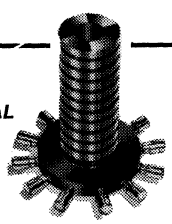


No. 116 Series CYLINDRICAL TYPE to 36" O.D.



Typical Layout

Model 319 CYLINDRICAL SLIP-RING Assembly

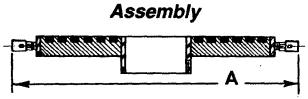


SOLID COIN SILVER RINGS

Model	Rings	Length
319-4	4	2 9/16"
319-6	6	3 5/16"
319-10	10	4 13/16"
319-14	14	6 5/16"

O.D. Slip Ring 1⅝"
Terminal 4"
Assembly I.D. .814/.813"

Model 409 FLAT SLIP-RING Assembly

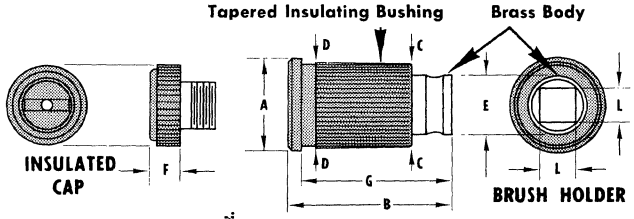


SOLID COIN SILVER RINGS

Model	Rings	O.D. "A"
409-2	2	5½"
409-4	4	7"
409-6	6	8½"
409-10	10	11½"

Hub O.D. 2" I.D. 1.753/1.751"
Length 1⅛" To 5 Amps., 125 V.
More rings on application.

GRAPHALLOY BRUSH HOLDERS



BRUSH HOLDER & CAP NO.	BRUSH SIZE	SUGGESTED MIN. SLIP-RING WIDTH	**MOUNTING HOLE DIAMETER	BRUSH HOLDER TO SLIP RING—MIN.	OVERALL LENGTH A	B	F	Other Sizes Available C	D	E	G	BROACHED HOLE L
14326	⅛" sq.	3/16"	13/32"	1/16"	.437"	7/8"	3/16"	.404"	.418"	.281"	25/32"	.129"
11509†	5/32" sq.	¼"	13/32"	1/16"	.437"	7/8"	3/16"	.404"	.418"	.281"	25/32"	.160"
11570†	3/16" sq.	¼"	7/16"	1/16"	.484"	7/8"	3/16"	.441"	.451"	.313"	25/32"	.193"
19011†	¼" x 3/16"	5/16"	9/16"	⅛"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256 x .193"
11527†	¼" sq.	5/16"	9/16"	⅛"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256"
14292†	⅜" x ¼"	7/16"	43/64"	⅛"	.718"	1 7/16"	¼"	.672"	.682"	.533"	1 5/16"	.382 x .256"
12166†	⅜" sq.	7/16"	13/16"	⅛"	.921"	1 13/16"	¼"	.813"	.828"	.628"	1 5/8"	.382"
31392†	½" sq.	9/16"	1⅛"	⅛"	1.237"	1 13/16"	¼"	1.126"	1.141"	.878"	1 9/16"	.503"
35439†	¾" x ½"	⅞"	1 33/64"	⅛"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"
35440†	¾" sq.	⅞"	1 33/64"	⅛"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"

†Shunts are provided. **Mounting hole diameter for brush holder dimension D.

GRAPHALLOY BUSHINGS and PILLOW BLOCKS





Survive unlubricated! Replace oil-lubricated bushings in synchros, instruments, timers and missiles. Advantages:

(1) Lower friction at room temperatures;
(2) No oil to solidify at low temperatures;
(3) No oil to carbonize at prolonged elevated temperatures.
(4) No oil or grease drag.

Ask for Data Sheets 270 and 277 on Miniature Bronze-Graphalloy Bushings.

Ask for the following Data Sheets

GRAPHALLOY BRUSHES, SLIP RINGS & ASSEMBLIES...DS-218
GRAPHALLOY BUSHINGS, PILLOW BLOCKS...DS-117 and DS-1001

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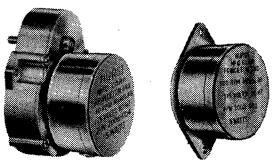
EMERSON ELECTRIC COMPANY, BOX 326, PRINCETON, IN 47670. TELEPHONE (812) 385-2564. FAX (812) 386-7504

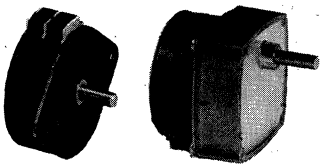
STEPPING AND SYNCHRONOUS MOTORS



A SERIES

Designed for long life at rated loads. Geared models have hardened steel gears and pinions running on steel studs. Hi-Torque rotors available; also voltages other than those shown may be specified. Widely used in applications requiring high quality components.

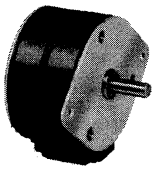
Dim. Geared: 2.81" H x 1.63" D
Direct Drive: 1.94" H x 1.02" D



S SERIES

Compact direct drive or geared motors for applications where space is limited and precise performance is required. Geared motors have typical torque ratings to 200 oz-in @ 200 p/s (max. gear train loading). Dual-stack motors featuring greater torque are now available. Call or write for complete specifications.

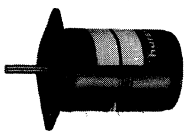
Dim. Geared: 2.45" H x 1.78" D
Direct Drive: 2.28" H x .97" D



SC SERIES

SC Series stepping motors have approximately 66% greater torque yet are only ⅔" longer than the popular SAS Series motors. Dual sleeve bearings are standard but ball bearings as well as double ended shafts may be specified.

Dim. Direct Drive: 3.13" H x 1.41" D



BA SERIES

This exceptionally small stepping motor — a mere 0.895" x 1.438" — has a relatively high torque to inertia ratio. Its design recognizes the demand for small components to fit where space is severely limited. Applications are found in a wide range of medical and scientific instruments and robotics. These stepping motors are also recommended for low duty-cycle, battery operated equipment.

Dim. Direct Drive: .895" H x 1.438" D

DIRECT DRIVE STEPPING MOTORS

	AS and ABS	SAS and SBS	SCS	BAS
STEP ANGLE (degrees)	7.5 and 15	7.5 and 15	7.5	18
STEPS PER REVOLUTION	48 and 24	24 and 48	48	20
2-PHASE HOLDING TORQUE (oz-in)	3.8 and 4.3	8.0 and 11.9	18.5 and 20.5	1.10
RATED TORQUE @ 4-5 p/s (oz-in)	2.3 and 2.75	7.5 and 9.0	12.5 and 16.5	0.625
INPUT POWER (Watts)	3.5 and 4.5	8	8	2.5
NOMINAL VOLTAGE (Volts)	12	6, 12, 24	5, 6, 12, 24	5, 6, 12, 24
WINDING RESISTANCE (Ohms)	100 and 53	9, 36 and 144	6.1, 8.8, 35, 140	20, 29, 115, 461
ROTOR INERTIA (oz-in)	0.07	0.17	.29	1.19
TEMPERATURE RISE (°C)	30 and 48	65	58	46
WEIGHT (oz)	6.8	8	11.5	2.1

GEARED STEPPING MOTORS

	AS and ABS	SAS and SBS
REDUCTION	300 to 4⅛	600 to 2
STEP ANGLE (degrees)	0.025 to 3.6	0.025 to 7.50
NOMINAL VOLTAGE (Volts)	12	12
OUTPUT SPEED @ 200 p/s (rpm)	0.83 to 120	0.42 to 125.0
TYPICAL TORQUE @ 200 p/s (oz-in)	150* to 5.3	200* to 3
INPUT POWER (Watts)	3.5 and 4.5	8
WINDING RESISTANCE (Ohms)	100 and 53	9, 36, 144
WEIGHT (oz)	11	16

*Maximum gear train loading

NOTES 1. Standard lead wire configuration is 6 leads.
2. All stepping motors shown here can be driven with Hurst Stepping Motor Controls.

DIRECT DRIVE SYNCHRONOUS MOTORS

	A and AB	SA and SB	SC	BA
SPEED @ OUTPUT SHAFT (rpm)	300 or 600	300 or 600	300	720
RATED TORQUE (oz-in)	2.0 to 3.75	6.0 to 9.0	8.75 to 11.5	0.625
INPUT POWER (Watts)	3 to 6.5	5 to 7	7 to 9	1.5
CAPACITOR VALUE (mfd)	.25 to .62	.50 to .62	.68 to .85 ± 10%	0.15 ± 10% 400 VDC
FULL LOAD TEMPERATURE RISE (°C)	21 to 43	28 to 37	35 to 40	30
WEIGHT (oz)	6.8	8	10	2.1

GEARED SYNCHRONOUS MOTORS

	A and AB	SA and SB	SC
SPEED @ OUTPUT SHAFT (rpm)	1 to 120	1 to 360	15 to 150
RATED TORQUE (oz-in)	150 to 4.0	200* to 7	116* to 13
INPUT POWER (Watts)	3 to 6.5	5 to 7	7 to 9
CAPACITOR VALUE (mfd)	.25 to .62	.50 to .62	.68 to .85
WEIGHT (oz)	11	16	18

*Maximum gear train loading

NOTES 1. Capacitors furnished with most standard synchronous motors.
2. All synchronous motors shown on this page operate on 115 VAC, 60 Hz.

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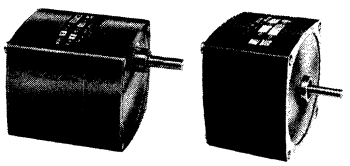
STEPPING AND SYNCHRONOUS MOTORS



T SERIES

Compact, rugged and efficient, TS Series motors are designed for heavy-duty applications. Geared models offer hardened steel gears and pinions with dynamic torque ratings up to 250 ounce-inches. Both geared and direct drive motors have machined die cast housings. Sleeve bearings are standard but ball bearings may be specified on the output shaft.

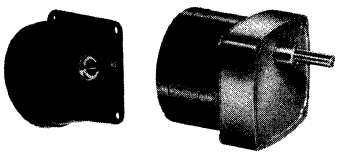
Dim. Geared: 2.38" H x 2.53"D
Direct Drive: 2.38" H x 1.75" D



KVS SERIES

KVS Series motors are hybrid permanent magnet types. The motors are constructed with multitoothed rotors and stators of unequal tooth number so that a vernier effect provides the equivalent of a large number of poles and small step angles without the necessity for gearing. Standard KVS motors are furnished with 6-lead bifilar windings for 12 VDC operation. Other voltages and 2-phase, bipolar windings may be specified.

Dim. Direct Drive: 2.38" H x 2.44" D



P SERIES

PAS and PBS Series motors provide users with a choice of direct drive or geared models, standard or Hi-Torque rotors and, for direct drive models, a choice of mounting plates. Voltages other than those shown may be specified.

Gearing is scaled to provide a maximum dynamic gear train loading of 200 ounce-inches.

Dim. PAS Geared: 2.38" H x 2.25" D
PAS Direct Drive: 2.28" H x 1.56" D
PBS Geared: 2.38" H x 2.13" D
PBS Direct Drive: 2.28" H x 1.41" D



R SERIES

Designed specifically to combine greater torque and small size, RAS and RBS stepping motors meet many industrial and instrument requirements. Standard 7.5° step angle motors have a torque rating at 4-5 p/s of 23 ounce-inches. The Hi-Torque model is rated at 29 ounce-inches. Models with 15° step angles are rated, respectively, 13 and 17 ounce-inches.

Dim. Direct Drive: 2.88" H x 1.84" D

DIRECT DRIVE STEPPING MOTORS

	TS	KVS	PAS and PBS	RAS and RBS
STEP ANGLE (degrees)	7.5	1.8 and 3.75	7.5 and 15	7.5 and 15
STEPS PER REVOLUTION	48	200 and 96	48 and 24	48 and 24
2-PHASE HOLDING TORQUE (oz-in)	14 and 15.5*	25 and 21	11, 12.3, 14, 16.5	24, 27, 33, 37
RATED TORQUE @ 4-5 p/s (oz-in)	8.5 and 10.4*	18.5 and 14	5.8, 7.3, 8.5, 11.5	13, 17, 23, 29
INPUT POWER (Watts)	8.5	12	8 and 8.5	12
NOMINAL VOLTAGE (Volts)	6, 12, 24	12	12	6, 12, 24
WINDING RESISTANCE (Ohms)	9.5, 31, 135	18	32 and 35	6, 24, 96
ROTOR INERTIA (oz-in)	0.34	0.82	0.19 and 0.34	0.92
TEMPERATURE RISE (°C)	40, 45, 52	56 and 50	50, 52	55 and 60
WEIGHT (oz)	20	30	13	26

*Hi-Torque rotor

GEARED STEPPING MOTORS

	TS	PAS and PBS
REDUCTION	300 to 2	300 to 2
STEP ANGLE (degrees)	0.025 to 0.375	0.025 to 3.75
STEP PER REVOLUTION	14,400 to 96	14,400 to 96
OUTPUT SPEEDS @ 200 p/s (rpm)	.83 to 125	.83 to 125
TYPICAL TORQUE @ 200 p/s (oz-in)	250* to 7.5	200* to 7.5
INPUT POWER (Watts)	8.5	8, 8.5
WINDING RESISTANCE (Ohms)	31	32 and 35
WEIGHT (oz)	27	18

NOTES
1. (PAS and PBS). Square mounting plate is standard for direct drive motors.
2. (TS, RAS and RBS). Standard motors have 4-phase bifilar windings (6 leads) for 6, 12, or 24 VDC operation.
3. All stepping motors shown here can be driven with Hurst Stepping Motor Controls.

DIRECT DRIVE SYNCHRONOUS MOTORS

	T and TA	PA and PB	RA
SPEED @ OUTPUT SHAFT (rpm)	300 or 360	300 or 600	300
RATED TORQUE (oz-in)	6.6 to 10.25	5.5 to 11	15 or 20
INPUT POWER (Watts)	6 to 9.5	7.5 to 11	11 or 14.5
CAPACITOR VALUE (mfd)	.68 to .85	.68 to 1	1.0 or 1.3
FULL LOAD TEMPERATURE RISE (°C)	27 to 38	31 to 45	37 or 46
WEIGHT (oz)	20	13	26

GEARED SYNCHRONOUS MOTORS

	T and TA	PA and PB
SPEED @ OUTPUT SHAFT (rpm)	1 to 150	1 to 360
RATED TORQUE (oz-in)	13-250*	6 to 200
INPUT POWER (Watts)	7 or 9.5	7.5 to 11
CAPACITOR VALUE (mfd)	.68 or .85	.68 to 1
WEIGHT (oz)	27	18

*Maximum gear train loading

NOTES
1. Capacitors furnished with most standard synchronous motors. (No capacitor furnished with TA or BA Series motors).
2. (PA and PB). Square mounting plate is standard for direct drive models.
3. All motors except some TA Series motors operate on 115 VAC, 60 Hz. Some TA models operate on 115 VAC, 50 Hz.

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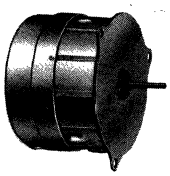
HYSTERESIS SYNCHRONOUS, REVERSIBLE MOTORS



CA SERIES

Efficient, compact CA Series hysteresis synchronous motors have a range of standard speeds from 1200 rpm (direct drive) to ⅓ rpm (geared). Gear train materials include high quality bronze bearings, brass gears, hardened steel pinions and wheel shafts.

The gear torque rating is 100 ounce-inches at 1 rpm.

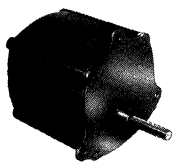
Dim. Geared: 2.13″ H x 2.5″ D
Direct Drive: 1.63″ H x 2.5″ D



DA/DB SERIES

Heavy duty DA and DB gear motors maintain timing accuracy and are offered in a broad range of shaft speeds 120 rpm through 24 rpd. They are recommended for applications requiring high gear torque ratings (100 oz-in max.) and small size.

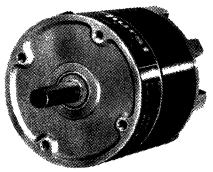
Dim. DA 1.8″ H x 2.5″ D
DB 2.05″ H x 2.5″ D



GA SERIES

GA Series motors provide the highest torque ratings of all the Hurst gear motors — 600 oz-in at 1 rpm. A choice of 14 different speeds, from 1 to 300 rpm, are available as stock models for operation at 115 VAC, 60 Hz. Other speeds may be specified. High quality construction throughout assures dependable field performance.

Dim. Mounting holes: 2.99″ W x 2.37″ H x 3.06″ D



MB SERIES

MB Series motors have inverted rotors and at 60 Hz have a synchronous speed of 1800 rpm. The "fly wheel" effect of the increased rotor inertia provides smooth operation with more uniform angular velocity characteristics than other types. These motors are particularly suited to applications requiring low flutter, direct drive, synchronous operation.

Dim. 2.66″ H x 2.0″ D

DIRECT DRIVE OR GEARED MOTORS

	CA	DA/DB	GA	MB
SPEED @ OUTPUT SHAFT (rpm)	⅓ to 1200	1 to 120	1 to 300	1800
RATED PULL-OUT TORQUE (oz-in)	100 to 0.10	100 to 1.25	600 to 2	5.50(C) 5.25(A) 6.00(B)
INPUT POWER (Watts)	5	5	10	30
CAPACITOR VALUE (mfd)	.50	.50	1.0	2.0
FULL LOAD TEMPERATURE RISE (°C)	40	40	50	40
WEIGHT (oz)	15	14	40	28

(A) Pull-in torque
(B) Locked rotor torque
(C) Pull-out

NOTES 1. Capacitors are furnished with most motors.
2. MB Series. Thermal protection available.

CUSTOM DESIGNED MOTORS A HURST SPECIALTY

For more than 30 years we have been providing top-drawer companys with special purpose motors. Often they are adaptations of standard Hurst motors, thus costs are kept to a minimum. In other cases, completely new motors are designed to exacting specifications.

BRUSHLESS D.C. MOTOR CAPABILITIES

Over the past several years our design, engineering and production groups have become completely familiar with brushless D.C. motors. Sophisticated machine tools are in place and meeting production needs for these motors. We invite your inquiries.

Virtually all piece parts of Hurst motors — rotors, shafts, gears, pinions, etc. — are produced in-house for stricter quality control. That is why all of our motors bear this symbol of precision:

hurst

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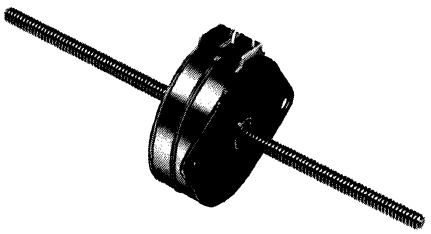
LINEAR ACTUATORS, Stepping or Synchronous



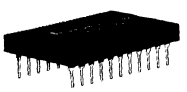
Stepping (SLS Series) or synchronous (SL Series) linear actuators are reversible, permanent magnet rotor types. An integral part of the rotor assembly is a sintered bronze nut for extended life. The nut accepts a ¼" diameter, .048 pitch Acme screw that provides linear motion for pushing, pulling, lifting and positioning applications. Standard 8" lead screws have a maximum travel of 6.75" and a maximum thrust of 25 pounds. Screws of other lengths may be specified. Ball bearings are standard. SL (synchronous) Series motors provide travel of .24 inch per second. SLS (stepping) Series motors have a resolution of .001" per step or 1000 steps per inch.

New 600 rpm versions of these motors are now available. They have all the quality features of the SL and SLS Series. The direct drive model has a linear travel rate of .48"/sec. The stepping version has 500 steps/in. Consult the factory for complete specifications.

CONTROLS FOR STEPPING MOTORS

MODEL 220001

The 220001 is a DIP package containing all the basic circuitry required for operation of a 4-phase, unipolar stepping motor: a pulse generator, bidirectional logic sequencer, and phase drivers. It is fabricated as a thick film hybrid circuit using CMOS and bipolar components for small size and low power consumption.

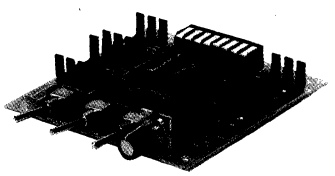


FEATURES:

- 5V logic level control of
  - — rotational direction
  - — run/hold
  - — single step (jog)
  - — phase driver disable
- 2-on, 2-off phase sequencing
- drivers rated at 500 ma per phase
- operation from single 6 to 24 VDC supply

MODEL EPC-016

The EPC-016 is a PC board assembly containing the 220001 hybrid, power drive transistors, and all external components needed for manual control of a stepping motor. A motor, DC power supply, and this board form a complete system.



FEATURES:

- 3 position switch for operation of motor in continuous step, jog, or hold mode
- CW/CCW rotation selection switch
- phase disable switch
- step frequency adjust potentiometer
- 2 amp per phase drive capability
- operation from single 6 to 24 VDC supply
- Dimensions: 4" x 4"

MODEL EPC-013

The EPC-013 is a PC board assembly with additional stepping motor control capabilities.

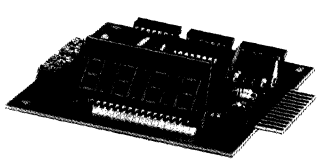
FEATURES:

- sequencing and drivers for 3 or 4 phase unipolar motors
- 3 modes of excitation
  - — full step, 2 phases on
  - — full step, 1 phase on
  - — half step, alternating 1-2 phases
- ramping oscillator for step rate control
- adjustable ramp rates
- linear or exponential ramp profile
- single step (jog) input
- gating for external control of input pulses
- manual or digital interface to control functions
- 2 amps per phase drive capability
- operation from single 6 to 30 volt supply
- 5V regulator output available for external use
- Dimensions: 6.5" x 4.5"



MODEL EPC-014

The EPC-014 is a general purpose presettable counter/display PC board assembly suitable for use with most stepping motor drive systems. In a typical application, it is preset with a number of motor steps, counts and displays the steps as executed, and provides a control signal when the preset count is reached. It is also suitable for count and control applications using input pulses derived from sources other than step commands, e.g., from an external encoder or other sensor.



FEATURES:

- 4 decade counter/display
- manual count preset via BCD switches
- optional remote location of count preset switches and display
- manual or digital control of enable input
- 5V logic level output latch
- operation from 5VDC supply
- Dimensions: 4.0" x 4.5"

MODEL EPC-015

The EPC-015 is a totally encased, hand-held driver containing all the control features of the EPC-016 plus selectable display of step frequency or step count. A motor, DC powder supply, and this controller form a complete control system.



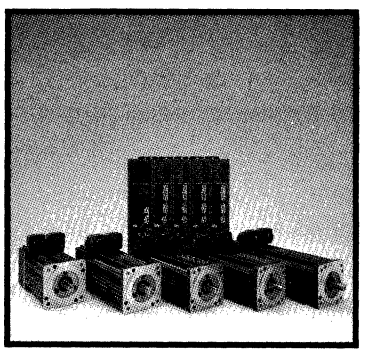
FEATURES:

- 4 decade frequency/count display
- all control features of EPC-016
- 1 amp per phase motor drive capability
- operation from a single 6 to 24 VDC supply
- compact size: 1" x 3.5" x 6"

INDUSTRIAL DRIVES

INNOVATIVE PRODUCTS FOR MOTION CONTROL

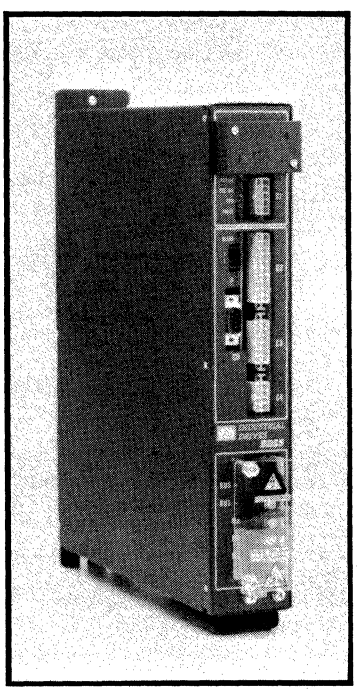
NEW GOLDLINE SERIES
Unsurpassed Brushless Servo Technology



- 0.6 to 82.0 lb-ft of continuous torque—speeds to 7,500 RPM
- Rugged TENV IP65 sealed construction for use in harsh environments is standard
- Highest acceleration and deceleration capabilities
- Class H insulation provides in excess of 9 years of winding life under rated conditions
- Compact single board design minimizing interconnections and vastly increasing reliability and life
- Precise torque and velocity control
- Continuous power ratings to 40 KVA—peak power ratings to 68 KVA
- Personality card in the amplifier matches the motor and drive to your application

NEW BDS5
DIGITAL BRUSHLESS SERVO AMPLIFIER/POSITIONER

The BDS5 is the newest member of the recently developed family of **GOLD**LINE products. It is a full-featured digital positioner and servo amplifier—all in one compact package.



- Low cost—very affordable with a full set of advanced features
- Easy installation—the servo amplifier and the positioner are integrated into one package, therefore, eliminating many interconnections
- Simple programming language—uses BASIC-like commands and allows you to write operator-friendly, menu-driven application software
- MOTION LINK—a powerful, menu-driven communications package for your IBM PC or compatible computer that enables the BDS5's programs and variables to be received from or saved to a disk drive
- True multitasking with several priority levels
- Self-tuning for automatic compensation
- Complete set of error diagnostics
- Smallest, totally integrated package available to motion control users
- Totally designed and manufactured by INDUSTRIAL DRIVES

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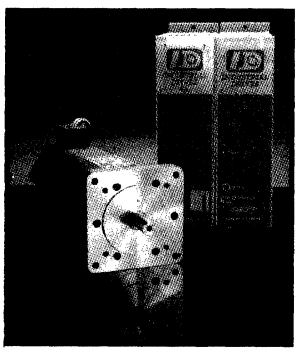
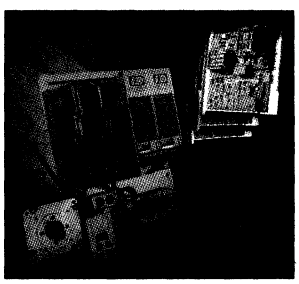
NEW EXPLOSION-PROOF BRUSHLESS SERVOMOTORS



- 1.8 to 11.2 lb-ft of continuous torque—speeds to 6,000 RPM
- Designed to operate in hazardous locations
- Same superior motor design as other brushless motors—utilizes high energy neodymium-iron-boron magnets
- Integral frameless resolver with amplifier options which allow closing a position loop
- Applications include chemical plants; munitions production; paint spraying; gasoline pumping equipment; and process control, and air and hydraulic pumps in hazardous environments
- U.L. listed

DIGITAL POSITIONING SYSTEMS



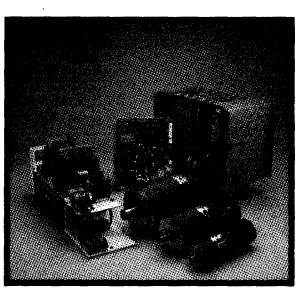
- Complete systems—all components premounted on back panel and thoroughly tested
- Menu-driven software tailored to your specific machine's operation sequence
- Built-in diagnostics for simplified troubleshooting
- Standard and custom systems available

SUBMERSIBLE MOTORS AND DRIVES



- Power ratings from 0.3 to 20 HP
- Pressure compensated—reliable operation of motors and drives to depths of 20,000 feet (10,000 PSI)
- Integral motor/controller packages
- Special control drives minimize audible noise, EMI, RFI, and structure-bourne vibrations—designed to military specifications

BRUSH-TYPE SERVOMOTORS AND DRIVES



- Permanent magnet DC servomotors—advanced designs
- Wide motor selection 35 oz-in to over 100 lb-ft of continuous torque—speeds to 6,000 RPM
- Patented technology PWM and SCR amplifiers complement motors with features including high bandwidth, commutation current limits, and overspeed shutdown
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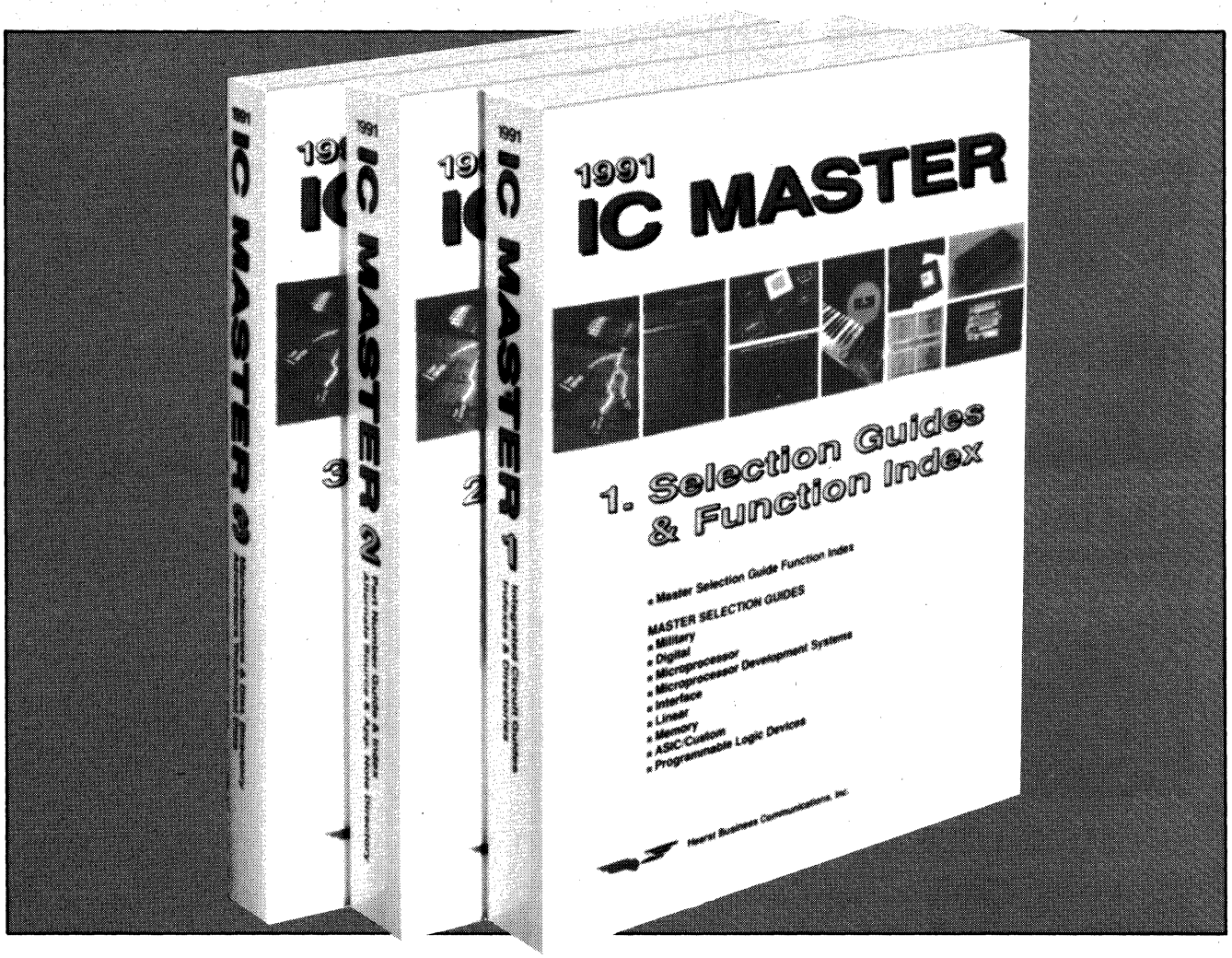

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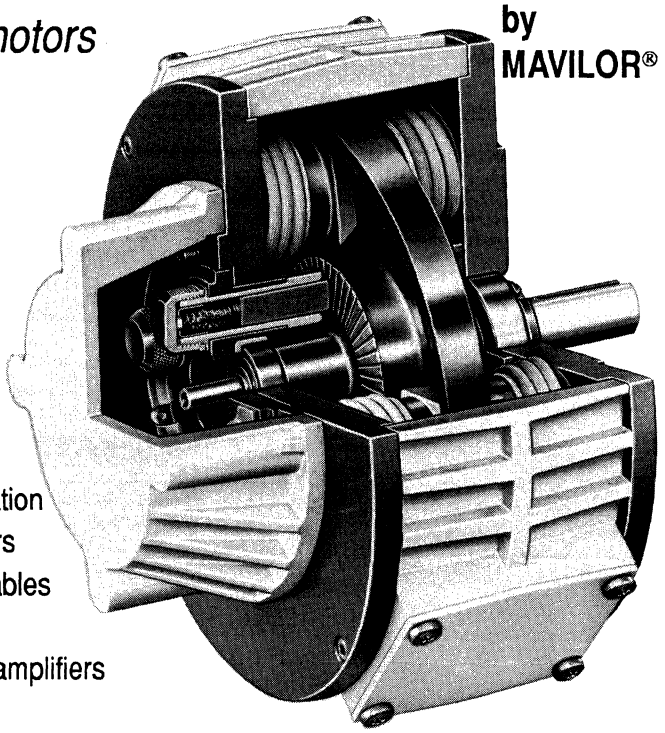

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Ultra-smooth, cog-free operation at low speeds to 0.1 RPM
Speed capability to 10,000 RPM
Peak output torques to 3,000 in-lb.
Efficiencies to 91%
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Ironless, low inertia rotor for fast acceleration
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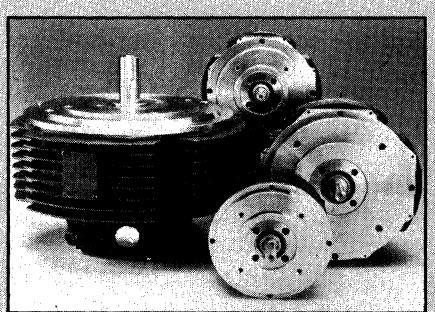
Shaftless models eliminate coupling variables
UL Recognized models available
Complete line of compatible DC and AC amplifiers

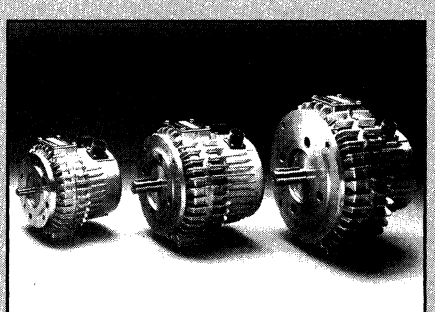
DC SERVOS

Compact, Pancake Design
Speeds to 10,000 RPM
Torques to 3,000 in-lb.
15,000 hour brush life
Cog-free to 0.1 RPM
Efficiencies to 91%
UL Recognized
Ironless, wire-wound industrial strength rotor handles 10X overcurrent



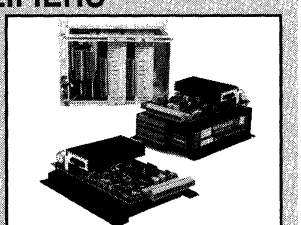
BRUSHLESS SERVOS

Compact, pancake design
Speeds to 6,000 RPM
Torques to 1363 in-lb.
Low inertia disc rotor
Ceramic rare earth magnets
3 Ms mech. time constant
Compact resolvers
Built-in brakes



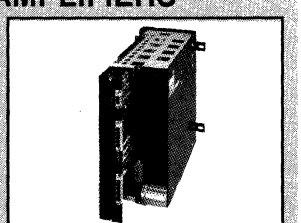
DC AMPLIFIERS

Compact design
Power outputs to 15 kW
Peak currents to 120 A
Non-audible switching
I^2t overcurrent protection
8 axes fit 19" rack
Efficiency to 96%



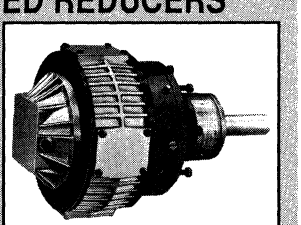
BRUSHLESS AMPLIFIERS

Drive any AC or DC brushless motor
6 axes fit 19" rack
Power outputs to 12 kW
Peak currents to 80 A
220 VAC single power source
I^2t overcurrent protection
Four quadrant operation



PRECISION SPEED REDUCERS

Zero backlash models available
Input speeds to 6,000 RPM
Torques to 51,000 in-lb.
Low input inertia
Efficiencies to 94%
Variety of ratios
200% overload capability



For Literature, Application Assistance, contact

1-800-BE-SERVO

203-729-8258
Fax: 203-729-6969

INFRANOR INC

45 GREAT HILL ROAD, NAUGATUCK CT 06770

STEPPER MOTORS & CONTROLS

INLAND MOTOR
KOLLMORGEN CORPORATION

Canned Stack Step Motors

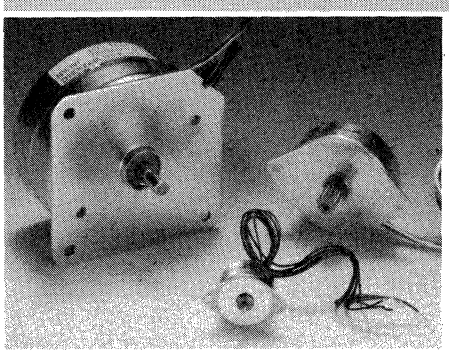
Model No.	Motor Dia. (mm)	Motor Length (mm)	Step angles	Pull-out torque With Double Voltage
PF25	25	15	7.5° or 15°	1.75 oz-in at 400PPS
PF35	35	20.6	7.5° or 15°	2.25 oz-in at 400 PPS
PF35T	35	15	7.5°	3 oz-in at 400 PPS
PF42	42	21.8	7.5° or 15°	6 oz-in at 200 PPS
PF42T	42	15	7.5° or 3.75°	6 oz-in at 200 PPS
PF55	55	25	7.5°	14 oz-in at 200 PPS
PF70	70	38	15°	35 oz-in at 100 PPS

Note: Selected models are available with gear heads and a choice of four magnet materials.
Ask for detailed data sheets.

Hybrid Step Motors

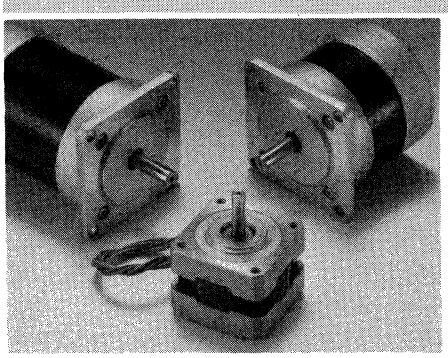
Model No.	Motor Dia. (mm)	Motor Length (mm)	Step angles	Pull-out torque With Unipolar chopper Driver (B1 windings)
PJ39	56	39	1.8°	18 oz-in at 500 PPS
PJ42	56	42	1.8°	27 oz-in at 500 PPS
PJ50	56	50	1.8°	39 oz-in at 500 PPS
PJ55	56	55	1.8°	55 oz-in at 400 PPS
PJ80	56	80	1.8°	85 oz-in at 400 PPS
PQ40	40 square	33	1.8°	8 oz-in at 400 PPS

PF Series



The PF series are permanent magnet stepping motors, with superior cost/performance, ideal for high volume mass production applications. Available in four step angles (3.75°, 7.5°, 15° and 18°), a choice of windings and magnet materials (isotropic ferrite, anisotropic ferrite, anisotropic plastic ferrite, neodymium (NdFeB), the PF series offer the design engineer the ultimate in flexibility to match the applications requirements with the most cost effective motors.
A variety of optional flanges, shafts and gear heads are available to meet the requirements of the most exacting applications.
Applications for the PF series include: printers, typewriters, facsimilie machines, copiers, word processors, automobile electrical equipment and medical equipment.

PJ & PQ Series



The PJ and PQ series are high performance, 1.8° step angle **hybrid** motors, ideal for applications requiring high torque and superior response characteristics. The PJ model (57 mm diameter, **size 23**) is available in a number of stack lengths and together with the PQ model (40mm square, **size 17**) enable the design engineer to choose the most cost effective motor to match the application's exact requirements.
Applications for the PJ and PQ series include: printers, facsimile machines, valves, pumps and a variety of automatic instruments.

Other Related Products From Inland Motor:

VR series variable reluctance step motors, PCL-Series programmable single chip high speed pulse generators, board level controller/drivers, and PTM series synchronous motors. SMC series low cost off-the-shelf controllers/drivers standard and micro-stepping versions with multiple axis addressing and input/output control.

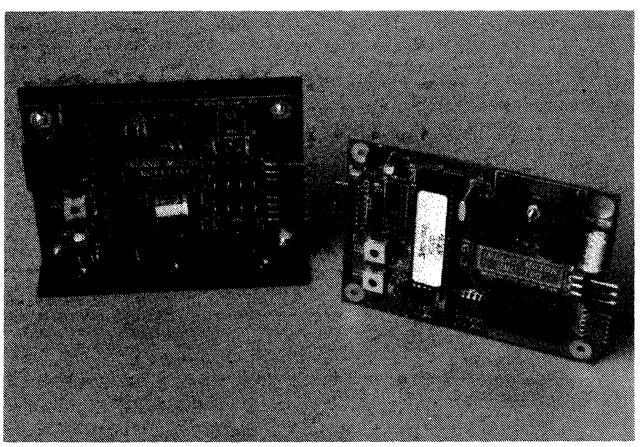
501 FIRST ST. • RADFORD, VA 24141 • TELEPHONE: 703-639-9045 • FAX: 703-731-4519

INLAND MOTOR
KOLLMORGEN CORPORATION

SMC Series
BOARD LEVEL STEP MOTOR MOTION CONTROLLERS/DEVELOPMENT TOOLS



SMC-500 Microstepping controller with built-in bipolar driver (2 amp and 3.5 amp) versions, input/output controller (four programmable inputs and four programmable outputs), RS232C serial multidrop interface to any PC (up to 8 controllers can be daisy chained on a single serial link), powerful high level language command set, on-board non-volatile RAM for program storage and auto-execution upon start up, microstepping software selectable up to 64 steps/step, unique mode indexing feature which enables microstepping mode changes on the fly to obtain high speed and high resolution at the same time and many useful and interesting features. The SMC-500 is an excellent quick-start development tool and it is also available in open chassis form as a very inexpensive OEM product. Size: 6″ × 4″ × 1.13″. Single supply operation 12-32 volts DC.



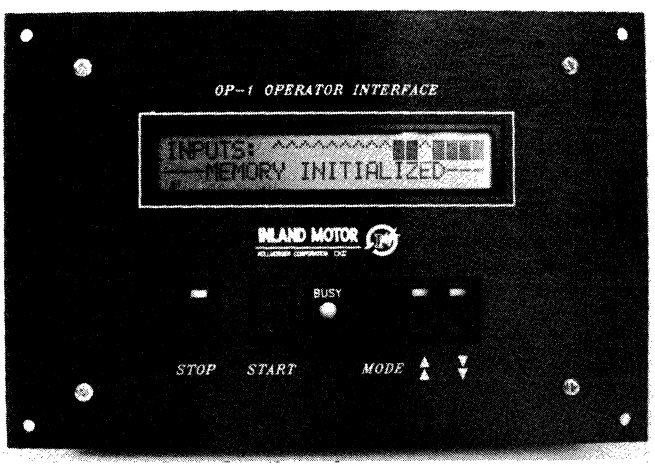
SMC-400 is identical to the SMC-500 in all respects except that it is designed for full and half stepping. It is a less expensive choice when microstepping is not required.

SMC-300 is a bipolar chopper driver with dip switch selectable ramps. It features a command buffer and TTL pulse and direction control. Single supply operation 12-32 volts DC. Size: 6″ × 4″ × 1.13″.

SMC-200 is similar to the SMC-300 except that it has a unipolar driver. Single supply operation 12-32 volts DC.

SMC-150 is a bipolar chopper driver with pulse train input and direction control. On board oscillator and adjustable potentiometer for self-contained variable speed operation. Size: 4.75″ × 3.63″ × 1.13″.

SMC-100 is similar to the SMC-150 except that it has a unipolar diver.



OP-1 & OP-2 are operator panels that hook up to the SMC-400 or the SMC-500. The built-in display and push button switches enable the manual setting of the program variables. The operating system can be customized to talk in application specific real units. An automatic calibration feature makes the OP and SMC400/500 combination truly remarkable and offers a low cost solution to a variety of applications such as fluid metering pumps, cut-to-length and may other applications where operator programmable indexing is required.

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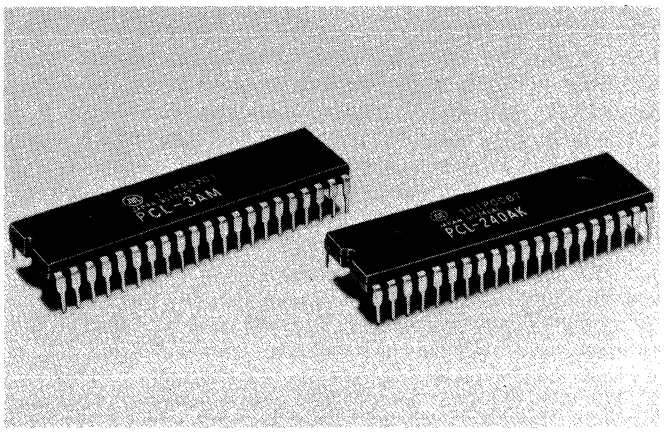
INLAND MOTOR
KOLLMORGEN CORPORATION

PCL Series
HIGH SPEED PROGRAMMABLE PULSE GENERATORS

The PCL series programmable pulse generator chips are motion control IC's that allow the programming of an output frequency with an external CPU. In addition, the PCL series are equipped with ramp up/down control which can vary the output frequency linearly. A variety of inputs and outputs are provided for sophisticated control through software. The PCL series are an ideal choice where the designer wishes to unload his CPU with the time consuming motion control tasks which can be taken over by these high performance, high speed chips.

PCL chips are suitable for use in either stepper or servo controls.



	PCL-AK/PCL-MK	PCL-240AK	PCL-3AM
Application	Stepping motors	Stepping motors DC/AC servo motors Linear motors	DC/AC servo motors D.C. motors Linear motors
Max. output frequency **Pulse rate setting steps**	16K pps 1~8,191 steps (13 bit)	240K pps 1~8,191 steps (13 bit)	3 M pps 1~16,383 steps (14 bit)
Pulse rate multiplication	1~2 times	0.01~30 times	0.018~200 times
Accel/Decal setting range	2~1,023 (common)	2~16,383 (separate)	2~32,767 (common)
Reference clock	4.9152 MHz	4.9152 MHz	9.8304 MHz
Pulse rate setting registers	2 types (Fl & FH)	3 types (FL, FH1, FH2)	2 types (FL & FH)
Pulse rate setting range	1~262,143 pulses (18 bit)	1~16,777,215 pulses (24 bit)	1~16,777,215 pulses (24 bit)
Ramping down point	Automatically Setting also available	Automatically Setting also available	Automatically Setting also available
Ramping down point setting range	1~65,535 pulses	1~1,048,575 pulses	1~16,777,215 pulses
Option		24 bit U/D counter x1 Encoder input (x4) Multiple In/output (one of each)	24 bit U/D counter x2 Encoder input (x4) Multiple In/output Input -1 & output -2 Ext pulse command
Bus interface	8 bit parallel	8 bit parallel	8 bit parallel
Operation mode	High-speed & Constant continuous operation High-speed & Constant programmed operation High-speed & Constant home position operation Dual rate during ramp up/down	High-speed & Constant continuous operation High-speed & Constant programmed operation High-speed & Constant home position operation Dual rate during ramp up/down	High-speed & Constant continuous operation High-speed & Constant programmed operation High-speed & Constant home position operation Dual rate during ramp up/down
Package configurations	PCL-AK 28 pin (DIP 600 mil) PCL-MK 28 pin (DIP 450 mil)	40 pin (DIP 600 mil)	42 pin (DIP 600 mil)

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Litton

Poly-Scientific

Slip Ring Products
1213 North Main Street
Blacksburg, Virginia
24060-3100
800-336-2112
FAX 703-953-1841
TWX 710-875-3694

HOW TO SPECIFY A SLIP RING

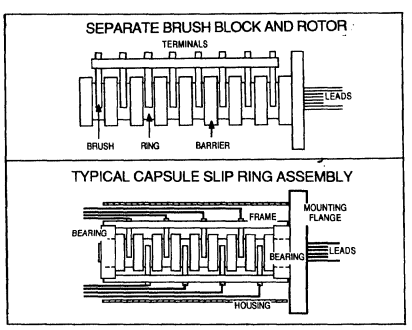
Many of the more than 4,000 Poly-Scientific slip ring designs are available for use in their existing configuration, or they may be modified to meet your specific requirements. New designs can also be created to meet the most demanding specifications.

Our engineers are experienced in a wide range of slip ring applications. We utilize resources such as the Anvil computer-aided design (CAD) system. And, a very active in-house quality circle program solicits the best inputs from all of our many skilled craftspeople, from start to finish.

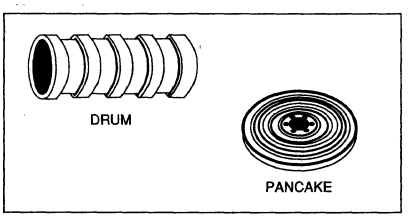
This section is designed to guide you through the process of specifying a slip ring. We've outlined below the major considerations that a slip ring engineer will need to know about your application.

A. Basic Slip Ring Design

Throughout these pages, you will see the terms "slip ring capsule" and "slip ring separates". The term "separate" indicates an individual rotor/brush block combination. The term "capsule" is used to denote a self-contained unit consisting of a rotor, stator and its own integral ball bearings.



There are two basic slip ring configurations to consider based on space allocation in your system: the more common drum approach where each ring is adjacent to the next along the centerline, somewhat like the threads on a bolt, and the pancake approach where the rings are concentric with one another like the grooves on a phonograph record. The pancake approach is used when length is at a premium but diameter is less restrictive.



B. Defining the Mechanical Envelope

The envelope is, of course, largely dictated by the space available in the system. The slip ring engineer should be given the maximum space available in the system so all existing candidate designs can be considered. It is imperative that the space required for the slip ring be specified in the early stages of the system design and that it be consistent with the structural and electrical demands.

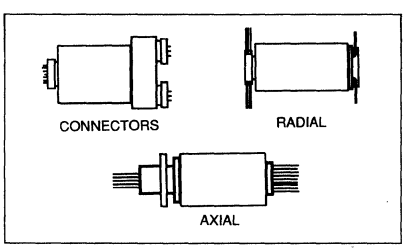
C. Defining System Interface Requirements

The slip ring engineer will need to know these system interface considerations:

1. Is a bore required through the slip ring for routing coolant plumbing, hydraulic lines, pneumatic lines, waveguides, etc? In such applications, the slip ring actually mounts concentric with these lines in the system.

2. How will the slip ring attach to the system? It is never advisable to hard mount both the rotor and the stator to the system since the slip ring bearings may be overloaded if there is any misalignment between them and the system bearings.

3. How should the electrical connections to the slip ring be made? Is it desirable to have connectors integral with the slip ring on both the rotor and stator, or would flying leads on one or the other ends be desireable? And if flying leads are preferred, should they exit the rotor in a radial or axial direction, and what length should the leads be?



D. Defining Electrical Requirements

The current specified enables the slip ring engineer to propose a unit with the appropriate cross-sectional area of the rings, brushes and lead wires. The specified voltage dictates the spacing between adjacent rings and brushes. It is helpful in achieving the most cost effective and smallest practical envelope not to rate all circuits at the maximum level. For example, if you need 20 circuits total, three of which must carry ten amps, designate three for high current. Don't go for 100% functional interchangeability by specifying that all 20 be able to carry ten amps. And, if the ten amps is a surge current with a continuous current of only two amps, tell us that, too. There is no reason for you to pay for ten amps continuous capacity when you only need two.

Be aware that voltage surges and spikes are the major cause of system slip ring failures. Poly-Scientific uses a very conservative approach to circuit design, however, it is not uncommon in some power supply systems to see voltage spikes ten or more times the normal operating voltage. We strongly recommend surge protection on all power supplies.

Most smaller slip rings will satisfactorily conduct signals to 1 MHz or 500 Kilobits. Special slip rings can be used to pass broadband signals from dc to 1 gigahertz and data rates of 500 megabits or even higher. Crosstalk, insertion loss and bit error rate information can be provided if data rates, formats and impedances are defined.

E. Defining Mechanical Requirements

1. Operating speed (rpm's). Almost any slip ring can operate successfully at speeds to 100 RPM although many applications only require operation at a few rpm. But slip rings are also routinely used to instrument jet turbine engines operating at speeds in excess of 20,000 RPM. The operating speed in conjunction with the diameter dictates the surface speed of the brush relative to the ring and hence the internal design approach and material selection.

2. What rotational life is necessary for your application? Will the unit oscillate or rotate at a continuous speed?

F. Defining the Environment

The environment in which the slip ring must survive is a key factor. Operating temperature is important in specifying the proper lubricant. And if the slip ring will operate exposed to the elements or to a hostile environment, integral seals must be included in the design. Any unusual shock or vibration should also be specified.

The next eight pages of the catalog give a brief overview of our slip ring design and production expertise. The last page of our section allows you to list your specific application needs. For specific product information, please contact our sales department at 800-336-2112.

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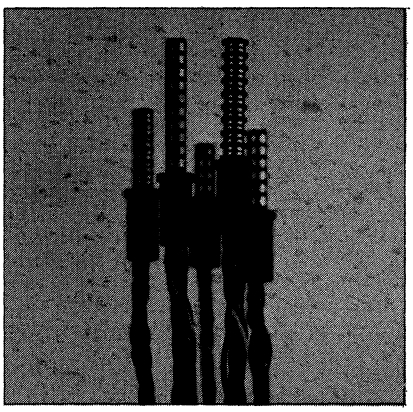
SLIP RING SEPARATES

Sometimes a self contained "capsule" slip ring is not practical due to size constraints or cost limitations. (Don't however, fail to include in this comparison your costs for mating the slip ring and brush block or to consider the risk of damage to the fragile unprotected brushes). If a separate rotor/stator approach is dictated for your application please review the following tabulation of an assortment of candidate designs—or contact us for a custom design.



Rotor Specifications

NUMBER OF CIRCUITS	PART NUMBER	MATING BRUSH BLOCK	RING O.D.	RING PITCH	SHAFT DIAMETER	SHAFT LENGTH	FLANGE DIAMETER	SPECIAL FEATURES
1-10	258	259	.081	.050	.125	.250	.150	P, RB, UG, VG, S, FB
1-37	263	262	.220	.050	.250	.375	.312	FB, RB
1-10	865	259	.080	.050	.109	.187	.170	S, FB
1-20	1202	262	.125	.050	.250	.375	.312	FB
8	1454	1455	.550	.060	.584	.640	.580	.376 Bore, RB, VG
10	1546	1547	2-.331 8-.151	.060	.187	.250	.345	VG #2 Ring Segment, #1 Shorted to #2
5	1555	259	.081	.050	.141	.300	.180	FB
19	2037	2038	1.860	.030	1.880	.685	1.880	1.500 Bore. VG
3	2384	2981 2385	.067	.025	.071	.070	.115	Double V-Groove
1-10	2690	259	.081	.050	.125	.250	.150	FB, Same as 258
1-37	2731	262	.220	.050	.250	.375	.312	RB, Same as 263
1-10	2914	259	.081	.050	.125	.250	.150	FB
5	3046-1	3046-2	.550	.060	.580	.640	.580	.376 Bore, RB, VG
6	3795	3416	.067	.025	.061	.125	.109	Double V-Grooves

Abbreviations used:

FB - Flat Barrier
RB - Raised Barrier
P - Plastic Backshaft
VG - V-Groove
UG - U-Groove
S - Stainless Steel Backshaft

Circuits 1-10—Option of having 1 through 10 circuits. Shaft lengths shown are for maximum number of rings (circuits).

Brush Block Specifications

NUMBER OF CIRCUITS	PART NUMBER	RING DIAMETER	PITCH	MOUNTING HOLE DIAMETER	HOLE SPACING	SETTING LENGTH	THICKNESS	SPECIAL FEATURES
1-10	259	.081	.050	.090	.437	.250	.188	-Silver Terminal -Tin Terminals -Gold Terminals -Leads
1-37	262	.220	.050	.090	.600	.250	.250	-Terminals
10	1547	.331 .151	.060	.116	.656	.312	.312	-Leads, -Terminals
8	1455	.550	.060	.096	.812	.290	.125	-Terminals (MD4036-2)
19	2038	1.864	.030	.090	.600	1.035	.250	-Terminals
6	3416	.067	.025	—	—	.200	.100	-Terminals -Double Brushes
3	2981	.067	.025	.053	.140	.180	.150	-Double Brushes -PCB Terminals
3	2385	.068	.025	—	—	.200	.100	-Terminals

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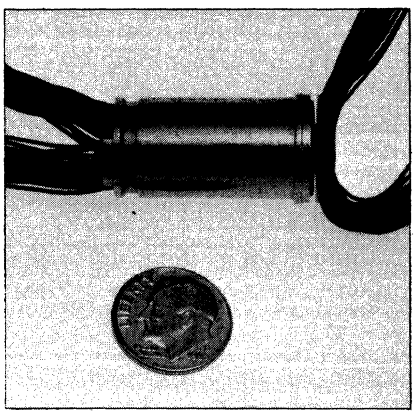
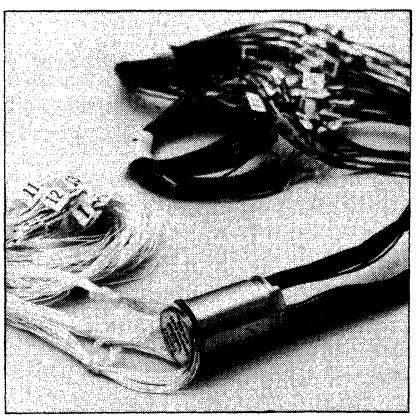
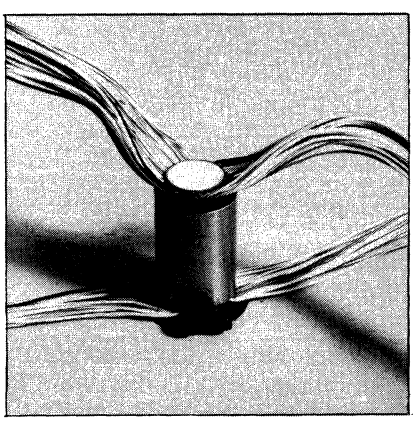
MINIATURE SLIP RING CAPSULES

These smallest of all slip ring assemblies are widely used in the pitch, roll and yaw axes of inertial navigation systems where there can be no sacrifice in reliability to achieve packaging density.

Very tight pitch controls are maintained on individual ring locations with center-to-center spacings as small as 0.015 inch between adjacent rings.







NUMBER OF CIRCUITS	PART NUMBER	CURRENT RATING		LENGTH	DIAMETER
		PER CKT	TOTAL		
16	267	1.2A	10A	.912	.375
20		1.2A	14A	1.932	.375
24		1.2A	17A	1.152	.375
28		1.2A	20A	1.272	.375
32		1.2A	23A	1.392	.375
36		1.2A	25A	1.512	.375
20	264	1.4A	17A	1.035	.500
40		1.4A	33A	1.635	.500
60		1.4A	49A	2.235	.500
7	2492	.4A	2A	.61	.375
12	2274	1.2A	12A	.728	.373
15	2493	.36A	4A	.660	.375
16	2075	1.3A	13A	.882	.372
17	1804	1.2A	16A	1.375	.350
30	2245	.7A	20A	.979	.380
32	1444	1.2A	29A	1.468	.375
36	2754	1.2A	31A	1.173	.498
40	3069	1.4A	37A	1.30	.682
45	2759	1.1A	36A	1.05	.593
50	2044	.95A	36A	1.025	.593
50	1937	1.4A	45A	1.470	.683
54	1956	1.2A	38A	1.403	.560
80	3312	1.4A	69A	2.00	.685
95	4175	1.6A	77A	3.09	.880

THE FOLLOWING MINIATURE SLIP RINGS HAVE A BORE:

NUMBER OF CIRCUITS	PART NUMBER	CURRENT RATING		LENGTH	DIAMETER	BORE
		PER CKT	TOTAL			
8	2395	1.6	7A	.70	1.75	0.75
30	4198	2.6A	36A	2.785	3.081	1.50
32	2335	4A	57A	3.39	4.10	2.30
12	2472	4A	22A	3.440	4.10	2.30
51	2837	4A	90A	4.50	4.10	2.30

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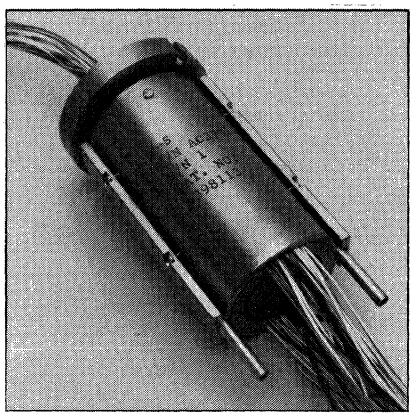
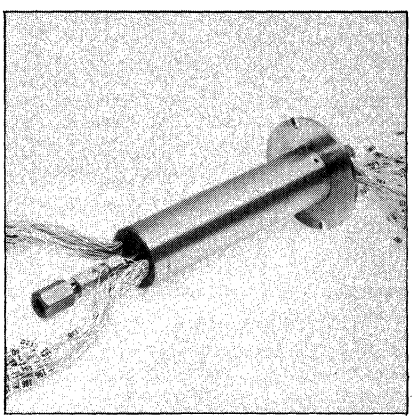
HIGH SPEED SLIP RINGS

For successful slip ring operations above several thousand RPM, increased structural demands and frictional heating at the sliding contact surface are two concerns that must be addressed. Applications for high speed slip rings include aircraft turbine testing, stressometer feedback in rolling mills, and gasoline or diesel engine testing.

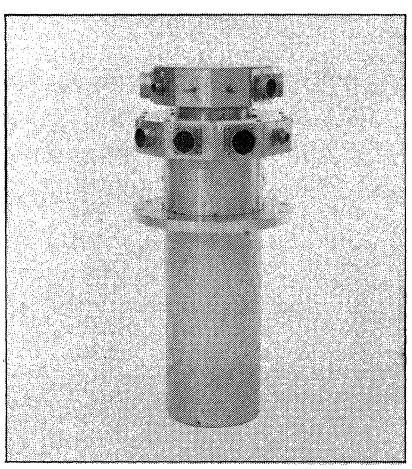




NUMBER OF CIRCUITS	PART NUMBER	LENGTH	DIAMETER	BORE	BRUSH	NOTES
15	2645	3.75	14.01	12.593	Composite	Separate
19	2275	9.84	9.05	7.48	Composite	Separate Ring & Brush Block
28	3042	1.635	.685	N/A	Gold	Liquid Cooled
28	3762	1.67	1.0	N/A	Gold Multifilament	Gas Cooled
35	3757	2.53	1.60	N/A	Gold Multifilament	Gas Cooled
40	1823	4.08	1.75	N/A	Composite	
64	4160	5.0	3.5	1.5	Gold Multifilament	
100	3057	6.40	1.5	N/A	Gold	Liquid Cooled
200	4064	10.0	2.25	N/A	Gold	Liquid Cooled
300	4075	11.75	2.28	N/A	Gold	Liquid Cooled

VACUUM AND SPACE CAPSULES

The use of slip rings in a hard vacuum environment focuses special attention on the area of outgassing organics that could interfere with other components in the system and in the area of lubrication for long term operation. Our contact material recommendations are based on a two year continuous life test program that we conducted in a 10^{-7} torr environment and have been proven in numerous space flights.



NUMBER OF CIRCUITS	PART NUMBER	LENGTH	DIAMETER	BORE	BRUSH	NOTES
24-84	2832	7.167-11.650	2.44	N/A	Composite 4 per ring	Cylindrical Separate
25	3881	1.376	5.832	1.24	Composite	2 sided pancake
31	3304	6.663	2.125	N/A	Gold Monofilament	Cylindrical Separate
34	2857	1.94	6.95	2.68	Gold 4 per ring	2 Sided Pancake Separate
70	3192	4.61	1.46	N/A	Gold Multifilament	Concentric Capsule
170	4238	18.00	6.00	N/A	Gold	Capsule, Lubrication Reservoir

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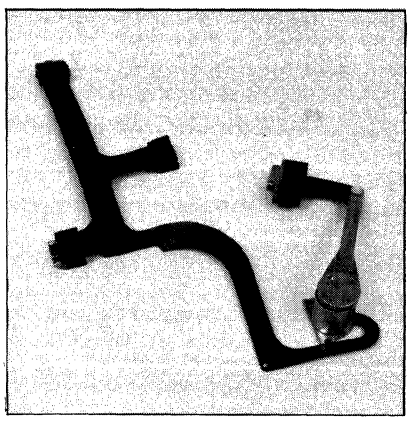
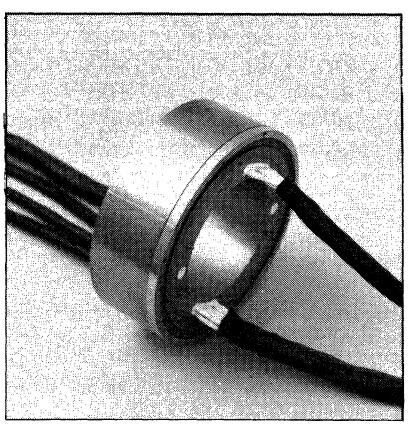
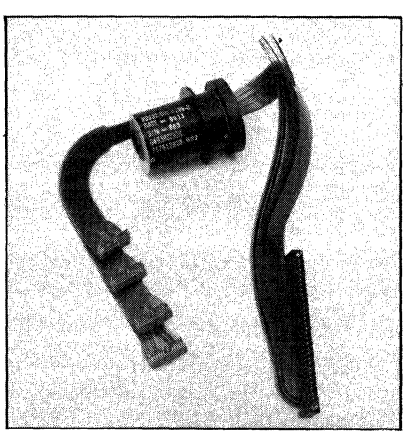
POLY-TWIST CAPSULES

The Poly-Twist is a reliable slip ring substitute for limited rotation applications. Sometimes called a twist-cap, this device provides a self-contained, no-sliding contact rotary interface using flexible circuit tapes. Typical dimensions and data are tabulated below for a few of our many twist-cap designs. Although the majority of applications for the thousands of units supplied to date have required miniature twist-cap assemblies, some very large designs have also been provided.

NUMBER OF CIRCUITS	PART NUMBER	ROTATION	CURRENT CAPACITY	LENGTH	DIAMETER
14	2728	+/–55	14 @ 12A	2.90	1.75
24	2938	+/–100	1 @ .2A 4 @ 1.2A 19 @ .8A	2.50	.75
24	3182	+/–45	4 @ 1.4A 20 @ .5A	1.10	.31
24	3197	+/–45	24 @ 1A	1.07	.75
38	2937	+/–90	4 @ 3.0A 34 @ 1.0A	2.00	5.75
45	2911	+/–45	2 @ 1.0A 4 @ 3.0A 4 @ 2.2A 35 @ .6A	1.75	1.20
46	2729	+/–55	4 @ 2.0A 42 @ 1.0A	2.90	1.75
50	2904	+/–90	2 @ 2.3A 2 @ 2.5A 4 @ 4.5A 6 @ 1.0A 36 @ 7.0A	1.63	1.00
51	3196	+/–45	51 @ 1.0A	1.12	.87
60	2613	+/–75	12 @ 3.8A 48 @ 1.2A	1.69	1.00
60	2644	+/–300	12 @ 0.9A 48 @ 0.2A	1.56	0.68
63	3004	+/–100	3 @ 3.5A 6 @ 4.5A 12 @ 1.7A 42 @ 1.2A	2.77	1.50
68	2783	+/–30	68 @ 1.7A	2.00	.69
80	2661	+/–210	24 @ 3.0A 56 @ 1.0A	2.25	2.50
80	3195	+/–70	80 @ .6A	.635	2.40
84	3003	+/–100	1 @ 3.4A 14 @ 1.5A 69 @ .8A	2.27	1.50
88	3719	+/–145	3 @ 5A 7 @ 2A 78 @ 1A	3.50	1.37
98	2805	+/–30	12 @ 4.0A 86 @ 1.0A	2.50	.99
110	3165	+/–200	22 @ 2.7A 88 @ 1.73A	1.90	2.50
110	2804	+/–60	20 @ 4.0A 90 @ 1.0 A	1.35	1.80
111	3053	+/–110	4 @ 5.8A 4 @ 4.1A 4 @ 2.1A 28 @ 1.4A 71 @ .8A	3.00	1.40
172	4134	+/–90	16 @ 5A 156 @ 2A	5.58	2.25
176	3002	+/–35	12 @ 3.2A 27 @ 2.6A	3.10	2.38
192	3428	+/–210	12 @ 3.0A 17 @ 2.5A 163 @ 1.0A	3.37	3.69
220	3842	+/–75	170 @ 1.5A 50 @ 5A	4.30	1.80
1920	4148	+/–90	1920 @ 3A	5.00	31.80







PolyTwist® is a registered trademark of Litton Poly-Scientific.

Call us toll-free at **800-336-5917** (In Virginia, call 703-953-4751) for more information.

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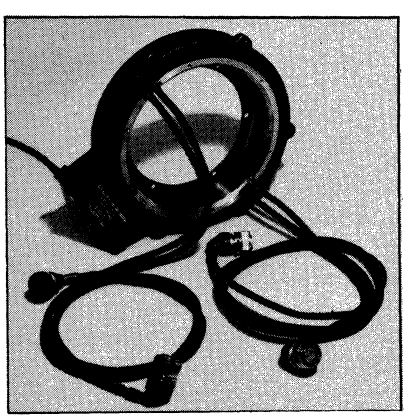
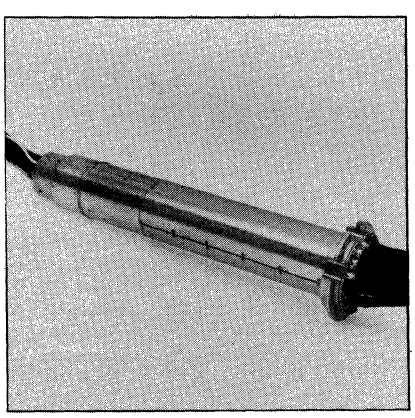
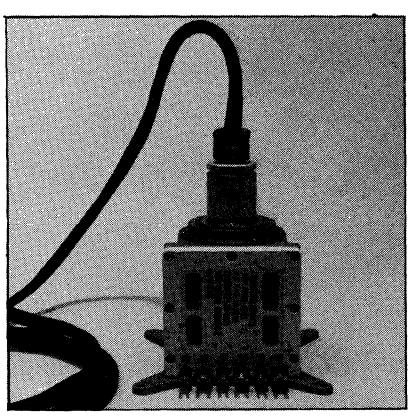
HELICOPTER SLIP RINGS

Slip rings that power de-icing and blade folding systems must transfer high current levels to blade systems rotating at high speeds. They must also withstand vibration levels and environmental hazards typical of helicopter operation. The latest de-icing applications include both main and tail rotor slip rings, with main rotor current levels to 60 amperes and tail rotor speeds to 1,500 RPMs.

		POWER				SIGNAL				
PART NUMBER	ROTATIONAL SPEED	DIMENSIONS	NUMBER OF CKTS	CURRENT RATING	VOLTAGE RATING	NUMBER OF CKTS	GAUGE OR TYPE	INTENDED SIGNAL	APPLICATION	MAX WEIGHT (LB)
1209	264 RPM	O.D. 3.999 Bore 3.000 Length 12.190	8	50A	200V 500V (Peak)	N/A	N/A	N/A	Sea Knight	
2876	258 RPM	O.D. 3.200 Length 6.500	3	60A	200VAC 400Hz	3	28VDC 5A		Main Rotor De-Ice SRA for U.S. Army Blackhawk	
3018	1200 RPM	O.D. 10.190 Bore 6.130 Length 4.462	3	20A	1800V (Peak)	N/A	N/A	N/A	Tail Rotor De-Ice for Seahawk/ Blackhawk	
3091	1500 RPM	O.D. 9.250 Bore 7.000 Length 1.650	2	16AWG	1500V	N/A	N/A	N/A	Tail Rotor De-Ice AH 64 Apache	2.40
3741	432 RPM	O.D. 3.150 Length 21.000	N/A	N/A	N/A	150	50VDC, 1A 24AWG		Main Rotor A129 Helicopter	
3742	1657 RPM	O.D. 5.000 Bore 2.20 Length 5.182	N/A	N/A	N/A	50	24 AWG		Tail Rotor	
4101	258 RPM	O.D. 4.190 Length 11.800	3 3	60A 25A	200V 400Hz	12	3A 28V	Pulses to control/ monitor rotor head loads	Main Rotor De-Ice and Blade Fold for Seahawk	10.5
4103	397 RPM	O.D. 3.250 Length 20.500	4	60A	220V	8 58	2 or 6A 1A	Resolver	V-22 Osprey	23
4106	210 RPM	O.D. 5.510 Length 22.676	14 22 1	130A 10A Bonding Ring	270VDC 200V 400Hz	32	24AWG	Signal & health monitoring Resolver	EH-101; De-Ice & Blade Folding ckts	39.5
4239	210 RPM	O.D. 5.510 Length 16.410	22 1	10A Bonding Ring	200V 400Hz	32	24AWG	Resolver	Same as 4106 w/o De-Ice ckts	19.0







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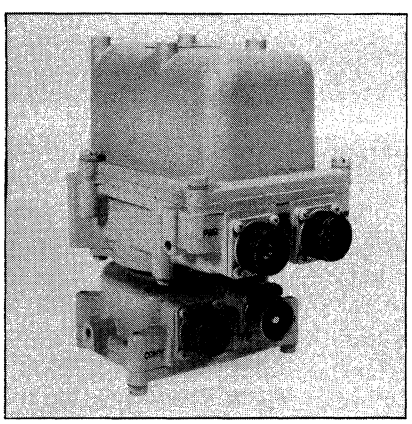
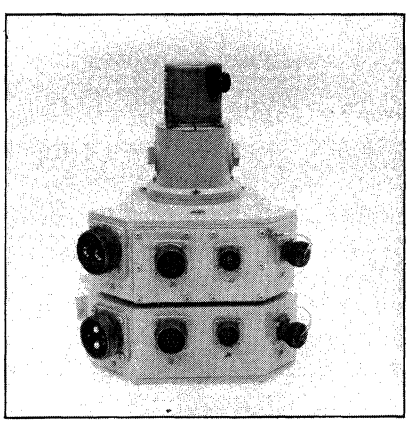
VEHICULAR SLIP RINGS

Electrical and hydraulic slip rings are used in vehicles such as tanks, retrievers, mobile missile launchers, and armored personnel carriers. A typical armored vehicle might contain slip rings in the turrett, the commander station, and the periscope.

POWER				SIGNAL			
PART NUMBER	NUMBER OF CIRCUITS	CONT. CURRENT RATING	VOLTAGE RATING	NUMBER OF CIRCUITS	GAUGE OR TYPE	INTENDED SIGNAL	SPECIAL FEATURES
2985	1 1	150A 150A	150V Peak Ground	12	Control	5A, 150V	
2993	1 1	150A 150A	150V Ground	24	Control	5A, 150V	
2869				160	20 AWG	28 VDC 7.5A	4 hydraulic at 200 PSI, 2 GPM; 1 pneumatic at 6 PSI
2772	2 1 1	300A 600A 75A	28VDC	40	Signal/ low power	28VDC 7.5A	1 pneumatic at 1200 PSI, 600 CFM
2676	1 1	150A 150A	Ground	14	3A		1 hydraulic at 200 PSI, 1 hydraulic at 50 PSI, 1 pneumatic at 2 PSI
2918	4	200A	28VDC	2 55	Twin AX 22 AWG	6MHz 4A, 28VDC	1 hydraulic at 2000 PSI, 34 GPM; 1 hydraulic at 100 PSI, 34 GPM; 1 pneumatic at 6 PSI, 15 CFM
3489	1 1	150A 150A	Ground	80		5A	
3733	2	200A	24VDC	42	20 AWG	3A, 28VDC	CBR Air Channel
4231	13	2 @ 15A 2 @ 10A 2 @ 5A 6 @ 3A 1 @ 10A	150V Peak Ground	34 1	Control RG 179	2A, 150V 10MHz	6.5 Inch Bore







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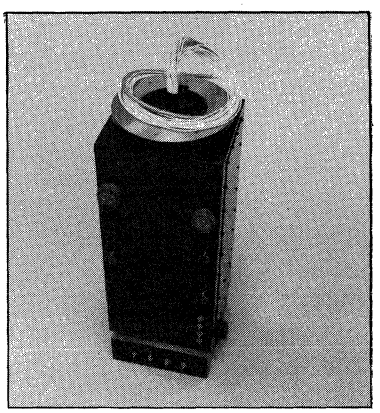
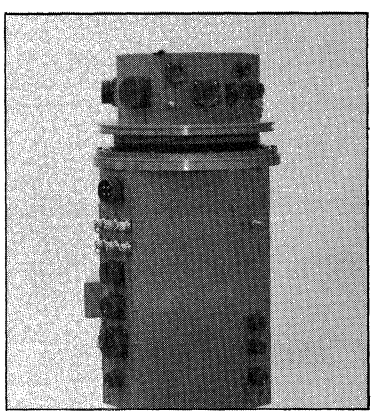
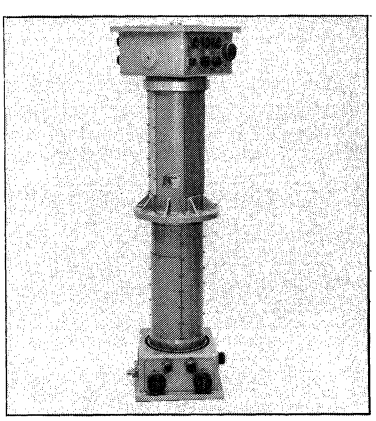
PEDESTAL SLIP RINGS

Typically found in radar, missile and gun fire control systems, Pedestal Slip Rings contain varying combinations of logic, control, and high frequency analog signal and power circuits.

NUMBER OF CIRCUITS	PART NUMBER	NUMBER OF POWER CIRCUITS/ CURRENTS	LENGTH	DIAMETER	BORE	SPECIAL FEATURES
65	2912	12 @ 10A	21.0	7.3	None	3-35 MHz channels
72	2672	6 @ 150A	33.3	12.0	None	Rugged & Sealed 4 10MHz channels
218	2686	16 @ 10A	17.8	3.6	None	Very high circuit density
259	2258	9 @ 160A 5 @ 10–30A	60.0	12.0	None	12-60 MHz Channels
18	4062	0	3.9	5.5	3.2	Integral Resolver
19	2608	3 @ 550A 2 @ 110A	8.3	20.8	1.0	
37	2945	0	5.9	7.1	2.7	
57	4120	13 @ 22A	17.2	11.4	4.5	
78	4189	6 @ 10A	11.0	7.9	3.0	Unlubricated contact technology
103	3474	18 @ 3A	14.6	7.4	3.5	4-1 GHz ckts.
127	2480	17 @ 60A	25.5	15.3	9.7	Lightweight (88 lbs)
150	2446	3 @ 50A 6 @ 20A	29.0	16.0	8.0	Sealed for shipboard use
153	2607	15 @ 50A 4 @ 20A	50.0	8.0	1.3	Meets MIL-STD-901 Hammer Drop
176	2284	10 @ 100A 95 @ 10-20A	33.0	12.8	6.0	12-6 MHz Channels
252	2125	4 @ 100A 3 @ 60A	37.5	21.5	10.0	3-30 MHz Channels







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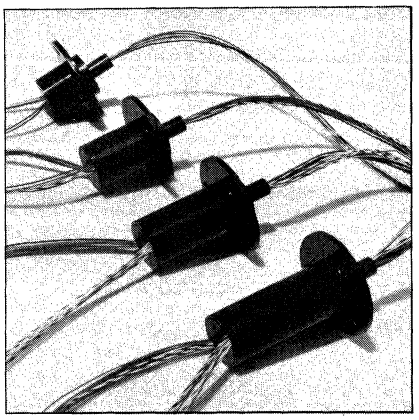
INDUSTRIAL SLIP RINGS

NUMBER OF CIRCUITS	PART NUMBER	CONTINUOUS CURRENT	LENGTH	DIAMETER	NOTES
6 12 18 24	4023	2A	.76 1.24 1.72 2.20	.870	Suitable for CCTV; Units can be shipped from stock
1-12	4183	2A	1.58	1.36	0.985 inch through bore
2	3773	5A	1.50	1.00	Water tight
10	4221	.5A	.78	.37	#10 circuit is a switch circuit
12	4102	.5A	BB 1.05 SR 1.67	.982 .46	Slip ring and brush block set Slip ring bore .196 inch
14	3141	1 ground-150A 1-150A 12-7.5	9.28	11.25	Sealed, rugged construction
16	4019	1A	2.35	1.00	Fiber brush capsule. 3000 RPM

No more than 20% of all rings should be loaded with rated current simultaneously.

Many industrial applications such as continuous-panning CCTV cameras, automated machinery and robotic end-effectors can benefit from the continuous, unrestrained, rotational freedom of a slip ring. Our 4023 Industrial Slip Rings offer the reliability of precious metal contacts at an affordable price. This is made possible by standardizing on four basic models (6, 12, 18, and 24 rings), which are mass produced for volume pricing.



SPECIAL SLIP RINGS

Cable Reel Slip Rings

Cable reel slip rings can be found in a wide range of military and industrial applications including marine/seismic exploration, underwater towed vehicles, remote tele-operated vehicles, construction cranes, and buoyant submarine antennas. These slip rings are designed for a particularly rugged environment while also providing field accessability of the brush block assemblies if repairs are necessary. With access plates in place, sealed bearings, and integral gasketed connectors, the internal portion of the unit is well protected from environmental conditions.

Mooring Slip Rings

Deep water drilling requires a slip ring to allow complete freedom to weathervane for floating power generation stations (SALM type installations). Experience to date in mooring applications include currents to 600 amps, voltages to 35,000 volts (transmission of 36 megawatts of power) in sizes to 8 feet in diameter by 10 feet in length.

Medical Electronics Slip Rings

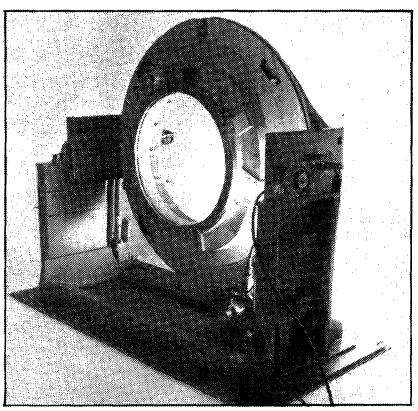
Slip rings are used in various scanner applications, particularly for computed axial tomography (CT Scanners) which require the need to scan at faster speeds, unencumbered by mechanical stops. These units provide a large through bore for mounting as an integral part of the gantry.

Voltages to 200,000 volts are handled safely with careful attention to gradients, internal surface contours, material selection and debris management.

Our slip rings require minimum inertia for spin-up and braking consistent with structural and electrical safety.

Slip rings for medical scanners are built on a history of reliable low maintenance applications, with reliability levels exceeding a million circuit hours being demonstrated.

Our CT slip ring capsules are typically sealed with static seals and redundant dynamic lip seals at all rotary interfaces. A slip ring with separate mating brush blocks is available in a low cost design for low voltage CT scanners where the X-ray voltage is stepped up on the rotating gantry.



Slip Ring Applications Are Only Limited by Your Imagination

These are just a few of the unique applications of slip ring technology. When you need to pass power and/or data through a rotating interface—turn to Litton.

Many of the designs and manufacturing processes are proprietary and are covered under one or more U.S. or European patents.

Call us toll-free at **800-336-5917** (In Virginia, call 703-953-4751) for more information.

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CUSTOMER SPECIFICATION FORM

Date _____ Engineer _____ Customer Part No _____

Customer Name _____ Phone Number _____

Address _____

CAPSULE ☐ SEPARATE SLIP RING ☐ SEPARATE BRUSH BLOCK ☐ POLY-TWIST ☐ (for +/- _____ Degrees)

Application _____

Number of Rings _____ (Detail circuit functions below)

Size: Available length _____ Diameter _____ Bore _____

Wear (life): Hours (or yrs) _____ @ Duty Cycle _____

Environment: Temperature: Operating Range _____°C, Pressure: Normal _____ Minimum _____

Vibration: _____ g's @ _____ Hz Shock _____ g's

Sealing: None _____ Dust _____ Water Spray _____ Submersion _____

Rotational Speed: Normal _____ Maximum _____

CIRCUIT DATA

Circuit Function	No. Rings	Current (amps)		Working Volts	Digital Risetime or Freq. (Hz)	Crosstalk Isolation (dB)
		Normal	Max			

Torque, max starting _____ gm-cm Weight-max _____

Lead Length: Rotor end _____ Stator _____

Connectors: Rotor end _____ Stator _____

Additional Requirements: (Integral Potentiometer, Resolver, Switch, Hydraulics, Pneumatics, Optical Channel, etc.)

_____

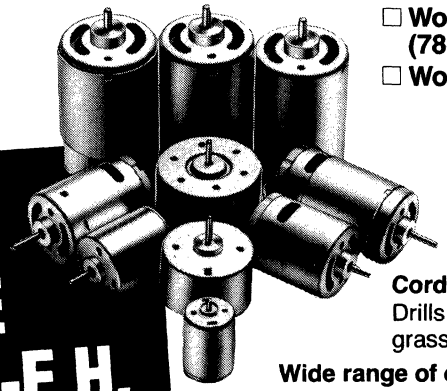
_____

_____

_____

Please provide sketch of available mounting space if possible.

Call us toll-free at **800-336-5917** (In Virginia, call 703-953-4751) for more information.



COST EFFECTIVE Smart Sub-F.H. dc Motors

☐ **World's largest DC motor manufacturer (780 million units/yr.)**

☐ **World-proven quality** ☐ **On-time delivery**

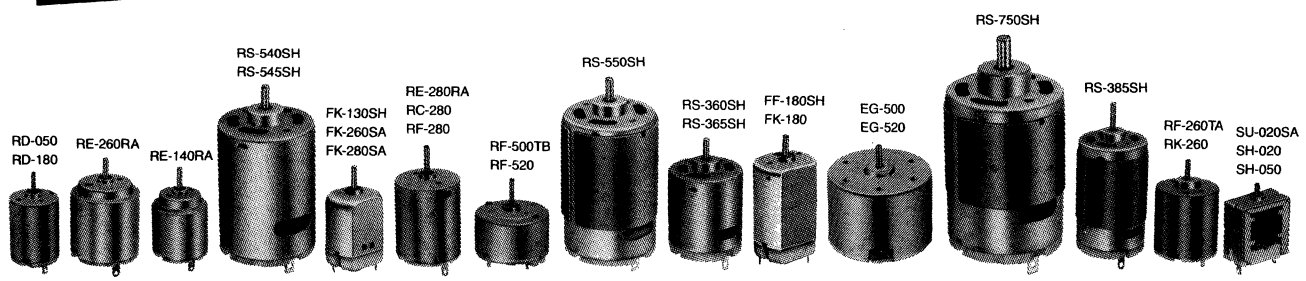
Typical applications:

Automotive Products
Actuators for car mirrors, door locks, A/C damper, fuel and washer pumps, lumbar support, cruise control, window lifters, air pumps, etc.

Cordless Power Tools
Drills, screwdrivers, string trimmers, hedge trimmers, grass shears, hand-held vacuum cleaners, etc.

Wide range of other applications
Home and kitchen appliances, products for personal care, audio-visual, cameras, office automation, bilge pumps, etc.

Call, fax, write us your performance requirements. We will suggest the best-suited motors from our extensive standard line — or with custom-made specifications.



MOTOR				SIZE		Typical Power Source	Operating Voltage Range	TYPICAL CHARACTERISTICS									Stall Torque
										NO LOAD		AT MAXIMUM EFFICIENCY					
Series	Group	Type	Model	Outside Diameter (inch)	Housing Length (inch)		V	Winding Code Number	Voltage V	Speed RPM	Current AMP	Speed RPM	Current AMP	Torque OZ-IN	Output W	F.ff. %	OZ-IN
ECONOMY	STANDARD	RE	RE-140RA	.827	.984	DRY CELL	1.5-3.0	2270	1.5	8,200	0.190	6,250	0.62	0.089	0.40	44.2	0.375
			RE-260RA	.937	1.059		1.5-4.5	2670	3.0	12,500	0.230	10,250	1.03	0.222	1.68	54.1	1.222
			RE-280RA	.953	1.201		1.5-6.0	2865	3.0	9,200	0.155	7,800	0.85	0.278	1.60	62.3	1.81
		SU	SU-020SA	.709 × .374	.744		1.0-3.0	09170	3.0	11,800	0.080	8,150	0.18	0.022	0.132	24.6	0.071
	CARBON	RC	RC-280S	.953	1.201		4.5-12.0	20120	6.0	7,800	0.125	6,450	0.60	0.417	2.00	56.0	2.430
		FK	FK-130SH	.791 × .594	.988		4.5-20.0	07500	12.0	7,200	0.030	5,350	0.09	0.108	0.43	40.8	0.424
			FK-260SA	.953 × .720	1.059		4.5-15.0	10350	12.0	7,300	0.036	5,950	0.16	0.244	1.07	56.3	1.32
			FK-280SA	.953 × .720	1.201		4.5-20.0	10350	12.0	5,700	0.028	4,650	0.13	0.253	0.87	57.5	1.39
		SH	SH-020S	.709 × .374	.744		4.5-12.0	09170	6.0	19,000	0.110	13,600	0.28	0.061	0.608	36.8	0.213
			SH-050S	.709 × .374	.866		4.5-12.0	09170	9.0	23,400	0.105	17,350	0.30	0.090	1.151	42.6	0.347
LOW NOISE	STANDARD	RF	RF-260TA	.953	1.059	DRY CELL BATTERY RECTIFIED A.C.	1.0-9.0	3255	1.2	5,700	0.160	4,750	0.800	0.164	0.575	59.9	0.986
			RF-280	.953	1.201		1.5-12.0	2485	3.0	7,300	0.115	6,130	0.602	0.236	1.069	59.2	1.472
			RF-500TB	1.260	.768		1.5-9.0	14430	6.0	3,650	0.024	3,050	0.122	0.196	0.441	60.0	1.194
			RF-520T	1.260	.846		1.5-12.0	12580	12.0	4,550	0.018	3,890	0.106	0.278	0.799	62.8	1.917
		RD	RD-050T	.673	9.13		1.5-6.0	09220	4.5	7,600	0.039	5,710	0.118	0.054	0.23	43.5	0.222
			RD-180S	.839	1.142		1.2-12.0	2085	2.4	5,310	0.052	4,530	0.304	0.142	0.476	65.2	0.972
		FF	FF-180SH	.803 × .606	1.264		1.0-6.0	3534	1.2	7,550	0.220	6,250	1.08	0.179	0.83	63.7	1.06
	CARBON	RK	RK-260S	.953	1.059		5.0-15.0	12250	12.0	10,900	0.056	9,030	0.27	0.289	1.925	59.5	1.681
		FK	FK-180S	.803 × .606	1.264		4.5-15.0	14150	6.0	7,050	0.060	5,700	0.26	0.197	0.83	53.6	1.04
HEAVY DUTY	CARBON	RS	RS-360SH	1.091	1.283	BATTERY RECTIFIED A.C.	4.5-26.0	14250	12.0	7,300	0.090	5,850	0.36	0.556	2.40	55.6	2.81
			RS-365SH	1.091	1.283		6.0-26.0	1885	18.0	20,800	0.220	17,000	0.99	0.897	11.3	63.3	4.93
			RS-380SH	1.091	1.488		12.0-26.0	2073	24.0	25,800	0.230	21,700	1.21	1.19	19.1	65.8	7.50
			RS-385SH	1.091	1.488		12.0-26.0	2073	24.0	22,000	0.180	18,800	1.05	1.27	17.6	69.7	8.68
			RS-395S	1.091	1.831		6.0-26.0	2455	12.0	10,000	0.190	8,400	1.00	1.36	8.4	69.6	8.61
			RS-540SH	1.406	1.969		3.0-12.0	7516	3.6	19,100	2.85	15,700	13.1	2.19	25.4	53.8	12.3
			RS-545SH	1.406	1.969		6.0-26.0	5016	6.0	15,000	1.20	12,600	6.35	2.87	26.8	70.3	18.1
			RS-550SH	1.406	2.244		3.6-15.0	7522	6.0	12,400	0.70	11,300	7.34	3.87	32.3	73.3	44.4
			RS-750SH	1.661	2.362		4.5-18.0	8027	9.6	18,400	1.8	15,800	11.10	6.76	79.1	73.9	48.6
ELECTRONIC GOVERNOR		EG	EG-500AD-6F	1.429	.984	DRY CELL RECTIFIED A.C.	4.2-7.5	18290	6.0	2,400 RPM at 8 G-CM load							
			EG-500AD-9F	1.429	.984		6.0-11.0	14430	9.0								
			EG-500AD-2F	1.429	.984		8.4-15.0	12580	12.0								
			EG-520AD-6F	1.429	1.063		4.2-7.5	16340	6.0								
			EG-520AD-9F	1.429	1.063		6.0-11.0	14470	9.0								
			EG-520AD-2F	1.429	1.063		8.4-15.0	12580	12.0								

SINCE 1954

MABUCHI MOTOR

Mabuchi Motor America Corp., 475 Park Avenue South, New York, NY 10016, Dept. EEM1 • Tel: (212) 686-3622 • Fax: (212) 532-4263
Detroit Office: 2701 University Dr., Auburn Hills, MI 48057, Dept. EEM1 • Tel: (313) 370-9090 • Fax: (313) 370-9092

VERNITRON
MAGTECH CONTROLS
1601 PRECISION PARK LANE • SAN DIEGO, CA 92173-1399 • PHONE (619) 428-5581 • FAX (619) 428-5090

Factory Contact: Karen Lindahl

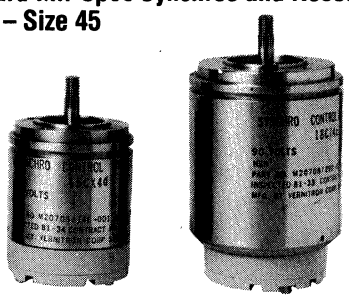
Vernitron Magtech Controls is a leading supplier of DC Torquers and Mil-Spec synchros and resolvers, and is a primary source for the more sophisticated, ultra-high-accuracy single, dual and multi-speed pancake-type componentry consistent with today's state of the art.

Vernitron Magtech Controls operates from a modern 60,000 square foot facility located on 4.6 acres in San Diego, California, specifically designed for the manufacture of electromagnetic devices.

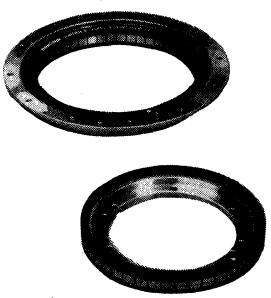
Vernitron Magtech Controls has supplied products for such programs as Harpoon, TOW/Cobra, FVS A-6, Trident, Phalanx, Leopard II, DD963, CG47, and many more. Vernitron Magtech Controls' products are also found in many areas of industrial applications, including robotics, automatic machine tools, and computer disk drives.

Product Lines from Vernitron Magtech Controls

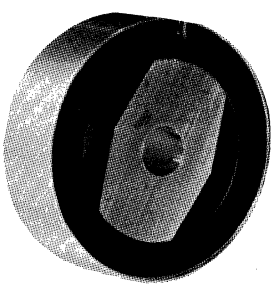
Standard Mil-Spec Synchros and Resolvers Size 8 – Size 45



Hi-Accuracy Multispeed Pancakes



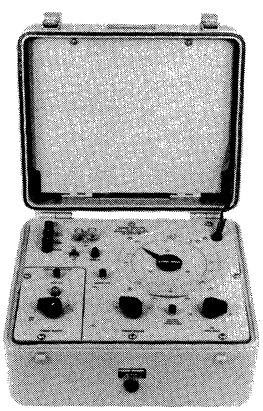
Limited Angle Brushless Torque Motors



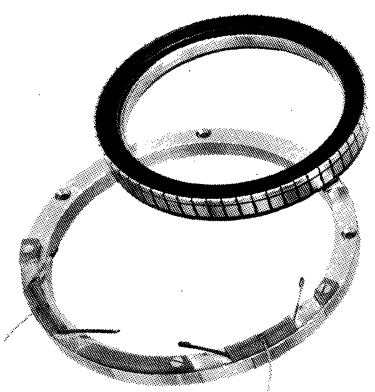
Torqsyn Remote Positioners Analog or Digital Input



Custom Subsystem Designs



DC Torquers



Other Products:

- **Digital Resolver (single turn absolute encoder, 16-bit output)**
- **50 VA Solid State Synchro Amplifier**
- **RVDT**
- **Segment Resolver**
- **DC Motors and Tachometers**

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Carlsbad, California 92009
619 431 7723 • Fax 619 431 0905

MERCURY ROTATING ELECTRICAL CONNECTORS

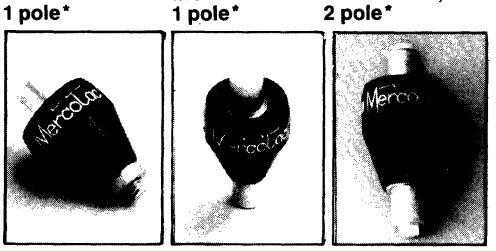
FEATURES

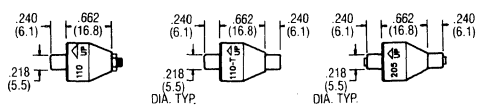
- Superior to conventional slip rings, Mercotac's mercury-wetted contacts provide increased reliability. Extremely low electrical noise, less than 1 milliohm resistance.
- Sealed, ball bearing construction.
- Durable, compact, low cost, no maintenance. Ideal for computers, instrumentation, thermocouples, strain gauges, packaging, heating and control equipment.
- Mercotac-mercury-wetted contacts.

COAX

Coaxial Connector Series: Small, up to 10 amps, high rpm, inexpensive series used with Mercotac accessories.

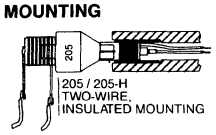
MODEL 110 1 pole*
MODEL 110-T 1 pole*
MODEL 205,205H 2 pole*



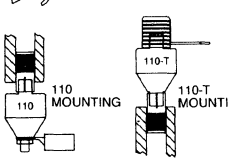


*Order accessories separately inches (mm)

MOUNTING



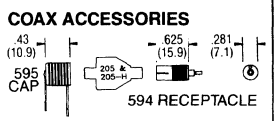
205 / 205-H TWO-WIRE, INSULATED MOUNTING



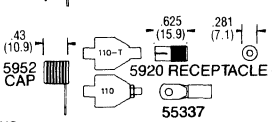
110 MOUNTING

110-T MOUNTING

COAX ACCESSORIES



594 RECEPTACLE



5920 RECEPTACLE

55337

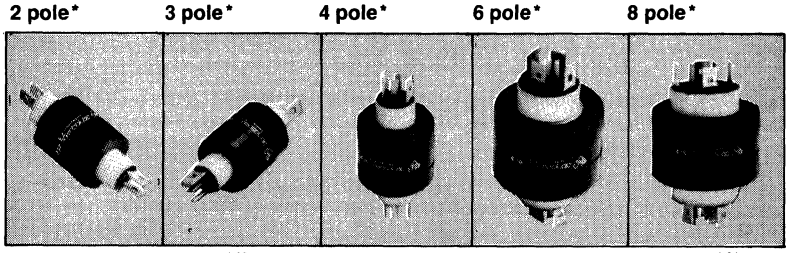
inches (mm)

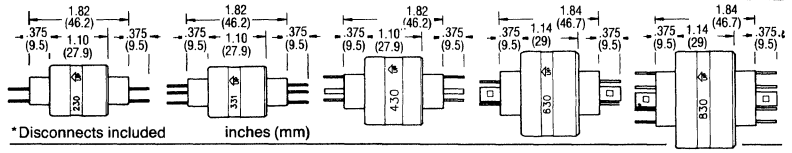
Receptacles w/single 6" lead (591) and double 6" leads (592), not shown, are available.

MODULAR

Modular Connector Series: Thirty amp rated connectors (small pins - 4 amp) available in 2, 3, 4, 6 and 8 conductors. Appropriate disconnects supplied with each Modular unit.

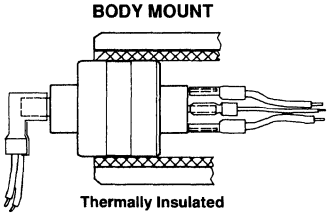
MODEL 230 2 pole*
MODEL 331 3 pole*
MODEL 430 4 pole*
MODEL 630 6 pole*
MODEL 830 8 pole*





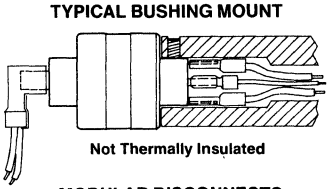
*Disconnects included inches (mm)

BODY MOUNT



Thermally Insulated

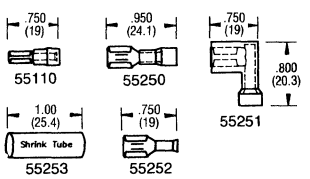
TYPICAL BUSHING MOUNT



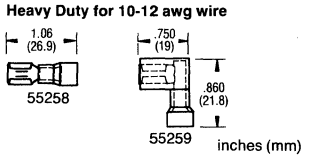
Not Thermally Insulated

MODULAR DISCONNECTS

Regular Duty for 14-16 awg wire



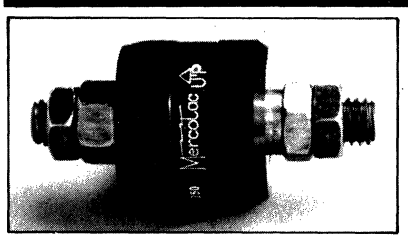
Heavy Duty for 10-12 awg wire

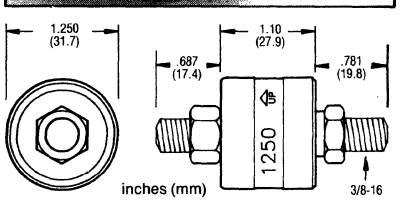


inches (mm)

SPECIFICATIONS	COAX			MODULAR				
MODEL NO.	110/110-T	205	205-H	230	331	430	630	830
Conductors	1	2		2	3	4	6	8
Voltage Range (V) AC/DC	n/a				0-500			
Current rating (A @ 240VAC)	10	4		30	sm. tab 4 lg. tab 30			
Frequency Range (DC)	200MHz				100MHz			
Mercury Contact Resistance	1 milliohm max							
Maximum RPM	3600	2000	3600	1800	1800	1200	300	200
Max. Temp. (on body) °C (°F)	60 (140)							
Min. Temp. °C. (°F)	– 29 (– 20)	7 (45)		– 29 (– 20)				
Circuit Separation M-ohms	n/a	>25						
Typ. Rotation . Torque gm/cm	35	75	35	400	200	400	700	1000

MODEL 1250





inches (mm)

MODEL 1250 SPECIFICATIONS	
Conductors	1
Current Rating (A @ 240VAC)	250
Frequency Range (Hz)	200MHz
Mercury Contact Resistance	< 1 milliohm
Maximum RPM	1200
Max. Temp. (on body) °C (°F)	60 (140)
Min. Temp. °C (°F)	– 29 (– 20)
Typ. Rotational Torque gm/cm	400

OPERATING AND MOUNTING INFORMATION:

1. Mercotac connectors can be used both horizontally and vertically. However the arrow on the body of the connector should not point below horizontal. The connectors are reversible so they need not be installed upside down. Store upright.

2. It is preferable to mount the connector with the body to rotate, to reduce the mechanical loads on the bearing. The unit may be held by the body or the plastic bushing (as shown).

3. Use wires of ample length and flexibility to avoid mechanical loads. Do not have rigid mounting of both ends. The wires attached to the stationary end should be stiff enough to keep it from turning.

4. Vibration and mechanical shock reduce the connector life. Some installations require shock absorbing bushing to mount connector. Limit mounting eccentricity to .005".

5. Provide thermal insulation where necessary to prevent temperature of the unit exceeding 60°C (140° F)

6. Do not solder or bend connector tabs; such misuse voids warranty.

7. In food applications: ISOLATE MERCOTAC CONNECTOR FROM ANY POSSIBILITY OF CONTAMINATING FOOD.

Hearst Engineering Software



ICMASD...IC Alternate Source Directory

The all new 1991 version of the world famous Alternate Source Directory is now available in floppy disk form for your IBM XT & AT and 100% compatible personal computer with hard drive.

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You can personalize the **ICMASD** for your application. The program allows you to add comments, up to 20 digits long, to each listing. These comments can be part numbers, prices, or any information specific to your needs. You may also add, delete and/or discontinue devices!

For greater flexibility the base number search feature enables you to access parts by base number, i.e., the device number stripped of prefixes and suffixes. You don't need to know the manufactures codes to call up any of the alternates to these devices.

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Complete program documentation is included. When ordering, be sure to specify if you want the **1991 ICMASD** on three, double-sided, double-density disks OR on one high-density disk.

For immediate delivery you can order the **1991 ICMASD** at $179.50* simply by charging your Visa or MasterCard credit card. To place your order or for more information, call or write:

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BRUSHLESS SERVO MOTORS & CONTROLLERS

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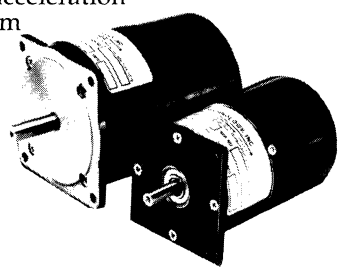
New!...and only from MFM Technology. Brushless NEMA 23 and 34 frame size servo motors replace stepper and DC brush motors. Advantages of these MFM brushless servo motors:

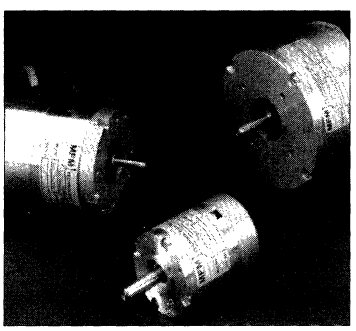
* smooth at all speeds - no cogging!
* instantaneous linear acceleration
* full torque to 6,000 rpm
* no resonance effects
* cool operation



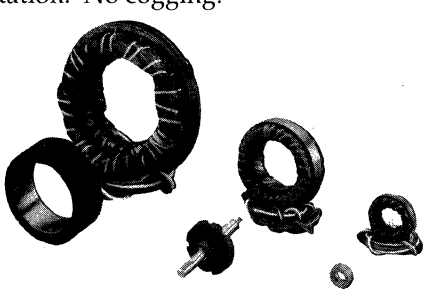
Using samarium-cobalt magnets, MFM brushless DC motors are available in 10 frame sizes from 1.25 inch through 10.0 inch diameter with peak torque ratings from 13.5 oz-in. to 4500 lb-in.

Modular motor components are matched to provide optimum performance using many standard rotor configurations.

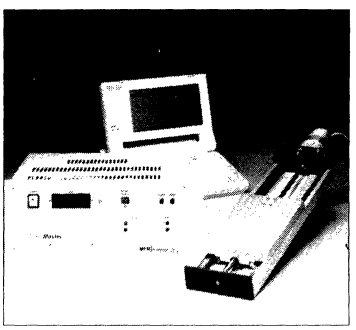
No cogging!



Unhoused motors are supplied as kits for better performance and cost savings for direct mounting onto the driven shaft. Eliminate performance-reducing effects of conventional couplings, belts, or pulleys. Choice of Hall sensor, optical encoder, or resolver commutation. No cogging!

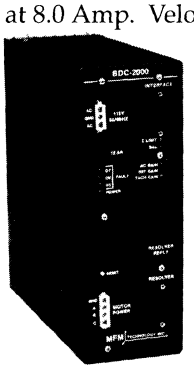


Servo *Master* is a complete brushless servo system consisting of a programmable motion controller, power supply, brushless servo amplifiers, and brushless DC motors with shaft encoder feedback.



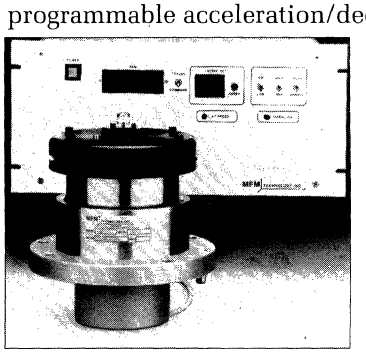
This system provides closed loop control of up to three axes, and makes possible micropositioning of mechanical stages, combined with high speeds.

Model BDC 2000 is a four quadrant sine-wave PWM brushless motor drive. Output bus rating is 160 Volt at 8.0 Amp. Velocity or current loop control accepts a ±10 volt analog command signal. Resolver-to-digital conversion provides electronic commutation, absolute shaft position, and velocity control.



Emulated channel A, B and index encoder output is provided for use with a motion controller. Other models offer power ratings to match a broad range of motor speed and torque requirements.

Precision air or ball-bearing spindles with embedded brushless DC motors are available with micro-inch shaft run-out tolerances.
Model BDC 0550 linear sine-wave drive offers programmable acceleration/deceleration, virtually no EMI/RFI, closed loop servo control and IEEE-488 or RS-232C digital interface.
Speed accuracy > .001% with smooth speed from less than 1 rpm to more than 15,000 rpm.



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MINIATURE ELECTRIC DRIVE SYSTEMS AND ROTARY
POWER TRANSMISSION COMPONENTS UP TO 1 H.P.

■ Originators of Skew-Wound Coreless Micromotors. ■ Patented and Licensed the World Over.

MOTOR STYLE SELECTOR

STYLE	SERIES	CASE DIAMETER (mm)	CASE DIAMETER (in)	OVERALL LENGTH (mm)	OVERALL LENGTH (in)	CONT. MA.X. POWER OUTPUT (W)	MAX.CONT. TORQUE (oz.-in)	RECOMMENDED MAX SPEED (RPM)
	1016	10	(.39)	16	(.63)	0.45	.07	13,000
		FITS GEARHEAD SERIES 10/1, & 12/3						
	1212	12	(.47)	12.2	(.48)	0.1	.01	15,000
		FITS GEARHEAD SERIES 12/3, & 10/1						
	1219	12	(.47)	18.7	(.74)	0.45	.11	12,000
		FITS GEARHEAD SERIES 12/3, & 10/1						
	1319	13	(.51)	19	(.75)	0.9	.17	12,000
		FITS GEARHEAD SERIES 14/1, 15/1, 15/2,15/3 & 15/5						
	1331	13	(.51)	31.2	(1.23)	2.0	.36	12,000
		FITS GEARHEAD SERIES 14/1,15/5 & 15/8						
	1516	15	(.59)	15.8	(.62)	0.3	.07	12,000
		FITS GEARHEAD SERIES 15/1, 15/2,15/3,15/5,15/8 & 16A						
	1524	15	(.59)	23.8	(.94)	0.6	.14	12,000
		FITS GEARHEAD SERIES15/1, 15/2, 15/3,15/5, 15/8 & 16A						
	1616	16	(.63)	15.8	(.62)	0.45	.11	12,000
		FITS GEARHEAD SERIES 16/2,16/3,16/5,16/7,16/8 & 16A						
	1624	16	(.63)	23.8	(.94)	0.9	.21	12,000
		FITS GEARHEAD SERIES 16/2,16/3,16/5,16/7,16/8 & 16A						
	1717	17	(.67)	17	(.67)	1.8	.20	13,000
		FITS GEARHEAD SERIES 16A & 16/7						
	1724	17	(.67)	24	(.95)	2.2	.28	8,000
		FITS GEARHEAD SERIES 16A & 16/7						
	2017	20	(.79)	17.2	(.68)	0.45	.11	12,000
	2025	20	(.79)	24.8	(.98)	0.9	.21	8,000
	2225	22	(.87)	24.8	(.98)	1.0	.28	8,000
		FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1, & 34PG						
	2230	22	(.87)	30.0	(1.18)	2.0	.36	8,000
		FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1, & 34PG						
	2233	22	(.87)	32.8	(1.29)	2.0	.43	8,000
		FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1, & 34PG						
	2338	23	(.91)	37.6	(1.48)	3.5	.85	8,000
		FITS GEARHEAD SERIES 23/1, 30/1, & 34PG						
	2842	28	(1.10)	42.0	(1.65)	6.0	2.80	5,000
		FITS GEARHEAD SERIES 23/1, 30/1, 34PG, 38/1, & 38/2						
	3540	35	(1.38)	40.0	(1.57)	10.0	3.55	5,000
		FITS GEARHEAD SERIES 30/1, 34PG, 38/1, & 38/2						
	3557	35	(1.38)	57.0	(2.24)	15.0	6.38	5,000
		FITS GEARHEAD SERIES 30/1, 34PG, 38/1, & 38/2						
	3557...CS	35	(1.38)	57.0	(2.24)	25.0	7.09	5,000
		FITS GEARHEAD SERIES 30/1, 34PG, 38/1, & 38/2						
	3557...CR	35	(1.38)	57.0	(2.24)	50.0	8.50	5,000
		FITS GEARHEAD SERIES 30/1, 34PG, 38/1, & 38/2						
GEARMOTORS								
	2020	20	(.79)	20.0	(.79)	0.4	.21 to 1.42	200 to 3,000
	2034	20	(.79)	33.3	(1.31)	0.8	.43 to 1.42	500 to 2,000

- Ask about our "Guaranteed Stock Program" with expedited sample delivery.
- Ship-from-Stock Program available for OEM Blanket Orders.

MME4915K

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MINIATURE ELECTRIC DRIVE SYSTEMS AND ROTARY
POWER TRANSMISSION COMPONENTS UP TO 1 H.P.

ALSO AVAILABLE:
- Tacho-Generators
- Optical Encoders
- Control Systems
- Shaft Couplings
- Precision Gearheads
- Motor-Tachometers

MOTOR STYLE SELECTOR

STYLE	SERIES	CASE DIAMETER (mm)	(in)	OVERALL LENGTH (mm)	(in)	CONT. MA.X. POWER OUTPUT (W)	MAX.CONT. TORQUE (oz.-in)	RECOMMEND MAX SPEED (RPM)
	GNM 2130	34	(1.34)	94	(3.70)	8.0	1.81	6,000
	FITS GEARHEAD SERIES G4, G4A, & G5							
	GNM 2145	34	(1.34)	110	(4.33)	12.0	2.70	6,000
	FITS GEARHEAD SERIES G1.1, G4, G4A, & G5							
	GNM 2636	45	(1.77)	98	(3.86)	22.0	13.14	4,000
	FITS GEARHEAD SERIES G1.2 & G12.1							
	GNM 2670	45	(1.77)	142	(5.59)	40.0	21.72	4,000
	FITS GEARHEAD SERIES G13.1							
	GNM 3125	55	(2.17)	126.5	(4.98)	30.0	15.07	4,000
	FITS GEARHEAD SERIES G24							
	GNM 3150	55	(2.17)	126.5	(4.98)	55.0	27.65	4,000
	FITS GEARHEAD SERIES G2.6							
	GNM 3175	55	(2.17)	126.5	(4.98)	75.0	37.74	4,000
	FITS GEARHEAD SERIES G11.1							
	GNM 4125	70	(2.76)	118	(4.65)	45.0	32.71	3,000
	FITS GEARHEAD SERIES G8N							
	GNM 4150	70	(2.76)	143	(5.63)	75.0	52.67	3,000
	FITS GEARHEAD SERIES G11.2							
	GNM 4175	70	(2.76)	168	(6.61)	100	79.01	3,000
	GNM 5440	83	(3.27)	166.5	(6.56)	125	79.37	3,000
	FITS GEARHEAD SERIES G3.1 & G6.1							
	GNM 5480	83	(3.27)	206.5	(8.13)	210	149.53	3,000
	FITS GEARHEAD SERIES G6.1, G40.1							
	GNM 6250	100	(3.94)	193	(7.60)	250	133.00	3,000
	GNM 62100	100	(3.94)	243	(9.57)	450	225.00	3,000
	FITS GEARHEAD SERIES G40.1							
	GNM 7045	120	(4.72)	202	(7.95)	175	177.87	3,000
	GNM 7085	120	(4.72)	256	(10.08)	300	295.16	3,000
	GNM 70130	120	(4.72)	313	(12.32)	430	414.88	3,000
	FITS GEARHEAD SERIES G50.1							

- Available with Integral Brakes, AC/DC Tachs, and Optical & Magnetic Encoders.
- High Voltage Versions Available Upon Request (to 180 VDC).
- Single Piece Prototypes Available
- Complete Applications Liaison – Prototype Through Production.

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Micro Mo®

MINIATURE ELECTRIC DRIVE SYSTEMS AND ROTARY
POWER TRANSMISSION COMPONENTS UP TO 1 H.P.

GEARHEAD STYLE SELECTOR

STYLE	SERIES	OUTSIDE DIAMETER (mm)	(in)	SHAFT DIAMETER (mm)	(in)	RATIOS FROM TO	MAX.CONT. TORQUE (oz.-in)	INTER-MITTENT TORQUE (oz-in)
GEARHEADS								
	10/1	10	(.394)	2	(.079)	4:1 - 1024:1	≤ 14.00	≤ 28.3
		FITS MOTOR SERIES 1016, 1212, & 1219						
	12/3	12	(.472)	2	(.079)	9.17:1 - 154,368:1	≤ 5.6	≤ 14.1
		FITS MOTOR SERIES 1212,1219, & 1016						
	14/1	14	(.551)	3	(.118)	3.71:1-5647:1	≤ 42	≤ 63.0
		FITS MOTOR SERIES 1319,1331						
	15/1	17	(.669)	2	(.079)	11.8:1- 5752:1	≤ 2.8	≤ 7.1
		FITS MOTOR SERIES 1516, & 1524						
	15/2	16	(.630)	2	(.079)	3.45:1- 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1516, & 1524						
	15/3	16	(.630)	2	(.079)	6.3:1 - 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1516, & 1524						
	15/5	16	(.630)	3	(.118)	6.3:1- 235,067:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1516,1524, & 1331						
	15/6	16	(.630)	3	(.118)	6.3:1- 235,067:1	≤ 7	≤ 21
		FITS MOTOR SERIES 1319, 1331, 1516, & 1524						
	15/8	16	(.630)	3	(.118)	22:1- 1670:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1516, 1524, & 1331						
	16A	16	(.630)	2	(.079)	11.8:1 - 5752:1	≤ 7.1	≤ 14.2
		FITS MOTOR SERIES 1516, 1524, 1616, & 1624						
	16/2	17	(.669)	2	(.079)	3.45:1 - 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1616, & 1624						
	16/3	17	(.669)	2	(.079)	6.3:1 - 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1616, 1624						
	16/5	17	(.669)	3	(.118)	6.3:1 - 235,067:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1616,1624						
	16/6	17	(.669)	3	(.118)	6.3:1-235,067:1	≤ 7	≤ 21
		FITS MOTOR SERIES 1616,1624						
	16/7	16	(.630)	3	(.118)	3.71:1-5647:1	≤ 42	≤ 64.0
		FITS MOTOR SERIES 1616,1624,1717,1724						
	16/8	17	(.669)	3	(.118)	22:1 - 1670:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1616, 1624						
	22B	24	(.945)	4	(.157)	9:1 - 2187:1	≤ 14.2	≤ 56.6
		FITS MOTOR SERIES 2225, 2230, & 2233						
	22/2	23.8	(.937)	4	(.157)	3.1:1 - 983,447:1	≤ 14.2	≤ 56.7
		FITS MOTOR SERIES 2225, 2230, & 2233						
	22/5	23.8	(.937)	4	(.157)	29.6:1-2050:1	≤ 14.2	≤ 56.7
		FITS MOTOR SERIES 2225, 2230, & 2233						
	23/1	23	(.906)	6	(.236)	3.71:1-1526:1	≤ 100	≤ 141.6
		FITS MOTOR SERIES 2225, 2230, 2338, 2233, & 2842						
	30/1	30	(1.18)	8	(.31)	3.71:1-1526:1	≤ 640	≤ 850
		FITS MOTOR SERIES 2338, 2444, 2842, 3540, & 3557						
	34PG	34	(1.339)	8	(.315)	12:1 - 54880:1	≤ 710	≤ 710
		FITS MOTOR SERIES 2233, 2338, 3540, & 3557						
	38/1 & 38/2	38	(1.60)	8	(.315)	14:1 - 1526:1	≤ 1.416	≤ 2.124
		FITS MOTOR SERIES 3540, 3557, & 2842						

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■ Full-Line Stocking Distributors Worldwide. ■ Zero Back-Lash Gearing on Selected Models.

GEARHEAD STYLE SELECTOR

STYLE	SERIES	OUTSIDE DIAMETER (mm)	OUTSIDE DIAMETER (in)	SHAFT DIAMETER (mm)	SHAFT DIAMETER (in)	RATIOS FROM TO	MAX.CONT. TORQUE (oz.-in)	INTER-MITTENT TORQUE (oz-in)
	G1.1	—		6	(.236)	7.3:1 - 38:1	≤ 92	≤ 283.2
	FITS MOTOR SERIES GNM 2145							
	G1.2	—		8	(.315)	7.3:1- 38:1	≤ 155.7	≤ 283.2
	FITS MOTOR SERIES GNM 2636							
	G2.6	—		10	(.394)	4.8:1 - 36:1	≤ 424.8	≤ 1132.8
	FITS MOTOR SERIES GNM 3150							
	G3.1	—		12	(.472)	5.6:1-35:1	≤ 877.9	≤ 1,840.8
	FITS MOTOR SERIES GNM 5440							
	G4	—		8	(.315)	15:1 - 43740:1	≤ 339.8	≤ 424.8
	FITS MOTOR SERIES GNM 2130 & 2145							
	G4A	—		8	(.315)	60:1 - 9720:1	≤ 453.1	≤ 566.4
	FITS MOTOR SERIES GNM 2130, & 2145							
	G5	34	(1.34)	8	(.315)	30:1 - 54880:1	≤ 710	≤ 710
	FITS MOTOR SERIES GNM 2130, & 2145							
	G6.1	83	(3.27)	20	(.787)	8:1-185.7:1	≤ 7,080	≤ 18,408
	FITS MOTOR SERIES GNM 5440, & 5480							
	G8N	—		12	(.472)	15:1-405:1	≤ 2,832	≤ 2,832
	FITS MOTOR SERIES GNM 4125							
	G11.1	56	(2.21)	14	(.551)	8.3:1- 242.9:1	≤ 3,115	≤ 4,248
	FITS MOTOR SERIES GNM 3175							
	G11.2	56	(2.21)	14	(.551)	8.3:1-242.9:1	≤ 3,115	≤ 4,248
	FITS MOTOR SERIES GNM 4150							
	G12.1	—		10	(.394)	10:1 - 810:1	≤ 708	≤ 1,133
	FITS MOTOR SERIES GNM 2636							
	G13.1	45	(1.77)	12	(.472)	5.5:1 - 220:1	≤ 2,195	≤ 2,832
	FITS MOTOR SERIES GNM 2670							
	G24	—		10	(.394)	15:1- 540:1	≤ 1,416	≤ 1,699
	FITS MOTOR SERIES GNM 3125							
	G40.1	—		15	(.591)	10:1- 56:1	≤ 3,540	≤ 9,912
	FITS MOTOR SERIES GNM 5480 & 62100							
	G50.1	—		20	(.787)	10:1-40:1	≤ 5,310	≤ 14,160
	FITS MOTOR SERIES GNM 70130							

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MME4915K

600/300 Watt

SERVO AMPLIFIERS for DC MOTOR DRIVE

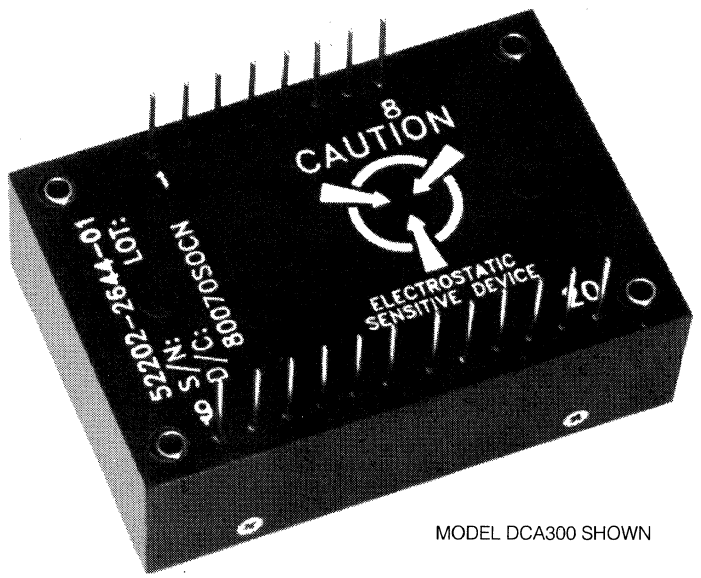
DCA600/300

Description

The DCA600 and DCA300 are versatile and compact 600 watt and 300 watt rated servo amplifiers for DC motor drive and other linear amplifier applications. These linear amplifier have a MOSFET "H" bridge output power stage for bi-directional motor drive with a unipolar power supply. The MOSFET power stage provides excellent safe operating area and ruggedness. The amplifier can handle the back EMF's produced by motor loads.

External terminals for voltage and current feedback are provided for external user configuration. External terminals are also provided for adjustment of output current limiting. A thermal over-temperature shutdown is incorporated. These amplifiers operate from a voltage source of either 44 VDC or 100 VDC and require a bias supply of –15 VDC.

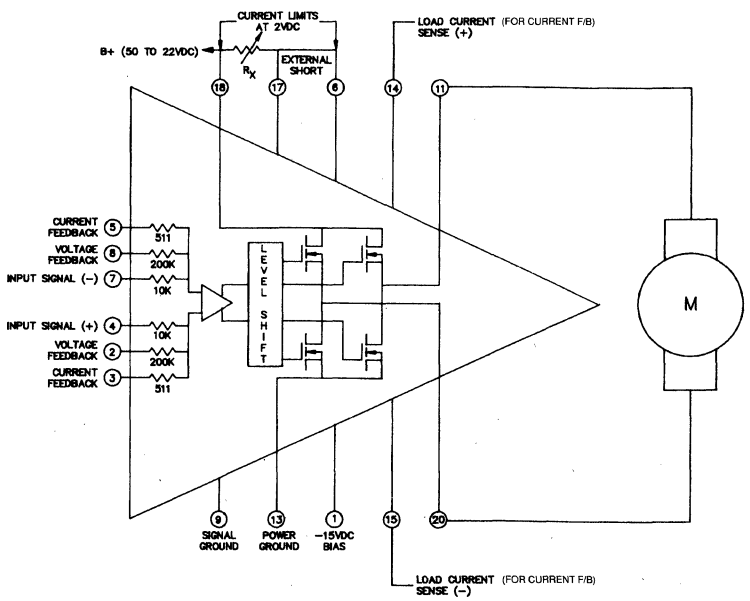
The DCA series amplifiers are available in military and industrial ranges. The military version is also radiation hardened. The design is fully derated, and low thermal resistances between the power semiconductors and the baseplate minimize junction temperatures. The amplifier is designed to be conduction cooled and is mounted to the heat sink surface by four through mounting holes.



MODEL DCA300 SHOWN

Features

- 600 or 300 watt rated
- For DC motor loads and other linear amplifier applications
- Operates from 44 VDC (DCA300)
  100VDC (DCA600)
- Bi-directional motor drive
- Unipolar power supply
- Rugged MOSFET "H" bridge output power stage provides excellent safe operating area
- Thermal over-temperature shutdown
- External user configuration provided via external terminals for voltage and current feedback
- Output current limiting adjusted via external terminals
- Radiation hardened available
- High Reliability



Specifications

INPUT:	44 VDC (DCA300) 100VDC (DCA600)
BIAS SUPPLY:	-15 VDC
OUTPUT	
DCA300:	±20V @ 15A
DCA600:	±90V @ 6.7A
VIBRATION:	15 G rms (random)
SHOCK:	50 G peak
TEMPERATURE:	–55°C to +125°C
HUMIDITY:	to 100%
ALTITUDE:	50,000 ft., operating
DIMENSIONS	
DCA300:	3.25"x1.900"x0.96"
DCA600:	4.13"x3.52"x1.00"

We can modify these units to meet your custom amplifier requirements.

MODULAR DEVICES INC
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TEL 516-345-3100 • FAX 516-345-3106

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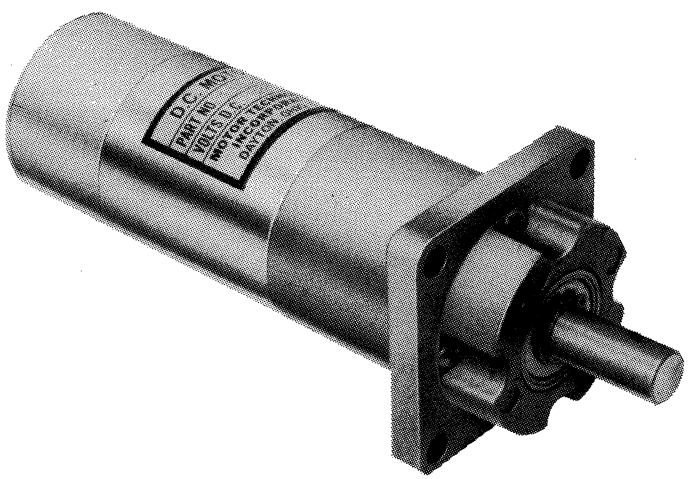
MOTOR TACHOMETERS

PLANETARY GEARMOTORS

ELECTRONIC CONTROLS



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PM MOTORS & MOTOR TACHOMETERS
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Special to 3/4 HP

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MILITARY · ROBOTICS
SERVO DRIVES



Immediate Solutions by Phone and FAX

At Motor Technology we solve most applications over the phone lines.

Your call to us goes straight to a competent motor application engineer, never to a clerk, correspondent or some other non-technical person. You discuss your project with a highly qualified engineer who is experienced with motors—motor application problem solving, motor design, and motor related hardware.

For a lot of projects, you won't always know the exact torque or speed you need. Or, maybe there's a voltage variation you're not sure how to cope with. The odds are 100:1 we've had experience with a similar application. So, basically, all you need to do is explain the conditions and what you want the motor to do. We help fill in the blanks, then come up with a design that's cost efficient for you.

If you're ready to talk about a prototype, the same application engineer will give you the price and a firm ship date—all in the span of a single phone call. (We don't shuffle you to other departments or make you wait days for the answers you need.)

Get an immediate solution by phone or FAX from Motor Technology the next time you have an application. And have the prototype on your desk within a few days.

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PM GEARMOTORS
1/1,000 to 1/4 HP, Standard
Special to 3/4 HP

Ratios (planetary) from 3.81 to greater than 20,000:1.
Output shaft concentric and in line.

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SERVO DRIVES



Custom Prototypes in Three to Four Days

Motor Technology is a quick response company.

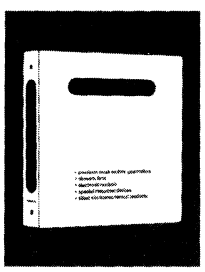
We custom engineer while you're on the phone, then follow-up with your prototype 3-4 days later. A distributor might be able to deliver as fast, but he couldn't match Motor Technology's factory engineering assistance. And our solution comes to you with two important guarantees:

1 We guarantee performance—the torque you need, over the speed range required, at the voltage selected. The motor, motor tachometer or gearmotor will do exactly what we say, or you don't pay for it.

2 We guarantee the prototype to be production feasible. That's assurance you aren't likely to get with a "kludge" assembled by a distributor technician.

Motor Technology is the quick response company that starts you off with a prototype that's engineered to be right for your breadboard and cost efficient in production.

To find out more about us, write or call for our extensive catalog. Or, just phone and/or FAX the problem to us.



The Motor Technology Catalog

Wide range of standards, with complete performance and specification data. Includes short course on how to predict performance when torque, speed or voltage conditions vary. Shipped UPS, same day.

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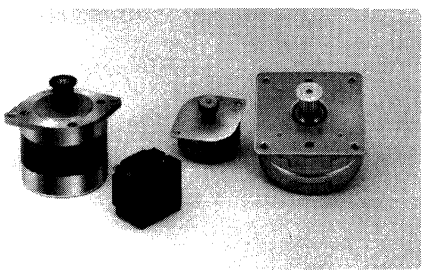
NMB TECHNOLOGIES

PRECISION STEPPING MOTORS

Whether design requirements require an existing motor or a custom design, NMB Technologies will fit your exact specifications. Vertically integrated processes assure quality and dependability. Parts and subassemblies are manufactured in-house on automated production lines. Motors from NMB Technologies offer higher torque, lower inertia, greater accuracy and cooler operation at very competitive prices.

ASTROSYN HYBRID TYPE (Laminated Construction) Typical Motor and Performance Specs

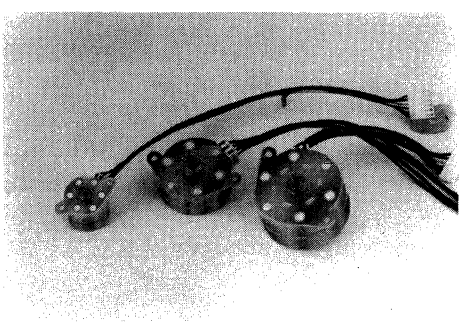


Model No.	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g-cm
0.9° Step Angle					
16PY-Q001	4	9.2	0.24	38.0	900
16PY-Q202	4	4.3	0.35	12.4	400
17PY-Q001	4	9.2	0.24	38.0	900
17PY-Q201	4	9.2	0.24	38.0	400
23LY-C001	4	8.5	0.85	10.0	5000
23LY-C201	4	5.5	0.78	7.1	2500
23LY-C301	4	3.0	1.70	1.8	4000
1.8° Step Angle					
14PM-K001	4	12.0	0.24	48.0	650
15PM-K004	4	8.6	0.36	24.0	700

ASTROSYN PM TYPE (Press Construction) Typical Motor and Performance Specs

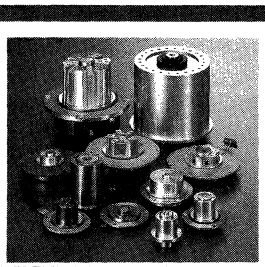
Model No.	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g-cm
1.8° Step Angle					
27BM-H101	4	12	0.36	33	450
7.5° Step Angle					
17BB-H051	4	16	0.13	120	300
20BB-H051	4	12	120.00	100	400

ACCUSTEP PM SERIES STEPPING MOTORS



Type	Length (S.L.) *	Steps Per Rotation	Hold Torque (g-cm)	Max. Pull-In Freq. (P.P.S.)
PM15	L	20	45.3	860
PM20	S	20	55.0	740
	L	20	85.0	670
PM25	S	24	74.0	660
	L	24	90.0	690
PM25	S	48	80.0	680
PM35	S	24	260.0	480
	L	24	350.0	430
PM35	S	48	420.0	710
	L	48	580.0	650
PM42	S	48	680.0	640
	S	96	450.0	730
	S	100	440.0	750
	L	48	1100.0	550
PM55	L	48	1800.0	370
	L	96	1600.0	430
	L	100	1500.0	440

PM.DM SERIES SPINDLE MOTORS



Two premier companies — Minebea Co., Ltd., a world leader in manufacturing precision ball bearings and mechanical components and Papst-Motoren GMBH & Co., a world renowned technology leader in electronically commutated DC motors — have formed a joint venture company, Papst Minebea Disc Motors. PM.DM, Thailand and PM.DM, Germany will supply technically advanced spindle motors for the worldwide hard disc drive motor market. Contact NMBT for additional information.

FEATURES AND BENEFITS

ASTROSYN STEPPING MOTORS
HYBRID AND PERMANENT MAGNETIC MODELS

- Quiet, reliable performance, long life
- Wide range of laminated and press construction models — standard or custom designs

ACCUSTEP PM SERIES MOTORS

- Up to 15% more torque than comparably sized units
- As much as 20% lower operating temperature

COMPETITIVE PRICING

- Vertically integrated processing for total quality control
- Precision automated production
- In-line quality control and testing

INVENTORY

The designer/user should contact his local NMBT Sales Office. Spindle Motors are designed to specification for prototypes and production. No inventory available.

Model No.	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g-cm
1.8° Step Angle (Cont'd)					
17PM-M002	4	12.0	0.15	38.00	500
17PM-M012	4	6.0	0.67	9.00	900
23LM-C004	4	6.0	1.2	5.00	5000
23LM-C108	4	5.4	1.5	3.60	6000
23LM-C202	4	4.0	1.1	3.50	2500
23LM-C302	4	1.3	3.9	0.33	4000
23LM-C401	4	1.7	4.7	0.37	8000
23LM-C501	4	2.2	4.6	0.48	10,800
23LM-C602	4	12.0	0.16	75.00	980
34PM-C006	4	2.0	3.6	0.55	10,000

Model No.	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g-cm
1.8° Step Angle (Cont'd)					
34PM-C108	4	12.0	1.00	12.00	20,000
34PM-C201	4	5.0	4.40	1.13	30,000
42PM-C015	4	4.0	3.10	1.20	45,000
42PM-C109	4	12.0	1.50	7.70	81,000
42PM-C201	4	4.3	6.10	0.70	150,000
3.6° Step Angle					
17PS-C026	4	12.0	0.24	50.00	900
17PS-C035	4	9.0	0.50	18.00	760
5° Step Angle					
23PQ-C001	4	6.0	1.20	5.00	1700

Model No.	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g-cm
7.5° Step Angle (Cont'd)					
23BB-H001	4	5	750.00	6.6	900
28BB-H101	4	5	1.40	3.6	2600
15° Step Angle					
15BA-H052	4	12	170.00	70.0	150
17BA-H052	4	12	0.24	50.0	230

ASTROSYN MODELS

Notes:

1) First two digits of P/N denote frame diameter size in inches x 10. Example: 23 LM C006 has a frame size of 2.3 inches.
2) Most motors listed are available with single or double-ended shafts.
3) Options available include lead screws, gears and pulleys.
4) Standard drivers are available for all standard motors. For special designs contact NMBT applications engineers.

Typical Torque Characteristics				Driving Conditions	
Drive Freq. (P.P.S.)	Pull-Out Torque (g-cm)	Drive Freq. (P.P.S.)	Pull-Out Torque (g-cm)	Winding Ohms	Drive Volts (V)
100	41.4	500	20	10	5
100	34.0	500	22	100	12
100	59.0	500	28	80	12
100	44.0	500	30	80	12
100	75.0	500	45	50	12
100	55.0	500	42	65	12
100	190.0	400	105	30	12
100	270.0	300	160	120	24
100	290.0	400	175	30	12
100	470.0	300	320	20	12
100	485.0	300	355	15	12
100	410.0	600	210	15	12
100	400.0	600	210	15	12
100	820.0	300	530	10	12
100	1100.0	200	850	10	12
100	1000.0	300	570	10	12
100	980.0	300	570	10	12

ACCUSTEP PM/SERIES MODELS

Notes:

1) First two numerical digits indicate frame diameter size in mm. Example: PM35L-024 has a frame size of 35 mm (1.58″).
2) A range of shaft lengths, front plate styles and wiring harnesses are available.
3) Pinion gear option is available.

*Denotes (S) Short or (L) Long

NMB TECHNOLOGIES INCORPORATED
MOTOR DIVISION

For complete specifications and pricing, contact

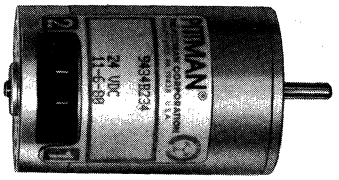
NMB TECHNOLOGIES INCORPORATED
9730 Independence Ave., Chatsworth, CA 91311 • **(800) 662-8321**
Telephone: (818) 341-3355 • FAX: (818) 341-8207



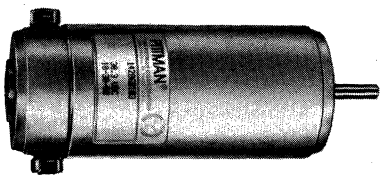
Series 8000 LO-COG® Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.2 in.; 3 lengths to 2.4 in. overall. Stall torques to 17 oz.-in. Mechanical time constants as low as 14.1 ms. (some models).



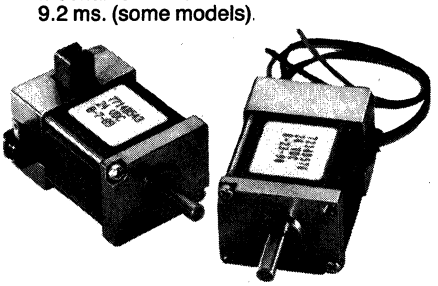
Series 9000 LO-COG® Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.6 in.; 3 lengths to 2.5 in. overall. Stall torques to 24 oz.-in. Mechanical time constants as low as 14.7 ms. (some models).



Series 9030 Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.6 in.; 3 lengths to 2.5 in. overall. Stall torques to 41 oz.-in. Mechanical time constants as low as 9.2 ms. (some models).

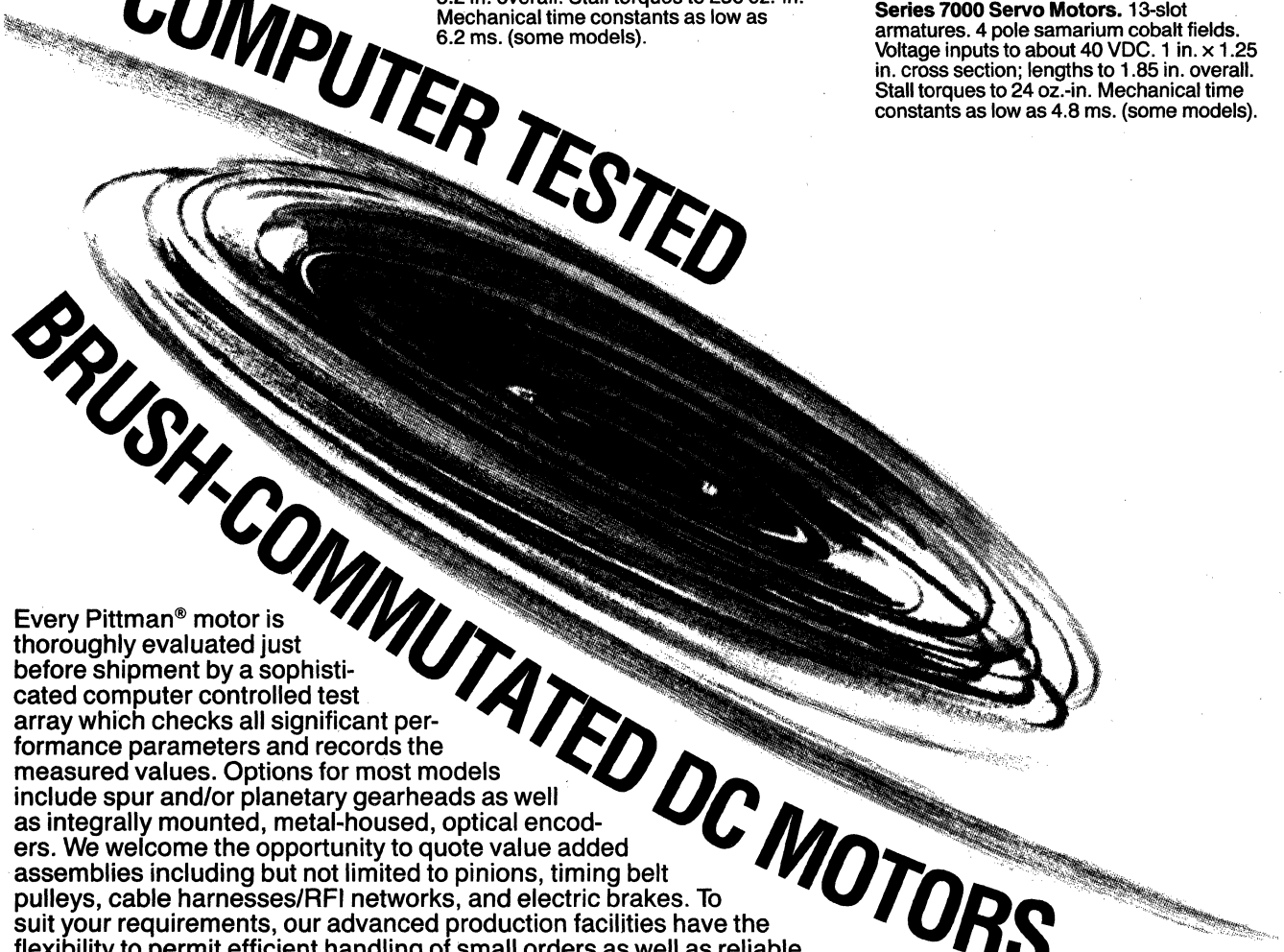


Series 14000 Servo Motors. 11-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 2.13 in.; 4 lengths to 5.2 in. overall. Stall torques to 286 oz.-in. Mechanical time constants as low as 6.2 ms. (some models).



Series 7000 Servo Motors. 13-slot armatures. 4 pole samarium cobalt fields. Voltage inputs to about 40 VDC. 1 in. x 1.25 in. cross section; lengths to 1.85 in. overall. Stall torques to 24 oz.-in. Mechanical time constants as low as 4.8 ms. (some models).

COMPUTER TESTED BRUSH-COMMUTATED DC MOTORS



Every Pittman® motor is thoroughly evaluated just before shipment by a sophisticated computer controlled test array which checks all significant performance parameters and records the measured values. Options for most models include spur and/or planetary gearheads as well as integrally mounted, metal-housed, optical encoders. We welcome the opportunity to quote value added assemblies including but not limited to pinions, timing belt pulleys, cable harnesses/RFI networks, and electric brakes. To suit your requirements, our advanced production facilities have the flexibility to permit efficient handling of small orders as well as reliable deliveries of thousands of motors per week. Contact us for complete data and application assistance. Phone (215) 256-6601. Fax (215) 256-1338.

56-C

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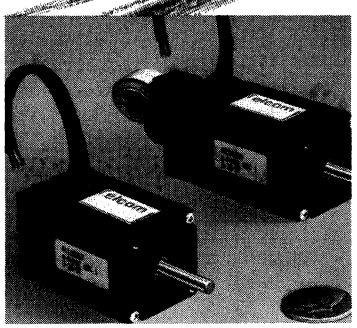
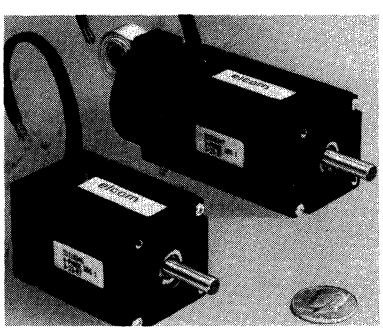
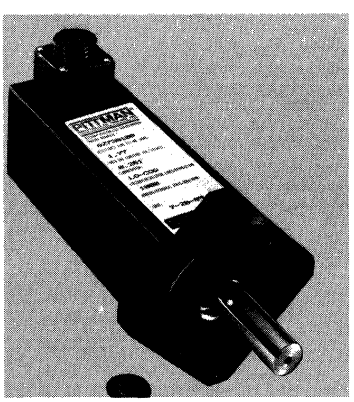
Series 3000 30mm sq. frame size; lengths of 55.2 and 65.4mm. At 7,200 rpm, longest motor develops 1/15 hp, continuous duty, with normal heat sink.



Series 4000 40mm sq. frame size; lengths of 67.8, 75.3, and 83.0mm. At 7,200 rpm, longest motor develops 1/6 hp, continuous duty, with normal heat sink.



Series 5000 50mm sq. frame size; lengths of 77.4, 90.1, and 102.8mm. At 7,200 rpm, longest motor develops 1/3 hp, continuous duty, with normal heat sink.



Series 6000 65mm sq. frame size; 202mm long. Internally mounted 1,000 line, 3-channel optical encoder. At 3,600 rpm, develops 1 hp, continuous duty, with normal heat sink.

- Samarium cobalt rotor construction
- Exceptional thermal efficiency
- Negligible magnetic cogging
- Very low winding inductances
- High torque to inertia ratios
- Low mechanical time constants
- Capable of high speed operation
- Optional patented 12-step drive for minimum commutation torque ripple
- Conventional 6-step drives, digital control systems, and power supplies available from Pittman

Options for Series 3000, 4000, and 5000 include optical encoders and/or planetary gearheads. Get the whole story on unique Pittman® ELCOM® electronically commutated servo motors by calling (215) 256-6601; Fax (215) 256-1338.

55-C

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Tachometers, Encoders, Brushless Tach/Commutators.

dc tach generators

Servo-Tek 1.135″ OD tachometer generators are built to last. With silver-alloy commutators, stainless-steel shafts and bearings, brushes rated for 100,000-hour life, temperature compensation, and full factory run-in, our tachs deliver stable, long-term performance. A complete line with a variety of mechanical and electrical characteristics is available from stock. Output ratings from 1 to 45 V/1000 rpm.

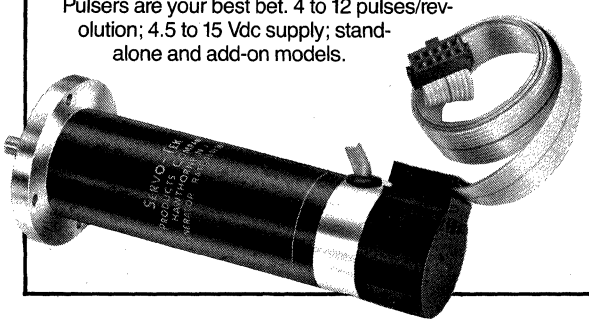


incremental encoders

These high-resolution (100 to 512 pulses/revolution) optical encoders are offered both as options on 1.135″ Servo-Tek rotating components (pictured) and as stand-alone feedback devices. All configurations provide 3-channel (2 in quadrature and 1 index) LSTTL logic output. Combination units give position, speed, and direction feedback.

5 Vdc supply; 3.2 mA output standard; 16 mA with standard amplifier, others available, STTL.

For inexpensive single-pulse-train feedback, Servo-Tek Pulsers are your best bet. 4 to 12 pulses/revolution; 4.5 to 15 Vdc supply; stand-alone and add-on models.



tachsyn® brushless tach/ commutators

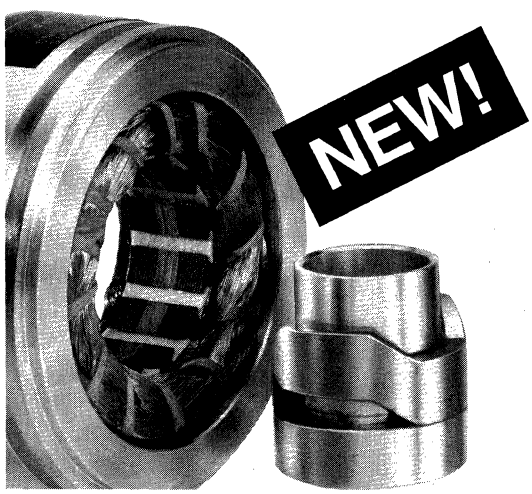
Does your brushless dc drive require

- High-accuracy commutation?
- Linear, low-noise tach signal?
- Elevated-temperature operation?
- No electronics in the motor?
- Low-inertia rotor?

The new patented Tachsyn tach/commutator from Servo-Tek may be the ideal transducer for your exacting requirements.

The Tachsyn brushless three-phase transducer is available in 4-, 6-, and 8-pole configurations to match your motor. With remote signal conditioning electronics, it provides accurate 6-step Hall-equivalent or sine-wave signals plus a low-ripple analog dc tachometer output.

The rotor is a low-inertia, passive component suitable for high speeds. Overhung mounting eases addition to your motor–no extra bearings or couplings are required.



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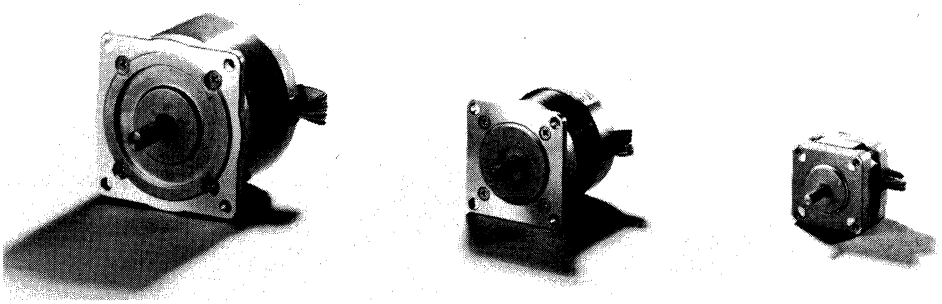
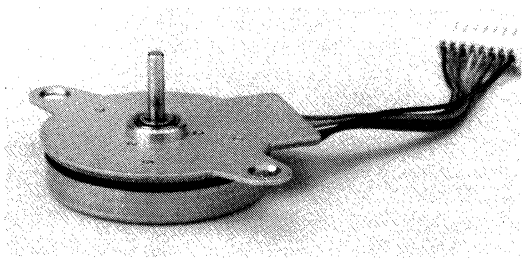
STEPPING MOTORS

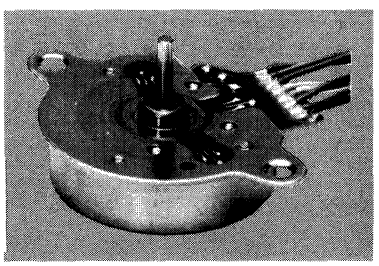
Sizes: 15 (35mm), 17 (39mm), 23 (56mm) & 34 (83mm). **Step Angles:** 0.9°, 1.8°, 3.6° & 3.75°. Hybrid, unipolar or bipolar, precision ball bearings 3% accuracy, state-of-the-art performance. **Applications:** Disk drive, tape streamer, printers, plotters, medical equip., office automation machines.



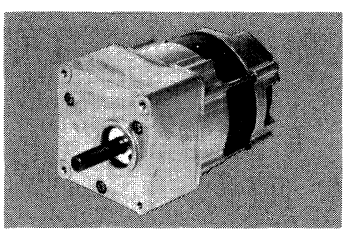
BRUSHLESS DC MOTORS



High energy rare earth magnet, 3 phase bipolar winding, efficient radial gap, precision ball bearing, outer or inner rotor, with or without hall sensors. **Applications:** Capstan motor of tape streamers, spindle motor of laser scanners, medical equip., peripheral equip. and air movers. **Options:** Optical encoder, tachometer, capstan, pulley & integral driver chips.

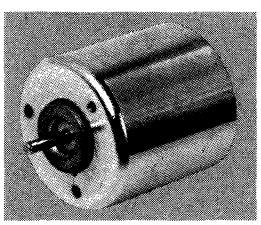


AC & DC GEARED MOTORS



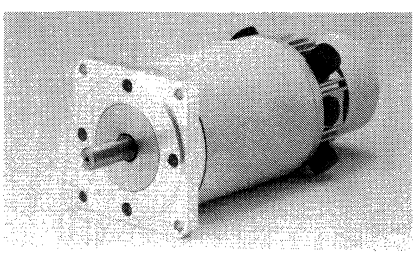
Induction motors, frame sizes of 60 to 100 mm dia. 120 or 220 vac, 50 or 60 HZ, torque ratings up to 70 KG-CM at 70 RPM. DC motors, frame sizes of 50 & 70 mm, various voltage ratings, torque ratings up to 40 KG-CM at 82 RPM.

CORELESS DC MOTORS



Ironless rotor, 23mm to 50mm dia., 8.5 to 1400 GM-CM starting torque. **Options:** Ball bearings, tachometer, terminals. **Applications:** Medical equip., office equip., recorders, small printers, plotters.

DC SERVO MOTOR AND ENCODER



State of the art performance, output range: 12 watts to 330 watts. Torque constant up to 1.8 KGCM/AMP, DIA: 38, 50, 52 and 72 mm. Precision ball bearings, high energy magnet, incremental encoder, all steel construction **Applications:** Robotics, NC machines, office automation, computer peripherals.

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Stock Drive Products—founded by engineers provides unique application assistance in the form of detailed handbooks and catalogs. In keeping with SDP traditions, this material provides very complete details on SDP products to help design engineers choose the products most acceptable to their needs. It is an accepted industry fact that SDP product quality is of the highest order as is SDP use of standard products detailed in the catalogs.

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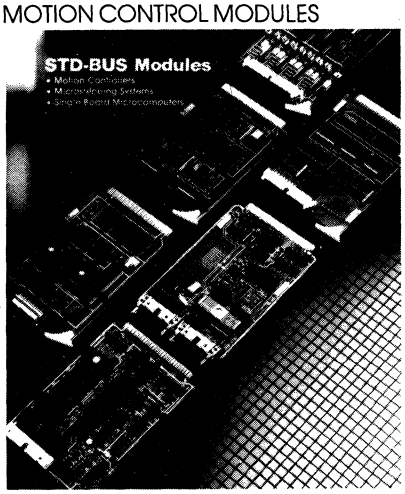
Send for your free copy of the extensive catalog of over 1,000 standard motion control products including DC and AC motors (both direct and reduction drive), steppers, tachometers, gearheads and fans plus off-the-shelf STD-BUS cards and motion control modules. Call 516-328-3970.

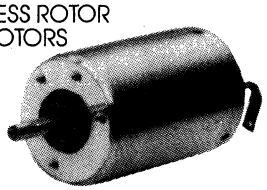


STD-BUS MOTION CONTROL MODULES



Control motor position, velocity or torque via RS-232, STD-BUS or local switch. Digital filtering. Idea for robotics/automation. Commands in ASCII. Stepper control, linear or circular interpolation. Microstep DAC controls 4 dc motors. A complete family of control modules, cards and boards available off-the-shelf. Catalog TI-822.

RONLESS ROTOR DC MOTORS



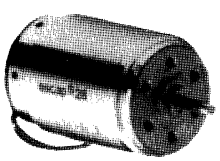
Permanent magnet ironless rotors provide up to 90% efficiency and high power/volume ratios. Many standard models from 7 mm x 12 mm rectangular motors to 36 mm diameter. Nominal voltages from 1.2 volts to 36 volts dc, stall torques exceeding 24 oz.-in.

DC GEARMOTORS



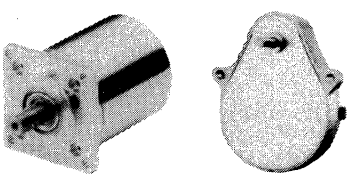
Supplied either with integral ironless rotor dc motors and gearheads or as assembled motors and gearbox components. A very wide range of torque and gear ratios. Static output torques up to 29.5 ft. lbs.

DC TACHOMETERS & MOTORS/TACHOMETERS



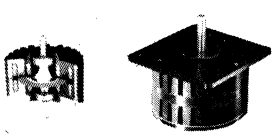
Ironless rotor construction ensures maximum reliability and performance. EMF constant 0.84 to 13.5 V/1000 rpm. Typ. ripple (pk-pk): 6-10%. Linearity & reversion error ±0.1%. Motor/tachs available with speed reducers.

GEARHEADS/SPEED REDUCERS



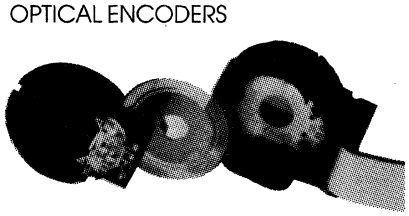
Precision construction in a variety of styles and ratios to fit most standard ac or dc motors. Ratios range from as little as 4.0625:1. to 360,000:1. A wide range of output torques are available. Static torque capability from 9.9 oz. in. to 29.5 ft. lbs. See Catalog SDP-823.

DISC MAGNET STEPPER MOTORS



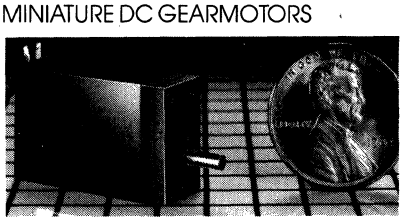
The outstanding performance offered by the escap line of disc magnet stepper motors is unequalled by any other kind of stepper motors. They are ideally suited for applications where rapid and precise incremental motion is to be achieved in a simple open loop drive. Weight is 50% less than comparable motors. From 32 mm to 112 mm diameter. Step angles of 1.8°, 3.6°, and 6° are available. Holding torques up to 354 oz. in.

OPTICAL ENCODERS



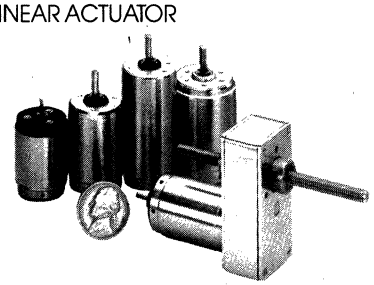
Integral single channel for motors 16 mm to 20 mm diameter. Integral Quadrature encoders for size 23 mm diameter to 34 mm diameter. HP HEDS 5000, 5010 and 5500 series for sizes 23 mm diameter to 36 mm diameter motors.

MINIATURE DC GEARMOTORS



Tiny precision ironless rotor dc motors with an integral gearbox with a choice of reduction of 3.67 to 2430; 1 of the 7200 rpm 2 or 4 Vdc motors. Maximum static output torque 9.9 oz. in. Maximum size is 9 mm wide x 15 mm high x 21.8 to 34.7 long. Wt.: 10 to 13 grams.

LINEAR ACTUATOR



Linear actuator with wide range of complimentary ironless dc and disk magnet stepper motors. Maximum holding force of 45 lbs. and linear speeds up to 3.9 ft./min.

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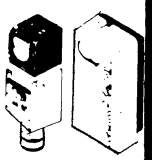
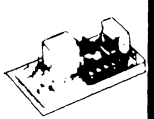
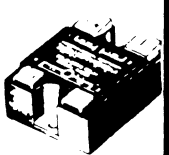

PHOTOELECTRICS

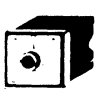

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

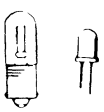

TERMINAL BLOCKS

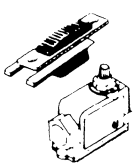

TEMPERATURE CONTROLS


TIMERS


CIRCUIT BREAKERS FUSES & FUSEHOLDERS


KNOBS


LAMPS & LEDS


SWITCHES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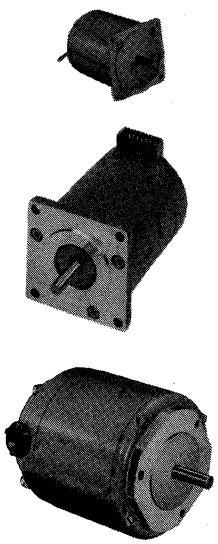
SLO-SYN® DC Stepping Motors

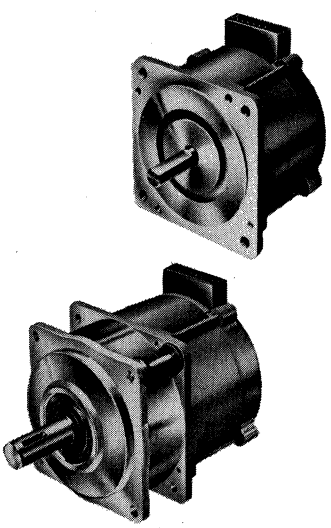
Permanent magnet type stepping motors that provide high torque-per-pound and torque-to-inertia ratios. Can be driven to speeds above 20,000 steps/second with low power input. Motors have Class B insulation and can be operated at an ambient temperature range of −40°C to +65°C. Continuous duty temperature is 65°C. Standard 1.8 degree step angle motors can be half-stepped or microstepped with accuracies of ± 5% or ± 3% noncumulative. Holding torque ratings from 53 to 5000 oz-in. To simplify installation and connections, new quick-connect, plug-in types are available. Motors have no brushes, ratches or gear and use shielded ball bearings to ensure reliability and long life.



BASIC MOTOR SERIES	MINIMUM HOLDING TORQUE,(2)(5) OZ-IN(6) (kg-cm)	MINIMUM RESIDUAL TORQUE,(5) OZ-IN (kg-cm)	NOMINAL ROTOR INERTIA, LB-IN² (kg-cm²)	TYPICAL TORQUE TO INERTIA RATIO (RAD/SEC²)	SHAFT DIAMETER, INCHES (mm)	MAXIMUM OVERHANG LOAD, LBS (kg)	MAXIMUM THRUST LOAD, LBS (kg)
M061	60 (4,3)	1 (0,07)	0.04 (0,12)	32x10³(3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M062	100 (7,2)	1.4 (0,1)	0.08 (0,23)	30x10³(3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M063	150 (10,8)	2.5 (0,18)	0.11 (0,32)	33x10³(3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M091	150 (10,8)	2 (0,14)	0.23 (0,67)	15.6x10³(3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M092	300 (21,6)	3.9 (0,28)	0.42 (1,23)	17.2x10³(3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M093	450 (32,4)	6.9 (0,5)	0.64 (1,87)	16.8x10³(3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M111	625 (45)	6 (0,43)	1.34 (3,93)	11.2x10³(3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M112-FD	1125 (81)	12 (0,86)	2.75 (8,06)	9.8x10³(3)	0.500 (12,7)	25 (11,3)	50 (22,7)
M112-FJ	1125 (81)	12 (0,86)	2.75 (8,06)	9.8x10³(3)	0.625 (15,88)	25 (11,3)	50 (22,7)
M113	1550 (112)	20 (1,44)	4.1 (12,0)	9.1x10³(3)	0.625 (15,88)	25 (11,3)	50 (22,7)
M172	2700 (194,4)	50 (3,6)	21 (61,5)	3.1x10³(3)	0.625 (15,88)	50 (22,7)	100 (45,4)

(2) Both windings energized at rated current.
(3) Calculated from holding torque in oz-in and rotor inertia in oz-in-sec² (lb. in²/24).
(5) Values are subject to change without notice. Parameters used as part of a specification should be verified with the factory.
(6) Operation below rated current will reduce torque and may degrade step accuracy.

SLO-SYN® AC Synchronous & Gearmotors



Provide slow basic shaft speed synchronous with line frequency. Allow direct load coupling without gearing. Instantaneous starting, stopping and reversing eliminate clutching and braking. Simple single-pole, 3-position switch provides complete forward, reverse and off control. Will not overheat or be damaged if stalled. Starting and running currents nearly identical. Conventional motors have speeds of 72 and 200 rpm at 60 Hz and torque ratings from 25 to 1800 oz-in.

New **high torque models** provide more power per frame size than any other synchronous motors. Types offered in NEMA frame size 23 and 34 with minimum running torque ranging from 60 to 420 oz-in. Shaft speed is 72 rpm at 60 Hz, 60 rpm at 50 Hz. **AC gearmotor models** offer torque ratings to 5000 oz-in and shaft speeds as low as 0.72 rpm at 60 Hz. All are designed for quick-connect, plug-in connection with optional mating connectors having 36 in. minimum length leads.

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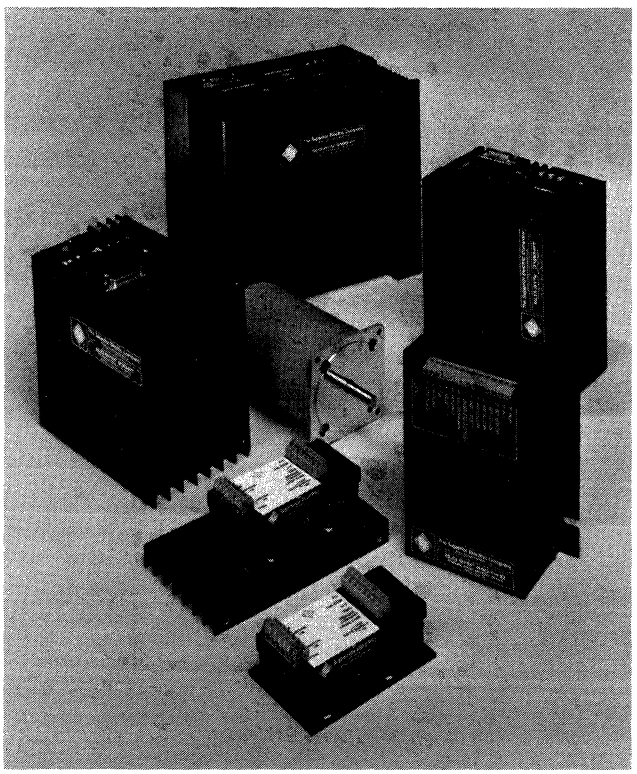
SLO-SYN®

Micro Series Stepper Motor Drives & Motion Controls



230 & 430 Series Translator Drives

All types in these series are available as modules for use with user supplied power supplies or packaged with all necessary power supplies.

- *Bipolar chopper, 2-phase stepper motor drives*
- *230 Series units are 2 A, 30 VDC*
- *430 Series units are 3.5 A, 30 VDC*
- *Capable of operating at reduced currents*
- *Full/half step operation*
- *Optically isolated inputs*
- *Modular units can be used alone or as integral PC board components with user supplied power supply*
- *Can be packaged with an integral power supply*
- *Also available with the following motion control features:*
  - *Oscillator for internal pulse source*
  - *Preset indexer for simple motion control*
  - *Fully programmable indexer for more sophisticated motion control*

440 Series Translator Drives

- *Bipolar chopper, 2-phase stepper motor drives*
- *1, 2, 3 or 4 A switch selectable motor current, 36 VDC*
- *1/5 – 1/10 or 1/125 microstep operation gives smoother performance and resonance-free operation*
- *Optically isolated inputs*
- *Full short circuit, undervoltage and transient overvoltage protection*
- *Available in easily mounted packages, power supply not included*

3180 Series Translator Drives

- *Bipolar chopper, 2-phase stepper motor drives*
- *0.5, 1, 2 and 3 A switch selectable motor current, 170 VDC*
- *Full/half, 1/10 or 1/125 step resolutions are available*
- *Optically isolated inputs*
- *Over-temperature protection*
- *Packaged with necessary power supplies*
- *Also available with the following motion control features:*
  - *Oscillator for internal pulse source*
  - *Preset indexer for simple motion control*
  - *Fully programmable indexer for more sophisticated motion control*

6180 Series Translator Drives

- *Bipolar chopper, 2-phase stepper motor drives*
- *1, 2, 3, 4 or 6 A switch selectable motor current, 170-190 VDC*
- *Full/half, 1/10 or 1/125 step operation*
- *Optically isolated inputs*
- *Over-temperature and short circuit protection*
- *Also available with the following motion control features:*
  - *Oscillator for internal pulse source*
  - *Preset indexer for simple motion control*
  - *Fully programmable indexer for more sophisticated motion control*

Enhanced Motion Controls



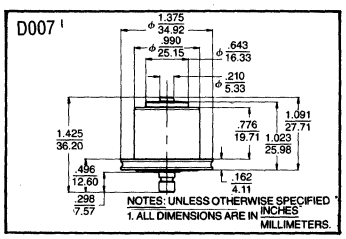
New SLO-SYN Enhanced Motion Controls are available for half- or full-step, 1/10 or 1/125 microstep operation of SLO-SYN DC Stepper Motors. Both open and closed loop indexer models are offered in preset (single line) and programmable (400 line) types for added versatility and improved performance. Features include:

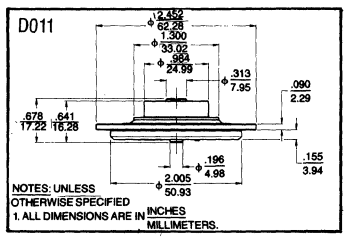
- *Selectable ramp profiles*
- *Additional I/O capabilities*
- *Velocity changes during motion*
- *Programmable backlash compensation*
- *Index from run*

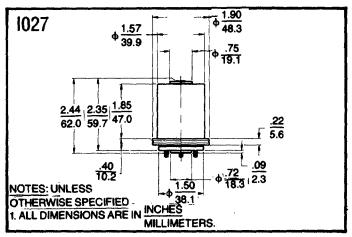
Call or write for complete literature on all Superior Electric Motion Control Equipment.

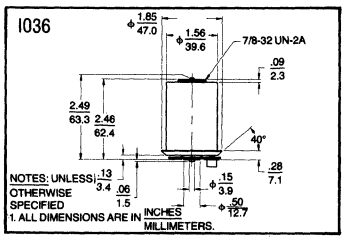
SYNEKTRON
THE MOTION CONTROL COMPANY

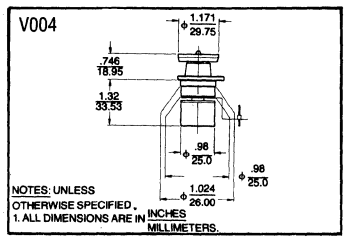
Spindle Motors

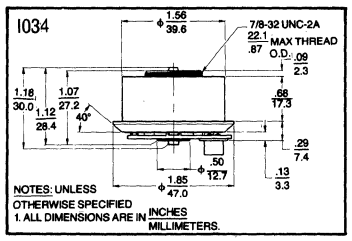












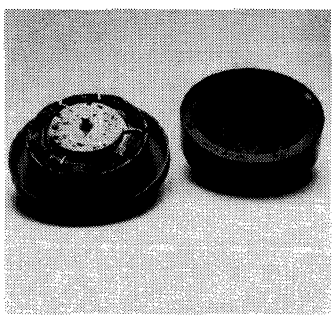
MOTOR MODEL NO.	UNITS	D007	D011	I027	I026	V004	I024
NO. OF POLES		8	8	8	8	4	4
V. MIN @ TERMINALS	VOLTS	9.6 to 12	9.1 to 11.6	11.0	10.0	12.0	10
R, RESISTANCE	OHMS	6	7	1.86	1.20	5.0	2.15 ± 10%
L, mHENRIES	mH	1-3 mH	10 mH (Max)	1.20	—	200-350	1.5 ± 15%
MOTOR SPEED, NOMINAL	RPM	3600	3600	3600	3600	1220	3600
AVE KT	OZ-IN/AMP	2.63	2.48	2.90	3.10	2.90	2.84 ± 0.1%
START TORQUE @	OZ-IN	2.4	1.7	10.6	9.0	6.0	5 (Min)
START CURRENT	AMPS	1.2	0.7	4.0	4.0	3.0	2.5
T/ISQRT (WATT)	OZ-IN (I*SQRT(R))	1.07	.94	2.16	3.10	2.19	1.94
TIMING TYPE		Sensorless	Sensorless	Hall	Hall	Hall	Hall
HALL TYPE		N/A	N/A	Digital	Digital	Digital	Digital
BEARING							
SIZE	MM	6x15x5	5x13x4	8x22x7	8x22x7	6x15x5	8x16x5
PRELOAD	POUNDS	4		11	8	5.5	4 to 5
TYPE		Double Shield	1 Shield 1 Non-Contact Seal	Double Seal	Double Seal	Double Shield	Non-Contact
GREASE		Multemp SRL	Multemp SRL	Multemp SRL	Multemp SRL	Andoc C	Multemp SRL
MAGNET MATERIAL		Ceramic	Ceramic	Ceramic	Ceramic	Rare Earth	Ceramic
SHAFT SEAL							
TYPE		Ferro Fluid	Labyrinth	Ferro Fluid	Ferro Fluid	N/A	Ferro Fluid
PRESSURE	INCHES (water)	3	N/A	5	6	N/A	6
REPETITIVE RUNOUT							
RADIAL	MICRO-INCH	500 (Max)	1000 (Max)	500 (Max)	800 (Max)	N/A	500 (Max)
AXIAL	MICRO-INCH	500 (Max)	600 (Max)	500 (Max)	300 (Max)	500 (Max)	300 (Max)
NON-REPETITIVE RUNOUT							
RADIAL	MICRO-INCH	20 (Max)	20 (Max)	20 (Max)	20 (Max)	N/A	20 (Max)
AXIAL	MICRO-INCH	30 (Max)	25 (Max)	25 (Max)	25 (Max)	90 (Max)	N/A

For more information about Synektron Spindle Motors and drives, write or call:

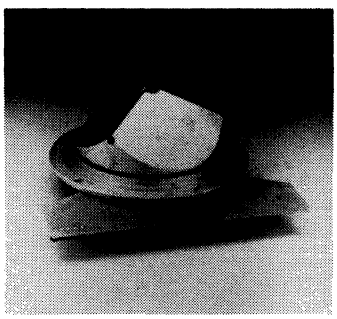
SYNEKTRON
THE MOTION CONTROL COMPANY
12000 Southwest Garden Place
Portland, Oregon 97223
Phone: 503•684•3090

SYNEKTRON
THE MOTION CONTROL COMPANY

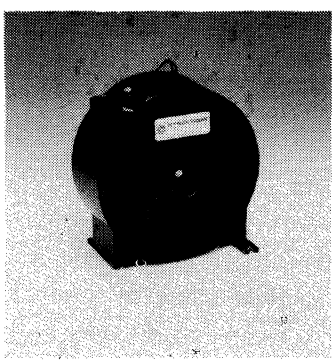
Variable-Speed, Brushless-Motors and Drives



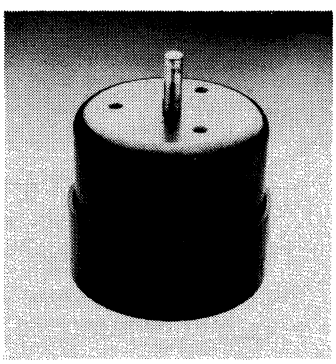
P/N F007



P/N S002



P/N F003



P/N H006

Synektron variable-speed, brushless-motors and drives save valuable space, reduce noise in products while increasing reliability and performance. The control electronics are integrated into the motor package.

A variety of control schemes are available to optimize speed/torque requirements for various applications. Synektron motors feature outer-rotating rotors. This gives a positive means of magnet retention and increases your flexibility in motor design and packaging.

P/N	PEAK OUTPUT POWER (W)	SPEED RANGE (rpm)	MAX. TORQUE (oz - in)	SUPPLY VOLTAGE (V)	RATED CURRENT (A)	MOTOR CONSTANT $\left(\frac{\text{oz - in}}{\sqrt{\text{W}}}\right)$	TORQUE CONSTANT $\left(\frac{\text{oz - in}}{\text{A}}\right)$	EFFICIENCY	CONTROL METHOD	MOTOR LENGTH (in)	MOTOR DIAMETER (in)	SHAFT DIAMETER (in)
F007	132	0-3000	92	9-20 DC	18	19.1	5.8	60-70%	VOLTAGE	2.75	5.55	.31
S002	6.5	5800-6200	2.3	20 DC	.55	1.6	2.6	30%	SPEED	1.65	3.30	.24
F003	50	4,000-9,000	10	115 AC	1.3	2.43	14.6	55%	SPEED	2.45	5.90	.31
H006	180	0-1200	240	115 AC	1.0	45.3	405	80-90%	CURRENT	4.82	5.60	.50

For more information, write or call:

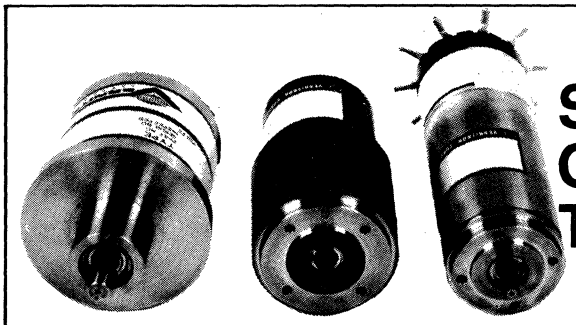
SYNEKTRON
THE MOTION CONTROL COMPANY
12000 Southwest Garden Place
Portland, Oregon 97223
Phone: 503•684•3090

VERNITECH

Division of VERNITRON CORPORATION

"TECHNOLOGY IN MOTION"

MOTORS/MOTOR GENERATORS



STANDARD DESIGNS OR CUSTOM DESIGNED TO YOUR REQUIREMENTS

HYSTERESIS SYNCHRONOUS MOTORS FOR LASER OPTICAL SCANNING POLYGON APPLICATIONS

VARIABLE FREQUENCY/SPEED
300 RPM To 48,000 RPM

BALANCED ROTORS
.0001 oz. inch

SHAFT RUNOUT & FLATNESS
.0001″

EXTENDED LIFE
10 Years without Relubrication

VOLTAGE RANGE
2.0 Volts to 280 Volts

THRU-BORE CONSTRUCTION
Precision Stator Bore

ALL UNITS WITH AND WITHOUT GEARHEADS

Servomotors Viscous Damped Motors Inertially Damped Motors Hysteresis Synchronous Motors*	Stepper Motors Motor Generators Rate Motor Tachometers	Computing Motor Tachometers Integrating Motor Tachometers Spin (Gyro) Motors

SIZES
BuOrd Size 5 (0.5″ Dia.) to BuOrd Size 33 (3.250″ Dia.)

SPEEDS
300 RPM to 48,000 RPM (Stepper Motors in Steps of 7.5°, 15°, 45°, and 90°)

FREQUENCY
30, 50, 60, 80, 400, 420, 800, 1000, and 1200 (Sine or Square Wave) Variable Frequency Motors are also standard at Vernitech

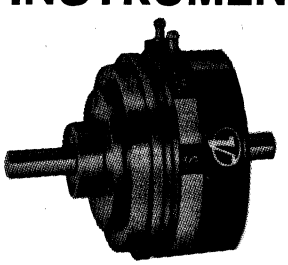
Poles — 2, 4, 6, 8, 12

VOLTAGES
2.0 Volts to 280 Volts

PHASES
1, 2, and 3
2, 3, and 4 (in Stepper Motors)

CLUTCHES AND BRAKES

PRECISION INSTRUMENT



These units are manufactured primarily to satisfy the high standards of Military requirements. Their above-standard quality is further emphasized by a high efficiency-to-size ratio. If precision is the need — then these are the instruments for you.

PERMANENT MAGNET HYSTERESIS CLUTCH

PMC Series

Designed for applications requiring repeatable torque and long life. Units can be utilized to comply with OSHA safety regulations and as a fail-safe device to protect other expensive components. In the 1.5 in. diameter frame size—torque is factory adjustable up to 8.5 oz. in. and can be held within 10% max., from unit to unit in speeds up to 10,000 R.P.M. Repeatability of torque level can be maintained within ±1%.

The PMC series will operate over a temperature range of −65°F to 260°F.

FAIL SAFE BRAKES (SBF SERIES)

DESIGN FEATURES

- ☐ Braking action occurs when coil is de-energized, or power fails.
- ☐ Unit is adjustable to compensate for wear.
- ☐ Zero backlash armature with spring release.
- ☐ Clamp-Lock hub for positive retention.
- ☐ Stationary field coil — no slip rings or brushes.
- ☐ Fast response time.

MANY INDUSTRIAL TYPES AVAILABLE

Refer to sections 2440, 4750, 5500 for additional product listings.

VERNITECH
300 Marcus Blvd., Deer Park, NY 11729
516-586-5100 • TWX 510-227-6089 • FAX 516-242-7940

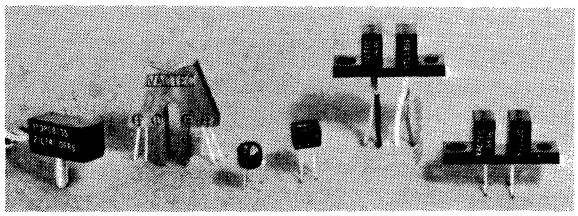
- Photoconductive Cells
- Interrupter Switches
- Phototransistors and Photodarlingtons
- Selenium Photovoltaic Cells
- Vactrols (Opto-Isolators)
- Standard Silicon and Blue-Enhanced Photovoltaic Cells, Blue-Enhanced Photodiodes, and PIN Photodiodes

EG&G VACTEC

INDUSTRY'S BROADEST OPTOELECTRONIC LINE

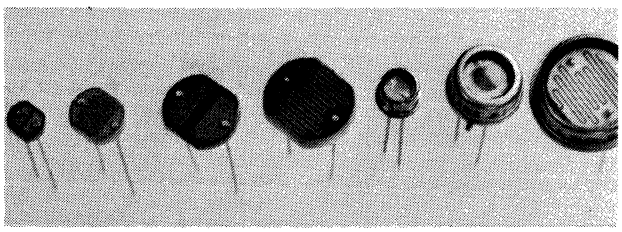
RETROREFLECTIVE & INTERRUPTER SWITCHES (SLOTTED)

Standard and custom optical switches—infrared GaAs LED and silicon phototransistor interrupters available in sealed housing of I-R transmitting plastic or opaque plastic with open apertures. Three retro styles: arrow, TO-18, and cubic.



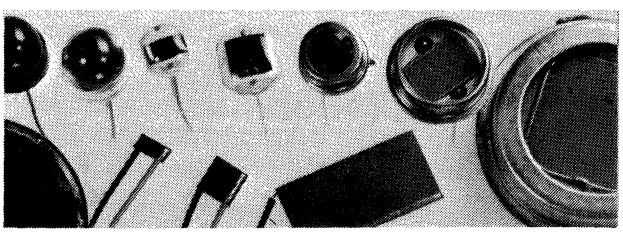
PHOTOCONDUCTIVE CELLS

Vactec light dependent resistors (LDR's) are available in three hermetic enclosures (TO-18, TO-5, TO-8) and 4 ceramic types. Ceramic types have automatically inserted wires which insure perfect contact integrity. Six materials of CdS, CdSe and CdSeS-CdS mixtures with spectral response peaks from 565-735 nm. Each material has a variety of sensitivities to satisfy all requirements.



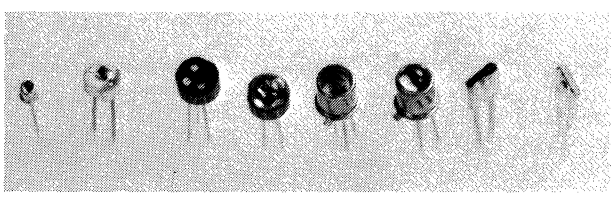
SILICON PHOTOVOLTAIC CELLS

Three processes: BLUE ENHANCED, LOW CAPACITANCE, STANDARD SOLAR. All available in a variety of hermetic, ceramic, as chips, or with flying leads. The BLUE ENHANCED cells are unique large area detectors with high U-V sensitivity to as low as 200 nm. Almost non-existent U-V enhancement effect with stability equivalent to high quality photodiodes. LOW CAPACITANCE cells have fast response less than 15μS with 10KΩ load. The high shunt impedance is desirable for driving amplifiers. SOLAR cells have high V_{oc} at low illumination (typ 200mV at .05mW/cm²). Linear over wide illumination range.



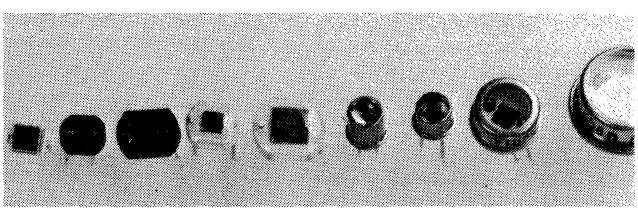
PHOTOTRANSISTORS — LED'S — PHOTODARLINGTONS — LIGHT ACTIVATED SWITCHES (LAS)

Phototransistors and photodarlingtons are NPN passivated—4 chip sizes of 25, 40, 50, and 60, mil square in TO-18, ceramic, coaxial, and lateral (side looking) packages. High light current at very low drive current ideal for instrumentation applications. GaAs I-R LED's with excellent stability in TO-18, T-1, T-1¾, lateral packages. LAS (light activated switches) have high sensitivity with Schmitt Trigger output. New—high power GaAlAs I-R LED's in TO-18, T-1, T-1¾ packages.



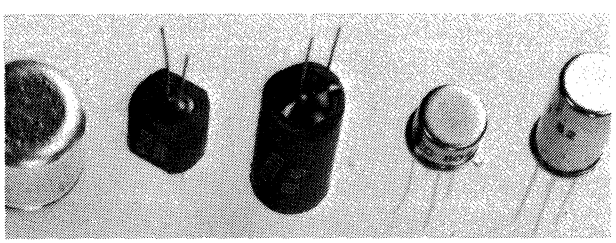
PHOTODIODES

BLUE ENHANCED photodiodes are extremely low dark current devices with excellent response in the U-V. Less than 10pA (I_D) for small chips. Large area diodes (VTB5051) 14.8mm² active area with 1.2A/(W/cm²) at 365nm and I_D of 250pA max. FAST photodiodes have low capacitance. Use with reverse bias for fast response time and excellent linearity. Ideal for remote I-R sensor digital controls.



VACTROLS

Optical couplers using LED's, neons, or incandescent lamps as the emitter and Vactec photoconductive cells (LDR's) as the detector. For noiseless switching and signal monitors for audio. Neon types to sense telephone ring. LED types for triac gate control. Incandescent types for low cost true RMS sensor as voltage regulator or control of constant wattage heater. Five package types include 2 hermetic.



WRITE FOR CUSTOM DETECTORS OR ASSEMBLIES ALL PRODUCTS

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MICRO SWITCH
a Honeywell Division

Solid State Sensor Capabilities

Honeywell, MICRO SWITCH division, means one-stop shopping for all commercially available sensors - from electromechanical through solid state.

Solid state sensing capabilities include: optoelectronic, Hall effect, pressure, temperature, air flow, optoelectronic airborne-ordnance-marine sensors, and fiber optic interconnect local area network (LAN) components. We are the complete single source for solid state components to meet your requirements. Our worldwide field specialists can recommend the best sensing solution for all your application needs.

Hall effect, pressure, temperature and airflow sensors are in the Switches section 5100.

Our Richardson, Texas facilities consolidate a full sensor/integrated circuit design capability with a "Class 10" wafer fabrication operation. Our sensor design specialists utilize the most up-to-date technologies and processes to provide you with the best quality solutions, at the best prices worldwide. Real time, Honeywell operated data links allow us to meet your JIT and SPC requirements.

You can get the world's largest lines of standardized catalog listings and customized sensing solutions in:

- Optoelectronic sensors
- Fiber optic sensors
- AOM (airborne-ordnance-marine) optoelectronic sensors.

We offer optoelectronic fiber optic components, modules, and integrated interfaces such as ethernet. Also available are custom-designed or off-the-shelf components and value-added assemblies for government, military and other applications requiring high reliability, radiation hardened, or special packaging. Applications range from satellites to missiles to drilling equipment.

Optoelectronic Sensors

Optoelectronics, the integration of optical principles and semiconductor electronics, has become the technology of choice for many sensing applications. Products include:

- **IREDs** (Infrared Emitting Diodes)
  Hermetic IREDs
  Plastic Encapsulated IREDs
- **Sensors**
  Hermetic Sensors
  Plastic Encapsulated Sensors
  Hermetic Optoschmitts
  Plastic Encapsulated Optoschmitts
- **Transmissive Assemblies**
- **Reflective Assemblies**

General application areas include:
- Object presence sensing
- Motion sensing
- Position encoding
- Non-invasive medical applications
- Limit sensing

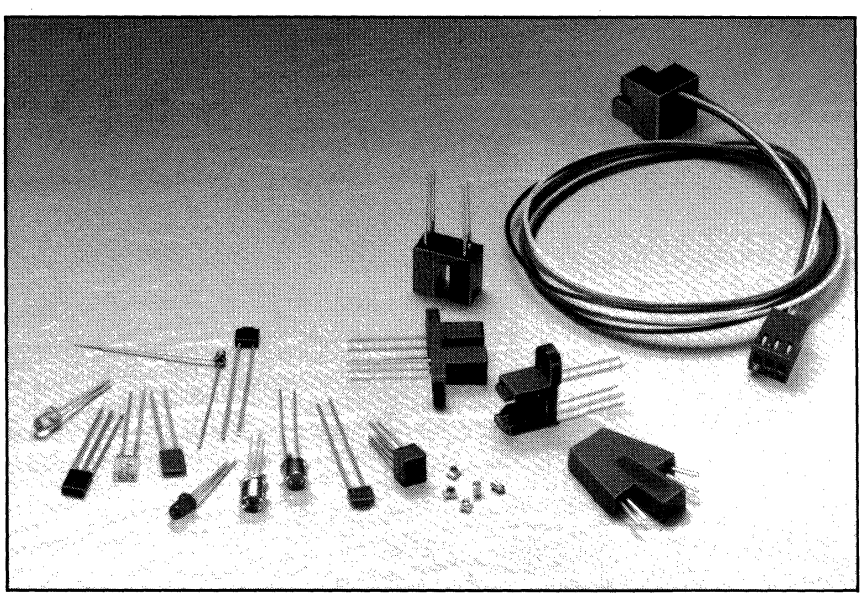
Some specific application for Honeywell sensors are:
- Printers
- Tape drives
- Copiers
- Flow meters
- Drop sensors
- Liquid-level sensing
- Thread-break sensing

One of Honeywell's many advantages is the unique transfer molded T-1 package which has no parting line in the optical lens area to interfere with beam emission.

The sensors in Catalog 25 are the standard listings. They offer a broad selection of low cost, off-the-shelf solutions for many applications.

Telephone: 1-800-367-6786
In Texas: 214-470-4271

In addition to the standard products offered in Catalog 25, Honeywell can also provide custom solutions, ranging from special parameter selections, special marking or packaging, to completely customized sensors. Honeywell has a staff of experienced design engineers who are available to provide assistance at any stage of the product development, from R & D through production. Contact one of Honeywell's field sales engineers for further information or design assistance.



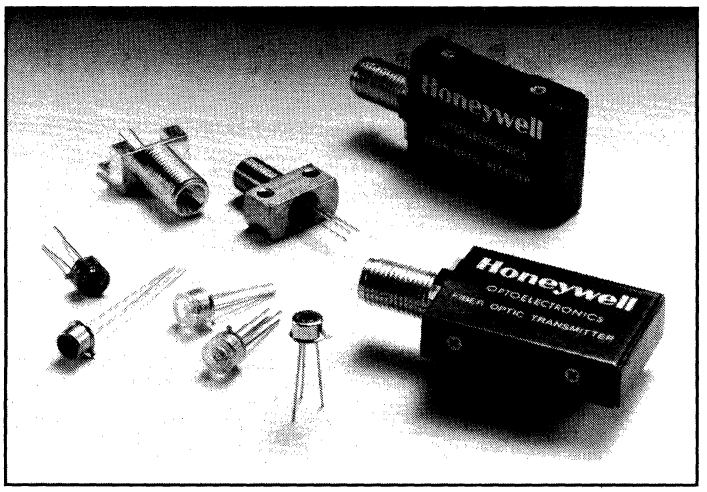
MICRO SWITCH
a Honeywell Division

Other Optoelectronic Products

FIBER OPTICS

Honeywell is a leader in the field of fiber optics. The Fiber Optics group specializes in the design, development and manufacture of active optoelectronic components and subassemblies for the short-haul fiber optic datacom market. Honeywell active fiber optic products are compatible with the majority of standard multimode fiber optic connectors and cables now available in the industry.

Honeywell also offers custom fiber optic products (Dash 900). These products are Honeywell standard products with special testing, selection, documentation and/or minor physical changes to meet special requirements. In addition, Honeywell has the capability for major development programs for new innovative fiber optic products. Technical assistance and additional product data as well as custom capability are available from the Honeywell Sales Offices.



The **Fiber Optic Components Selection Guide** lists the Honeywell standard products now available and includes:

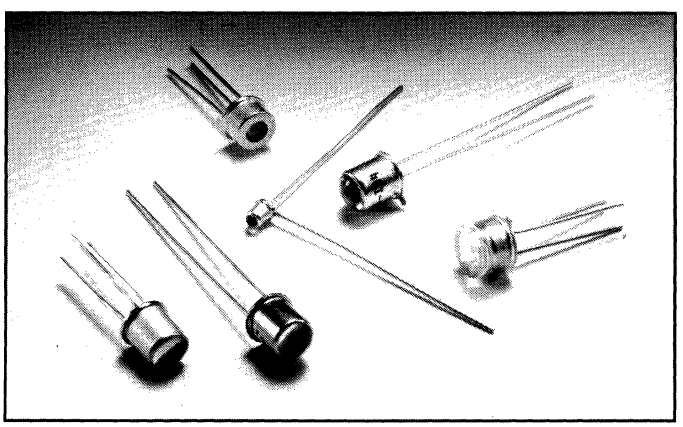
- Connectorized Components
- Fiber Optic Modules
- Fiber Optic LEDs and Integrated Transmitters
- Photo Diodes and Integrated Receivers
- Conversion Information

HIGH RELIABILITY PRODUCTS

Honeywell Optoelectronics has been a leader in advancing both fiber optic and optoelectronics technology. Its products have been used in many different commercial and military applications all over the world.

Both individual optoelectronic components and custom designed and manufactured sub-assemblies have been used in aerospace, missile, land vehicles, aircraft and shipboard systems. Honeywell Optoelectronics' products and sub-assemblies, for example, have been used in the TOW and Hellfire anti-armor missile systems, the Trident submarine navigation system, the heat-seeking Sidewinder air-to-air missile, PAVEWAY glided bombs, and in the M1 Main Battle Tank's fire control system.

Because Honeywell is a leading supplier of both commercial and high-reliability military specification optoelectronic components, it has the largest selection of emitters and detectors of any manufacturer in the industry.



Many of these proven commercial components undergo additional testing in accordance with MIL-S-19500 for vibration, thermal shock, burn-in, constant acceleration and hermeticity. They can be designed for radiation hardened applications, qualifying them for use by defence contractors in their products.

High reliability optoelectronic components from Honeywell are the choice of many major defense contractors because of their proven reliability, their electrical performance and because Honeywell delivers on-time.

SALES AND SERVICE

MICRO SWITCH serves its customers through a worldwide network of sales offices and distributors. For ordering, application assistance, pricing or name of nearest Authorized Distributor, contact a nearby MICRO SWITCH sales office. See the EEM Yellow Pages or contact:

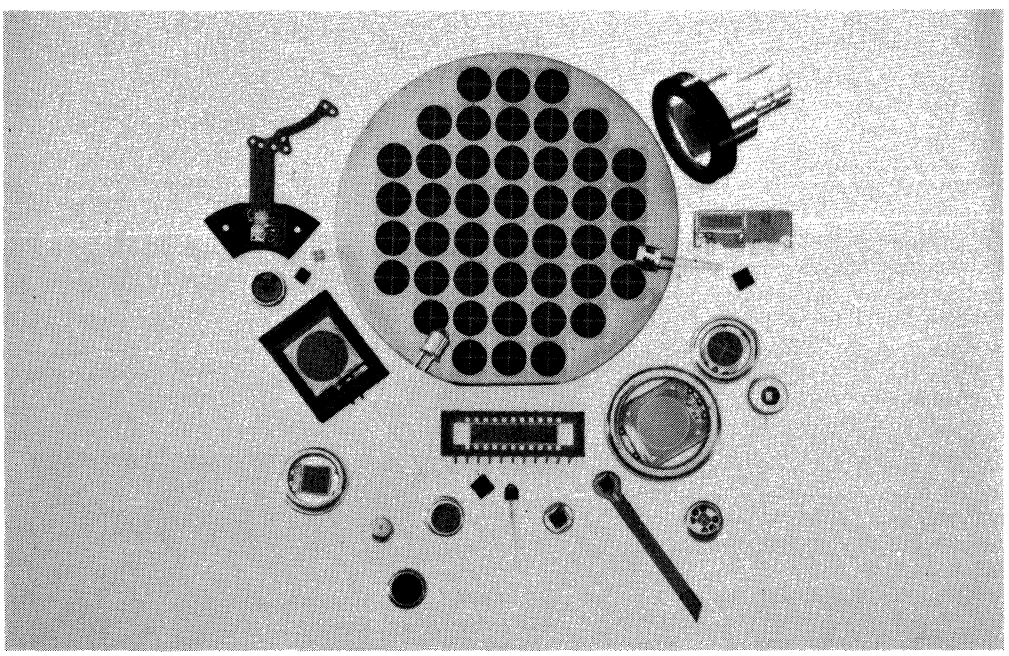
MICRO SWITCH
11 W. Spring St.
Freeport, Illinois 61032
Tel. 815/235-6600

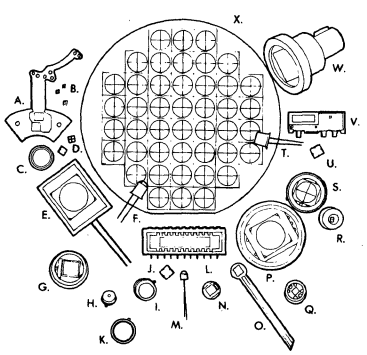
SILICON PHOTODIODES

CENTRONIC...making silicon sense

Custom
Standard
Commercial
Mil Spec

Always Cost effective





COMPONENT IDENTIFICATION

A. Special Flex Circuit Mounting
B. BPX65 Chips
C. Special Filter
D. Silicon Chips
E. OSD100-5T Special Mounting
F. BPX65B
G. OSI35
H. AX65-R2F
I. OSD5-E
J. Silicon Chip
K. OSD5-5T With Filter
L. LD20
M. CD1705
N. Special PC Board Mounting
O. Special Flex Circuit Mounting
P. OSI100-1R-40K
Q. CD3H-4D
R. Special Detector OP/AMP - 1444F
S. OD50-5T
T. BPX65
U. OSD15-5T Chip
V. Special PC Board Mounting
W. OSD100-5T-BNC
X. QD50-5T Silicon Wafer

WE ARE WELL EQUIPPED TO SUPPLY SILICON PHOTODIODES, WHETHER STANDARD LINE OR "APPLICATION SPECIFIC", AT VERY COMPETITIVE PRICING, WITH ON-TIME DELIVERY AND CONTINUING CUSTOMER SUPPORT.

CENTRONIC

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Tel: 805-499-5902 FAX: 805-499-7770

Morgan

sensors

MURATA ERIE NORTH AMERICA

Pyroelectric Infrared Sensor IRA Series

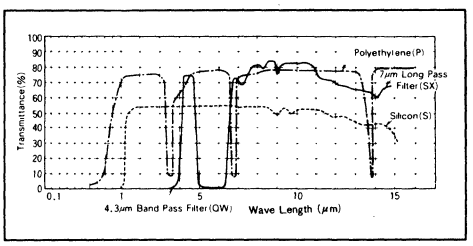
FEATURES

- Low cost
- Broad band response
- High sensitivity
- No cryogenics
- HIC® H8D1779 type preamplifier is available for dual elements.

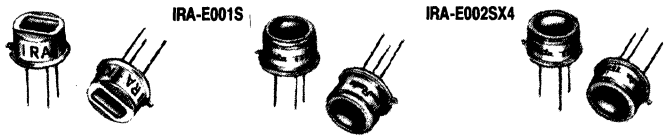
APPLICATIONS

- Passive IR Intruder Alarm System
- Automatic Door
- Light Switch
- Physical Detectors
- Toy, etc.

SPECTRAL RESPONSE OF WINDOW MATERIALS



IRA-K001SV IRA-E001S IRA-E002SX4



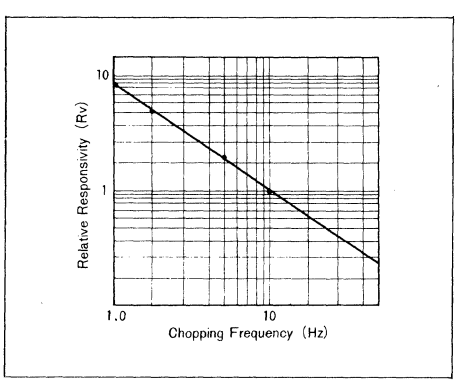
RATINGS (25°C, typical type)

Part Number	Responsivity (500°K) (1Hz, 1Hz)	Specific Detectivity 500°K 1Hz, 1Hz	Wave Length Range	Rise Time	Field of View	Window	Electrode	Supply Voltage	Output Resistance	Operating Temp. Range (°C)	Storage Temp. Range (°C)
IRA-E001S	870V/W	To 1×10^{8}cmHz1/2W^{-1}	1 To 20μm	<25msec.	70°	Silicon	2mmϕ	3 to 15VDC	10KΩ	−20 To +80	−30 To +100

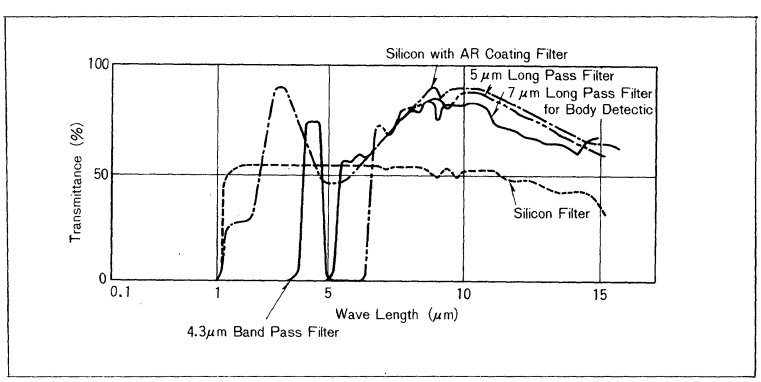
SPECIFICATIONS (At 25°C)

Product	Dual Element				Quad Element
Item	IRA-E100SZ1	IRA-E100ST1	IRA-E100SV1	IRA-E100S1	IRA-E009SX1
Sensitivity (500°K, 1Hz, 1Hz)	11150V/W	1690V/W	1860V/W	1470V/W	1080V/W
Specific Detectivity (500°K, 1Hz, 1Hz)	1.2×10^{8} cmhz$^{1/2}$W	1.0×10^{8} cmhz$^{1/2}$W	1.0×10^{8} cmhz$^{1/2}$W	1.0×10^{8} cmhz$^{1/2}$W	0.9×10^{8} cmhz$^{1/2}$W
Wave Length Range	7 to 14μm	5 to 14μm	1 to 20μm	1 to 20μm	7 to 14μm
Rise Time	<25msec	<25msec	<25msec	<25msec	<25msec
Field of View	$\theta_1=\theta_2=51°$	$\theta_1=\theta_2=38°$	$\theta_1=\theta_2=38°$	$\theta_1=\theta_2=38°$	$\theta_1=47°$ $\theta_2=32°$
Photoelectric Filter	7μm long pass silicon	5μm long pass silicon	silicon AR coat	silicon	7μm long pass silicon
Electrode	(2×1mm)×2	(2×1mm)×2	(2×1mm)×2	(2×1mm)×2	(1.75×1mm)×4
Supply Voltage	3 to 15V	3 to 15V	3 to 15V	3 to 15V	3 to 15V
Operating Tem. Range	-25 to +55°C	-25 to +55°C	-25 to +55°C	-25 to +55°C	-25 to +55°C
Storage Temp. Range	-30 to +100°C	-30 to +100°C	-30 to +100°C	-30 to +100°C	-30 to +100°C

FREQUENCY CHARACTERISTICS



SPECTRAL RESPONSE OF WINDOW MATERIALS



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NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94043 • 415/960-6000 • FAX: 415-965-6272

OPTOELECTRONIC DEVICES

Light Emitting Diodes

Remote Control

Part Number	Material	Features	Absolute Maximum Ratings (T_a = 25°C)			Typical Characteristics (T_a = 25°C)			
			P_d (mW)	I_F (mA)	T_{stg} (°C)	V_F TYP. (V) (I_F = 30 mA)	I_R TYP. (μA) (V_R = 3 V)	λp TYP. (nm) (I_F = 30 mA)	P_o TYP. (mW) (I_F = 30 mA)
SE301A	GaAs	High output High reliability	150	100	−65 to +125	1.2 (I_F = 50 mA)	0.01	940 (I_F = 50 mA)	6 (I_F = 50 mA)
SE302A	GaAs	Mini size	75	50	−30 to +80	1.2	0.01	940	1.5
SE303A-C	GaAs	High output Wide radiation angle	150	100	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	8 (I_F = 50 mA)
SE304	GaAs	Lateral direction output	100	50	−40 to +100	1.2	0.01	940	1.5
SE306	GaAs	Lateral direction output with a lens	100	50	−40 to +100	1.1 (I_F = 10 mA)	0.01	940 (I_F = 10 mA)	0.5 mW/sr (I_F = 10 mA)
SE307-C	GaAs	ULTRA High output Narrow radiation angle	150	100	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	30 mW/sr (I_F = 50 mA)
SE308	GaAs	Small package Lateral direction output	100	50	−40 to +100	1.14 (I_F = 20 mA)	0.01	940 (I_F = 20 mA)	0.85 mW/sr (I_F = 20 mA)
SE310	GaAs	High output Small package	150	60	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	11 mW/sr (I_F + 50 mA)
SE313	GaAs	ULTRA High output Middle radiation angle	150	100	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	25 mW/sr (I_F = 50 mA)
SE1003-C	GaAlAs on GaAs	ULTRA High output Wide radiation angle	150	100	−40 to +100	1.27 (I_F = 50 mA)	0.01 (V_R = 5 V)	950 (I_F = 50 mA)	20 mW/sr (I_F = 50 mA)

PIN Photo Diodes

Remote Control

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Typical Characteristics (T_a = 25°C)		
		V_R (V)	P_D (mW)	T_{stg} (°C)	S_{IR} TYP* (μA) (V_R = 5 V)	I_R (nA) (V_R = 10 V)	t_r (ns) (R_L = 1 kΩ) (V_R = 5 V)
PH302	Low cost PIN photo diode	32	150	−40 to +80	6 (S = 50 nA/lx)	to 30	50
PH302B	Low cost PIN photo diode PH302 with visible cut filter	32	150	−40 to +80	5 (S = 32 nA/lx)	to 30	50
PH302C	Low cost PIN photo diode Built-in visible cut filter	32	150	−40 to +80	5 (S = 32 nA/lx)	to 30	50
PH309	Low cost PIN photo diode Small Package with Lens Built-in visible cut filter	32	150	−40 to +80	5 (S = 32 nA/lx)	to 10	30
PH310	Low cost PIN photo diode Ultra Small Package with Lens Built-in visible cut filter	32	150	−40 to +100	5 (S = 32 nA/lx)	to 10	30
PH320	Low cost PIN photo diode Ultra Small Package with Lens Built-in visible cut filter	32	150	−40 to +100	4.3	to 10	30

*Measured with an infrared LED (λp = 940 nm).
**Measured with a tungsten filament lamp operated at a color temperature of 2 854 K.

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OPTOELECTRONIC DEVICES

PIN Photo Diodes (cont.)

Optical Disk

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)				Typical Characteristics (T_a = 25°C)							
						I_D (nA)		S(A/W)			t_r, t_f (ns)		
		V_R (V)	P (mW)	T_{opt} (°C)	T_{stg} (°C)	V_R (V)	Max.	V_R (V)	λ (nm)	Typ.	V_R (V)	R (kΩ)	Typ.
PH311	Small Package Multi Detecting Area	20	20	−20 to +80	−40 to +100	15	4	15	780	0.3	15	1	1
PH312	Small Package Multi Detecting Area	20	20	−20 to +80	−40 to +100	15	4	15	780	0.52	15	1	1
PH313	Small Package Multi Detecting Area	20	20	−20 to +80	−40 to +100	15	4	15	780	0.52	15	1	1
PH314	Small Package Multi Detecting Area	20	20	−20 to +80	−40 to +100	15	4	15	780	0.52	15	1	1

Photo Transistors

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)				Typical Characteristics (T_a = 25°C)		
		P_c (mW)	I_c (mA)	V_{CEO} (V)	T_{stg} (°C)	I_{CEO} (nA) V_{CE} = 10 V L = 0	$V_{CE(sat)}$(V) (L = 1000 lx)	L_L (μA) V_{CE} = 2 V (L = 100 lx)
PH101	High Sensitivity (Darlington Tr.)	100	50	20	−30 to +80	to 500 (V_{CE} = 15 V)	to 1.5	10 mA to
PH102	High speed	100	40	20	−30 to +80	to 200	to 0.3	50 to
PH103	High Sensitivity (Darlington Tr.)	100	50	30	−40 to +100	to 400	to 1.5	2 mA to
PH104	High speed	100	40	30	−40 to +100	to 100	to 0.3	20 to
PH105	High reliability	150	50	30	−40 to +100	to 200	to 0.3	500 (V_{CE} = 10 V)
PH106	High speed Built-in visible cut filter	100	40	30	−40 to +100	to 100	to 0.3	60 to
PH107	High sensitivity Built-in visible cut filter	100	50	30	−40 to +100	to 400	to 1.5	10 mA to
PH108	Small package High speed	100	40	30	−40 to +100	to 100	to 0.3 (I_C = 0.5 mA) (H = 5 mW/cm²)	0.3 mA to (V_{CE} = 5 V) (H = 0.5 mW/cm²)
PH108A	PH108w with Built-in visible cut off filter	100	40	30	−40 to +100	to 100	to 0.3 (I_C = .5 mA) (H = 5 mW/cm²)	0.2 mA to (V_{CE} = 5 V) (H = .5 mW/cm²)
PH110	Small package Built-in visible cut filter	100	40	30	−40 to +100	to 100	to 0.3 (I_C = 200 μA) (H = 5 μW/cm²)	200μA to (V_{CE} = 5 V) (H = 0.5 μW/cm²)

Photo ICs

Photo Interrupter

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Typical Characteristic (T_a = 25°C)	
		V_{CC} (V)	I_{OL} (mA)	T_{opt} (°C)	I_{CCL} (mA) (V_{CC} = 5 V)	V_{OL}(V) (I_{OL} = 16 mA) (V_{CC} = 5 V)
PH502HR	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor	17	50	−30 to +85	to 5	to 0.4
PH502HC	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output	17	50	−30 to +85	to 5	to 0.4 (R_L = 280Ω)

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OPTOELECTRONIC DEVICES

Photo ICs (cont.)

Photo Interrupter

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Typical Characteristic (T_a = 25°C)	
		V_{CC} (V)	I_{OL} (mA)	T_{opt} (°C)	I_{CCL} (mA) (V_{CC} = 5 V)	V_{OL}(V) (I_{OL} = 16 mA) (V_{CC} = 5 V)
PH502LR	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor	17	50	−30 to +85	to 5	to 0.4
PH502LC	Built-in Schmitt Trigger circuit Active "LOW" Open collector output	17	50	−30 to +85	to 5	to 0.4 (R_L = 280Ω)

Optical Disk

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)				Typical Characteristics (T_a = 25°C)								
						f_T	V_{BIAS}				V_O (mV)		S (A/W)	
		V_R (V)	P (mW)	T_{opt} (°C)	T_{stg} (°C)	I_{CC} (nA) Typ.	R_1 (kΩ)	R_2 (kΩ)	(V)	(MHz) Typ.	I_{IN} (μA)	Min.	λ (nm)	Typ.
PH503	Built-in I-V Amplifiers Small transparent 16 pin plastic package	20	20	−20 to +80	−40 to +100	14.1	18	13	2.5 ± 0.1	2	1.7	80	780	0.3

Optoisolators

Multichannel Type

Part Number*	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2501-1 PS2501L-1	4 pin DIP 1 channel	5 k	80	50	80 to 600	3	5
PS2501-2 PS2501L-2	8 pin DIP 2 channels						
PS2501-3 PS2501L-3	12 pin DIP 3 channels						
PS2501-4 PS2501L-4	16 pin DIP 4 channels						
PS2502-1 PS2502L-1	4 pin DIP 1 channel	5 k	80	200	200 to	100	100
PS2502-2 PS2502L-2	8 pin DIP 2 channels	5 k	80	160	200 to	100	100
PS2502-3 PS2502L-3	12 pin DIP 3 channels						
PS2502-4 PS2502L-4	16 pin DIP 4 channels						
PS2503-1 PS2503L-1	4 pin DIP 1 channel	5 k	50	30	100 to 400	8 (R_L = 10 kΩ)	60 (R_L = 10 kΩ)

*L suffix designates lead formed (gullwing) package for surface mount applications.

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OPTOELECTRONIC DEVICES

Optoisolators (cont.)

Multichannel Type (cont.)

Part Number*	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2503-2 PS2503L-2	8 pin DIP 2 channels	5 k	50	30	100 to 400	8 (R_L = 10 kΩ)	60 (R_L = 10 kΩ)
PS2503-3 PS2503L-3	12 pin DIP 3 channels						
PS2503-4 PS2503L-4	16 pin DIP 4 channels						
PS2505-1 PS2505L-1	4 pin DIP 1 channel	5 k	±80	50	80 to 600	3	5
PS2505a-2 PS2505aL-2	8 pin DIP 2 channels						
PS2505-3 PS2505L-3	12 pin DIP 3 channels						
PS2505-4 PS2505L-4	16 pin DIP 4 channels						
PS2506-1 PS2506L-1	4 pin DIP 1 channel	5 k	±80	200	200 to	100	100
PS2506-2 PS2506L-2	8 pin DIP 2 channels	5 k	±80	160	200 to	100	100
PS2506-3 PS2506L-3	12 pin DIP 3 channels						
PS2506-4 PS2506L-4	16 pin DIP 4 channels						

*L suffix designates lead formed (gullwing) package for surface mount applications.

Surface Mount Type

Part Number**	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2701-1 PS2701-1-E3 PS2702-1-E4	Surface mount 1 channel	2.5 k	50	80	50 to 300	3	5
PS2701-2	Surface mount 2 channels						
PS2701-4	Surface mount 4 channels						
PS2702-1 PS2702-1-E3 PS2702-1-E4	Surface mount 1 channel	2.5 k	50	200	200 to	100	100
PS2702-2	Surface mount 2 channels	2.5 k	50	160	200 to	100	100
PS2702-4	Surface mount 4 channels						
PS2703-1 PS2703-1-E3 PS2703-1-E4	Surface mount 1 channel	2.5 k	50	30	50 to 4000	10 (R_L = 1 kΩ)	10 (R_L = 1 kΩ)
PS2703-2	Surface mount 2 channels						

**E3, E4 suffix denote tape and reel versions. Please consult data book.

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OPTOELECTRONIC DEVICES

Optoisolators (cont.)

Surface Mount Type

Part Number**	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2703-4	Surface mount 4 channels	2.5 k	50	30	50 to 400	10 (R_L = 1 kΩ)	10 (R_L = 1 kΩ)
PS2705-1 PS2705-1-E3 PS2705-1-E4	Surface mount 1 channel	2.5 k	±50	80	50 to 300	3	5
PS2705-2	Surface mount 2 channels						
PS2705-4	Surface mount 4 channels						
PS2706-1 PS2706-1-E3 PS2706-1-E4	Surface mount 1 channel	2.5 k	±50	200	200 to	100	100
PS2706-2	Surface mount 2 channels	2.5 k	±50	160	200 to	100	100
PS2706-4	Surface mount 4 channels						
PS2707-1 PS2707-1-E3 PS2707-1-E4	Surface mount 1 channel	2.5 k	50	30	50 to 400	10 (R_L = 1 kΩ)	10 (R_L = 1 kΩ)
PS2707-2	Surface mount 2 channels						
PS2707-4	Surface mount 4 channels						

**E3, E4 suffix denote tape and reel versions. Please consult data book.

6 Pin Type

Part Number*	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2601 PS2601L	with base pin	5 k	80	50	80 to 600	3	5
PS2602 PS2602L							
PS2603 PS2603L	with base pin	5 k	80	200	200 to	100	100
PS2604 PS2604L							
PS2605 PS2605L	with base pin	5 k	±80	50	80 to 600	3	5
PS2606 PS2606L							
PS2607 PS2607L	with base pin	5 k	±80	200	200 to	100	100

*L suffix designates lead formed (gullwing) package for surface mount applications.

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OPTOELECTRONIC DEVICES

Optoisolators (cont.)

6 Pin Type

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_O (mA)	CTR (%)	t_{PHL} (µs) (Typ.)	t_{PHL} (µs) (Typ.)
PS2608 PS2608L	with base pin	5 k	±80	200	200 to	100	100
PS2621 PS2621L	with base pin	5 k	150	50	20 to 50	3	5
PS2622 PS2622L							
PS2625 PS2625L	with base pin	5 k	±150	50	20 to 50	3	5
PS2626 PS2626L							
PS2633 PS2633L	with base pin	5 k	80	150	1000 to 15000	100	100
PS2634 PS2634L							
PS2651	with base pin	5 k	80	50	50 to 400	3	5
PS2652							
PS2653	with base pin	5 k	80	200	200 to	100	100
PS2654							

*L suffix designates lead formed (gullwing) package for surface mount applications.

High Speed Type

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_O (mA)	CTR (%)	t_{PHL} (µs) (Typ.)	t_{PHL} (µs) (Typ.)
PS2006B (6N136)	8 pin DIP	3 k	25	8	15 to	0.3	0.8
PS2041	6 pin DIP	2.5 k	25	8	15 to	0.3	0.8
PS2043	8 pin DIP						
PS2044	8 pin DIP, (alternate pinout)						

Ultra High Speed Type

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_O (mA)	CTR (%)	t_{PHL} (µs) (Typ.)	t_{PHL} (µs) (Typ.)
PS2007B (6N137)	8 pin DIP, logic output	2.5 k (DC)	10	50	600	50	50

Photo SCR Coupler

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)	
		BV ($V_{r.m.s.}$)	V_{DRM} (V)	I_T (mA)	I_{FT} (mA)	t_{on} (µs) (Typ.)
PS3001 (1)	6 pin	2.5 k	200	300	to 12	20 I_{FT} = 50 mA R_{GK} = 27 kΩ V_D = 6 V R_L = 10 Ω
PS3002(1)	6 pin	2.5 k	400	300	to 12	
PS3603	6 pin	5 k	600	300	to 10	

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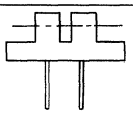
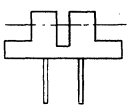
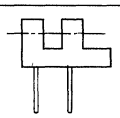
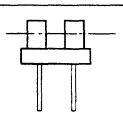
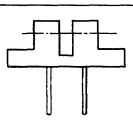
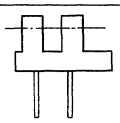
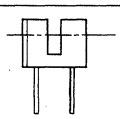
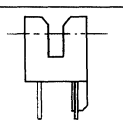
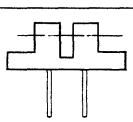
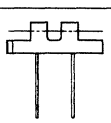
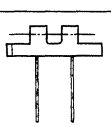
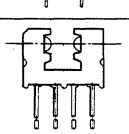
OPTOELECTRONIC DEVICES

Photo Interrupters

Transistor Output Type

Part Number	Outline	Characteristics (T_a = 25°C)			Features
		CTR (%)	I_F	V_{CE}	
PS4001		20 to	10 (mA)	2 (V)	Darlington Tr. Aperture: 1 mm□ 4 pin
PS4003		15 to	10	2	Darlington Tr. 4 pin
PS4005		20 to	10	2	Darlington Tr. 4 pin
PS4007		20 to	10	2	Darlington Tr. 4 pin
PS4008		0.5 to	10	2	Single Tr. High speed (t_r, t_f = 5 µs) 4 pin
PS4009		20 to	10	2	Darlington Tr. 4 pin
PS4010		20 to	10	2	Darlington Tr. 4 pin
PS4011		20 to	10	2	Darlington Tr. Aperture: 1 mm□ 4 pin
PS4014		0.5 to	10	2	Single Tr. High speed (t_r, t_f = 5 µs) 4 pin
PS4501		2.5 to	10	2	Single Tr. Aperture: 0.5 mm slit 4 pin
PS4502		200 to	5	2	Darlington Tr. Aperture: 0.5 mm slit High CTR 4 pin
PS4601		1.5 to	10	2	One-piece molded Single Tr. 4 pin

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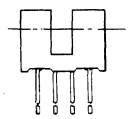
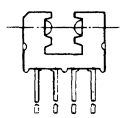
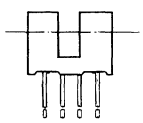
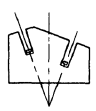
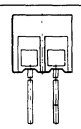
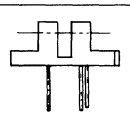
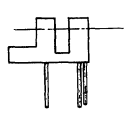
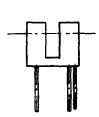
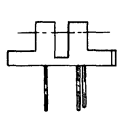
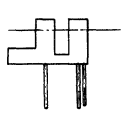
OPTOELECTRONIC DEVICES

Photo Interrupters (cont.)

Transistor Output Type

Part Number	Outline	Characteristics (T_a = 25°C)			Features
		CTR (%)	I_F	V_{CE}	
PS4602		1.5 to	10	2 (V)	One-piece molded PS4601 with a light-shielded case Single Tr. 4 pin in-line
PS4651		40 to	5	2	One-piece molded Darlington Tr. 4 pin
PS4652		40 to	5	2	One-piece molded PS4651 with a light-shielded case Darlington Tr. 4 pin
PS6001A		100 (μA) to	≈30	5	Photo Reflective Sensor Single Tr. 4 pin
			speculum reflecting surface		
PS6002		400 (μA) Typ.	10	2	Photo Reflective Sensor Single Tr. High sensitivity 4 pin
			white reflecting surface		

IC Output Type

Part Number	Outline	Characteristics (T_a = 25°C)		Features
		I_{FLH} (mA)	(V_{CC} (V)	
PS5001HC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5002HC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5003HC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5001HR		to 5	5	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5002HR		to 5	5	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin

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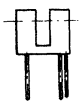
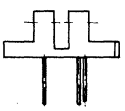
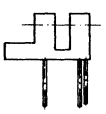
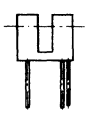
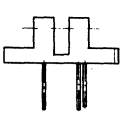
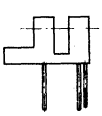
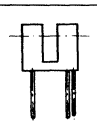
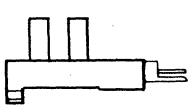
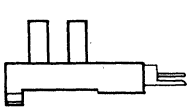
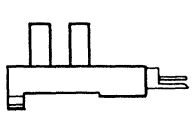
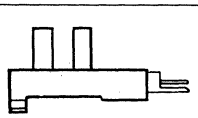
OPTOELECTRONIC DEVICES

Photo Interrupters (cont.)

IC Output Type (cont.)

Part Number	Outline	Characteristics (T_a = 25°C)		Features
		I_{FLH} (mA)	(V_{CC} (V)	
PS5003HR		to 5	5	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5001LC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "LOW" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5002LC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "LOW" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5003LC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "LOW" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5001LR		to 5	5	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5002LR		to 5	5	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5003LR		to 5	5	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin

Part Number	Outline	Characteristics (T_a = 25°C)		Features
		V_{OH} (mA)	Condition	
PS5501HC-1		V_{CC} × 0.8 to	opened aperture R_L = 47 kΩ	Built-in Schmitt Trigger circuit Housing with a connector** Active "HIGH" Open collector output Aperture: 0.5mm slit; 3 pin
PS5501HR-1		V_{CC} × 0.8 to	opened aperture	Built-in Schmitt Trigger circuit Housing with a connector** Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit; 3 pin
PS5501LC-1		V_{CC} × 0.8 to	closed aperture R_L = 47 kΩ	Built-in Schmitt Trigger circuit Housing with a connector** Active "LOW" Open collector output Aperture: 0.5mm slit; 3 pin
PS5501LR-1		V_{CC} × 0.8 to	closed aperture	Built-in Schmitt Trigger circuit Housing with a connector** Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit; 3 pin

**CONNECTOR: EI 3 pin series 17825-3 made by AMP

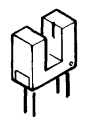
Optoelectronic Assemblies

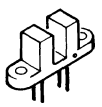
OPTEK

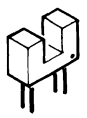
Slotted Optical Switches

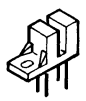
Part No.	Case Style	Slot Width Inches (mm)	Min. $I_{C(ON)}$ Slot Open
OPB804	B	0.155 (3.94)	500µA
OPB813S7	D	0.125 (318)	350µA
OPB813S5	D	0.125 (3.18)	250µA
OPB813S3	D	0.125 (3.18)	75µA
OPB818	E	0.20 (5.08)	100µA
OPB820	F	0.08 (2.03)	500µA
OPB20S10	F	0.08 (2.03)	400µA
OPB820S5	F	0.08 (2.03)	300µA
OPB21S3	F	0.08 (2.03)	170µA
OPB821	G	0.08 (2.03)	500µA
OPB821S10	G	0.08 (2.03)	400µA
OPB821S5	G	0.08 (2.03)	300µA
OPB821S3	G	0.08 (2.03)	170µA
OPB822S	H	0.10 (2.54)	250µA
OPB822SD	H	0.10 (2.54)	100µA
OPB830L55	J	0.125 (3.18)	500µA
OPB826S	I	0.10 (2.54)	250µA
OPB826D	I	0.10 (2.54)	100 µA

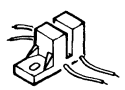
Slotted optical switches, also known as interrupter assemblies, are designed to provide non-contact sensing of linear or rotary motion as in optical encoders. Devices from Optek Technology consist of an infrared emitting diode and a silicon photosensor mounted on opposite sides of a slot in a molded plastic housing. Switching takes place whenever an opaque object passes through the slot. **All assemblies are available with wire leads. Contact Factory**

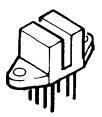

Style B

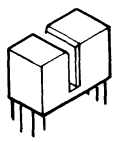

Style D

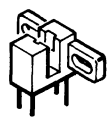

Style E


Style F


Style G


Style H

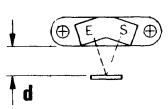

Style I

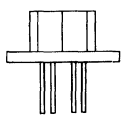

Style J

High Contrast Reflective Assemblies

Part No.	$I_{C(ON)}$	d"	$I_{C(OFF)}$	Contract Ratio
OPB750	500mA	.080	250nA	2000:1
	375mA	.150	250nA	1500:1
	250mA	.220	250nA	1000:1

Designed to decrease low-level gain while not affecting the high-level light gain. Photocurrent is measured using an Eastman Kodak neutral white test card as a reflective surface having a 90% diffuse reflectance. $I_{C(OFF)}$ is photocurrent measured with current to the input diode and a 5% reflecting surface.



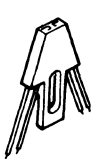


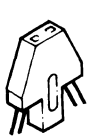
Reflective Assemblies

Part No.	Case Style	Max. V_F at Rated I_F	Min. $V_{(BR)CEO}$	Min. $I_{C(ON)}$
OPB701	AJ(2)	1.7V @ 50 mA	25V	2.0 mA
OPB700	AJ(1)	1.7V @ 50 mA	25V	25 µA
OPB703	AK(1)	1.7V @ 40 mA	30V	200 µA
OPB706A	AL(1)	1.7V @ 20 mA	30V	500 µA
OPB706B	AL(1)	1.7V @ 20 mA	30V	350 µA
OPB706C	AL(1)	1.7V @ 20 mA	30V	200 µA
OPB707A	AL(2)	1.7V @ 20 mA	15V	25 mA
OPB707B	AL(2)	1.7V @ 20 mA	15V	17 mA
OPB707C	AL(2)	1.7V @ 20 mA	15V	10 mA
OPB742	AM(1)	1.7V @ 40 mA	30V	10 µA
OPB746	AM(2)	1.7V @ 40 mA	15V	1.0 mA
OPB710	AJ(1)	1.7V @ 50 mA	30V	150 µA
OPB730	AN(2)	1.7V @ 50 mA	30V	1.0 mA
OPB711	AN(1)	1.7V @ 20 mA	30V	350 µA
OPB712	AO(2)	1.7V @ 20 mA	15V	20 mA

(1) Phototransistor output
(2) Photodarlington output

Reflective assemblies are designed to provide non-contact sensing of the presence of a reflective surface, or a change in surface reflectivity. Unfocused types, where the emitter and sensor are mounted on parallel optical axes, are best suited for sensing diffuse or rough surfaces. Focused types, where the emitter and sesor are mounted on converging optical axes are best suited for sensing specular or polished surfaces.


Style AJ


Style AK


Style AL


Style AM


Style AN


Style AO

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In order to develop new state-of-the-art products, customers often require special optoelectronic devices. In these cases, Optek engineers can design a part to meet the toughest mounting or electrical requirements.

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MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

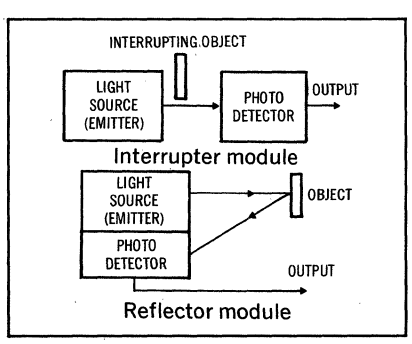
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

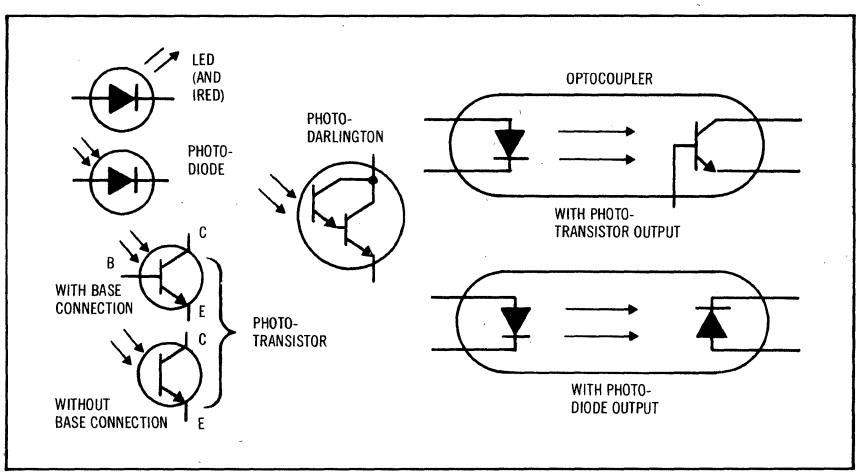
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

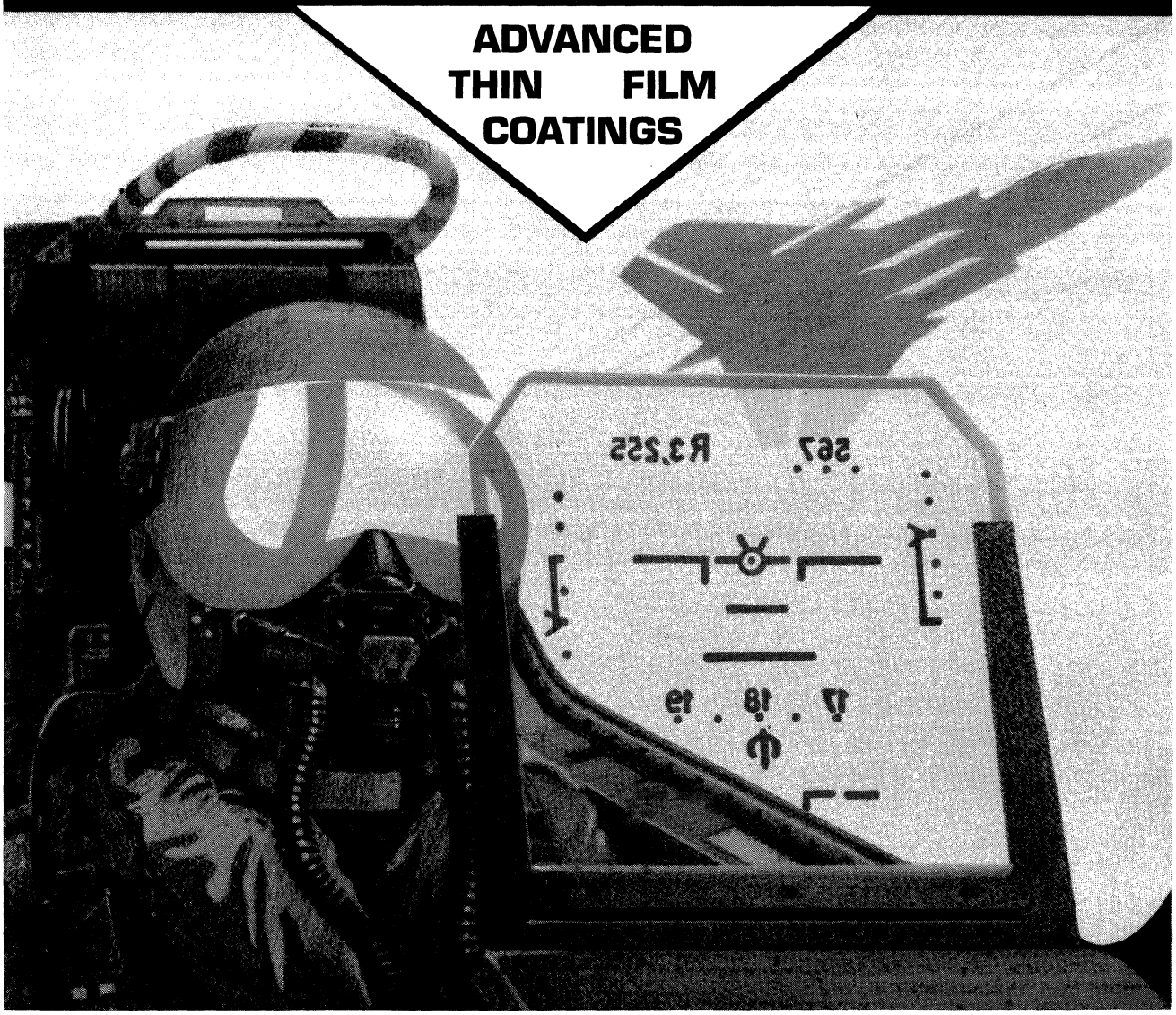
Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

OMITEC THIN FILMS

An enabling technology company which provides solutions allowing customers to gain technological and commercial advantage



APPLICATIONS:

- **Night vision goggles**
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C•2100 CONNECTORS, TEST POINTS Page **C**•1479

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OPTOCOUPLERS—Case Style SOT-90B

Transistor Output

Type	% min	CTR @ I_F mA	@ V_{CE} V	V_{ISO} V_{AC}	max V	V_{CE} (Sat) @ I_F mA	@ I_C mA	µS @	t_{ON}/t_{OFF} I_C@ mA	V_{CC} V	@ R_L Ω	V_{BR} min V
4N25	20	10	10	2,500	0.5	50	2.0	3/3	2	10	100	30
4N25A	20	10	10	1,775[1]	0.5	50	2.0	3/3	2	10	100	30
4N26	20	10	10	1,500	0.5	50	2.0	3/3	2	10	100	30
4N27	10	10	10	1,500	0.5	50	2.0	3/3	2	10	100	30
4N28	10	10	10	500	0.5	50	2.0	3/3	2	10	100	30
4N35	100	10	10	3,550	0.3	10	0.5	7/5	2	10	100	30
4N36	100	10	10	2,500	0.3	10	0.5	7/5	2	10	100	30
4N37	100	10	10	1,500	0.3	10	0.5	7/5	2	10	100	30
H11A1	50	10	10	2,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A2	20	10	10	1,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A3	20	10	10	2,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A4	10	10	10	1,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A5	30	10	10	1,500	0.4	10	0.5	3/3[3]	2	10	100	30
MCT26	6	10	10	4,400[2]	0.5	60	1.6	3/3[3]	2	10	100	30
MCT2	20	10	10	4,400[2]	0.4	16	2.0	5/10		note 4		30
CNX35U	40-90	10	0.4	4,400[2]	0.4	10	2.0	3/3	2	5	100	30
CNX36U	80	10	0.4	4,400[2]	0.4	10	4.0	7/5	2	5	100	30
CNX39U	60-90	10	0.4	4,400[2]	0.4	10	2.0	5/4	2	5	100	30

High Voltage Transistor Output

Type	% min	CTR @ I_F mA	@ V_{CE} V	V_{ISO} V_{AC}	max V	V_{CE} (Sat) @ I_F mA	@ I_C mA	µS @	t_{ON}/t_{OFF} I_C@ mA	V_{CC} V	@ R_L Ω	V_{BR} min V
4N38	10	10	10	1,500	1.0	20	4.0	5/5	2	10	100	80
4N38A	10	10	10	2,500	1.0	20	4.0	5/5	2	10	100	80
CNY17-1	40-80	10	5.0	4,400[2]	0.3	10	2.5	5/5	2	10	100	70
CNY17-2	63-125	10	5.0	4,400[2]	0.3	10	2.5	5/5	2	10	100	70
CNY17-3	100-200	10	5.0	4,400[2]	0.3	10	2.5	5/5	2	10	100	70
CNY17-4	160	10	5	4,400	0.3	10	2.5	5/5	2	10	100	70
CNX38U	70-210	10	10	4,400[2]	0.4	16	2.0	5/5	4	5	100	80

Darlington Transistor Output

Type	% min	CTR @ I_F mA	@ V_{CE} V	V_{ISO} V_{AC}	max V	V_{CE} (Sat) @ I_F mA	@ I_C mA	µS @	t_{ON}/t_{OFF} I_C@ mA	V_{CC} V	@ R_L Ω	V_{BR} min V
H11B1	500	1	5.0	2,500	1.0	1	1	125/100	10	10	100	25
H11B2	200	1	5.0	2,500	1.0	1	1	125/100	10	10	100	25
H11B3	100	1	5.0	2,500	1.0	1	1	125/100	10	10	100	25
H11B255	100	10	5.0	1,500	1.0	50	50	125/100	10	10	100	55
MCA230	100	10	5.0	3,550	1.0	50	50	5/100	10^5	5	100	30
MCA231	200	1	5.0	3,500	1.2	10	50	5/100	10^5	5	100	30
MCA255	100	10	5.0	3,550	1.0	50	50	5/100	10^5	5	100	55
4N29	100	10	10	4,400[2]	1.0	8	2	.7/25		note 7		30
4N30	100	10	10	4,400[2]	1.0	8	2	.7/25		note 7		30
4N31	50	10	10	4,400[2]	1.2	8	2	.7/25		note 7		30
4N32	500	10	10	4,400[2]	1.0	8	2	.7/35		note 7		30
4N33	500	10	10	4,400[2]	1.0	8	2	.7/35		note 7		30

Note: 1 = V_{RMS}; 2 = V_{DC}; 3 = t_{RISE}/t_{FALL}; 4 = I_F(15 MA, V_{CC}5V, R_B100kΩ, R_L2kΩ); 5 = I_F; (Note); 7 = I_F(200mA; v_{CC} = 10V, R_L = 180Ω).

See Philips Power Semiconductors in Vol. A, Section 4800 and Liquid Crystal Displays (LCDs) in Vol. B, Section 2450.

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Philips Components
Discrete Products Division
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PHILIPS DISCRETE SEMICONDUCTORS

OPTOCOUPLERS, TEMPERATURE SENSORS & MAGNETIC FIELD SENSORS

For Power Supply Applications

Type	Package Outline	Current Transfer Ratio (CTR) % min	AT I_f mA	V_{CE} Volts	V_{IORM} d.c. Volts	V_{CE}(SAT) max Volts	AT I_f mA	I_c mA	t_{ON}/t_{OFF} Typical µs	AT I_c mA	V_{CC} Volts	R_L Ohm	$V_{(BR)CEO}$ min Volts
CNX71	SOT-90B	40	10	0.4	5,300	0.19	10	4	20/20*	2	10	100	30
CNX62A	SOT-230	40	10	0.4	5,300	0.19	10	4	3/3	2	5	100	50
CNX72A	SOT-229	40	10	0.4	5,300	0.19	10	4	26/2.5*	2	5	1,000	30
CNX82A	SOT-231	40	10	0.4	5,300	0.19	10	4	3/3	2	5	100	50
CNX83A	SOT-231	40	10	0.4	5,300	0.19	10	4	3/3	2	5	100	50
CNY17G-1	SOT-231	40	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17G-2	SOT-231	63	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17G-3	SOT-231	100	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17G-4	SOT-231	160	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17GF-1	SOT-231	40	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17GF-2	SOT-231	63	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17GF-3	SOT-231	100	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17GF-4	SOT-231	160	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNW82	SOT-228	40	10	0.4	8,340	0.19	10	4	3/3	2	5	100	50
CNW83	SOT-228	40	10	0.4	8,340	0.19	10	4	3/3	2	5	100	50
CNX21	SOT-211	20	10	0.4	10,000	0.15	10	4	3/3	2	5	100	30

OPTOCOUPLERS with GaAlAs Emitter Diode

Type	Package Outline	Current Transfer Ratio (CTR) % Min	AT I_f mA	V_{ce} Volts	V_{IORM} d.c. Volts	V_{CE}(SAT) Max Volts	AT I_f mA	I_c mA	t_{on}/t_{off} Typical µs	AT I_c mA	V_{CC} Volts	R_L OHM	$V_{(BR)CEO}$ Min Volts
Low Input-Current Types (transistor output)													
CNG35	SOT-90B	40	10	0.4	4.400	0.15	10	2	3/3	2	5	100	30
CNG36	SOT-90B	80	10	0.4	4.400	0.19	10	4	8/6	2	5	100	30
For Power Supply Applications													
CNG82*	SOT-212	40	10	0.4	5,300	0.4	10	4	3/3	2	5	100	50
CNG83	SOT-212	40	10	0.4	5,300	0.4	10	4	3/3	2	5	100	50
CNW135	SOT-271	7	16mA	0.4	7,070V	—	—	—	1.5/1.5	16	5	4,100	20
CNW136	SOT-271	19	16mA	0.4	7,070V	—	—	—	0.8/0.8	16	5	1,900	20
CNW138	SOT-271	3	1.6mA	0.4	7,070V	—	—	—	10/35	16	5	2,200	7
CNW139	SOT-271	5	1.6mA	0.4	7,070V	—	—	—	1/7	12	5	270	18
CNW4502	SOT-271	—	16mA	0.4	7,070V	—	—	—	0.8/0.8	16	5	1,900	20
High-Speed Types (photodiode/transistor output)													
CNR36	SOT-97F	20	10	—	3,500	0.4[1]	10	2	0.5/0.4	10[2]	50	2,500	18
6N135	SOT-97F	7	16	—	3,500	.04[1]	16	1.1	0.2/0.6	16[2]	5	4,100	15
6N136	SOT-97F	19	16	—	3,500	.04[1]	16	2.4	0.4/0.6	16[2]	5	1,900	15

TEMPERATURE SENSORS

Type	Package Outline	Nominal Resistance Value (Ω)	Measuring Temperature Range (°C)
KTY81-100 SERIES	SOD-70	1000	−55 to +150
KTY81-200 SERIES	SOD-70	2000	−55 to +150
KTY83-100 SERIES	SOD-68	1000	−55 to +175
KTY84-100 SERIES	SOD-68	1000	0 to +300
KTY85-100 SERIES	SOD-80	1000	−40 to +125
KTY86-205	VO-69	2000	−40 to +150
KTY87-205	VO-69	2000	−40 to +125

Type	Package Outline	Operating Voltage (V)	Spectral Response (µ)

MAGNETIC FIELD SENSORS

Type	Package Outline	Field Range KA/m	Supply Voltage V	T_{amb} °C	Sensitivity mV/V / KA/m	Bridge Resistance KΩ
KMZ10A	SOT-195	−0.5 to +0.5	5	−40 to +150	14	1.7 ± 0.5
KMZ10B	SOT-195	−2 to +2	5	−40 to +150	4	1.7 ± 0.5
KMZ10C	SOT-195	−7.5 to +7.5	5	−40 to +150	1.5	1.4 ± 0.4

NOTE: In Air, 1 KA/m corresponds to approximately 12.5 G or to 1.25 mT.

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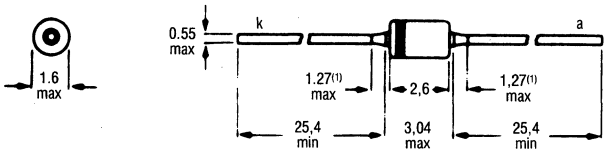
PHILIPS DISCRETE SEMICONDUCTORS

OPTOCOUPLERS, TEMPERATURE SENSORS & MAGNETIC FIELD SENSORS

SOD-68



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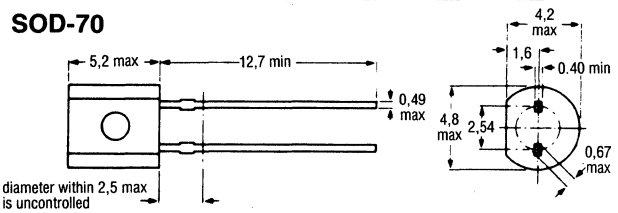

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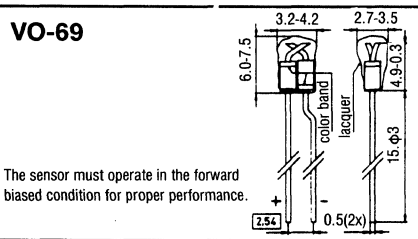

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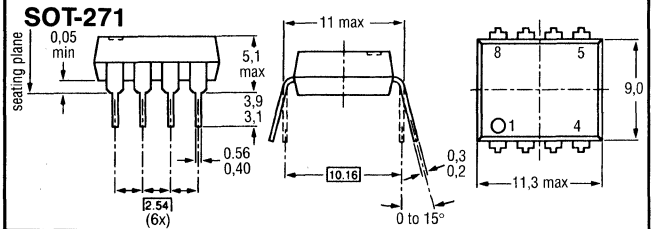

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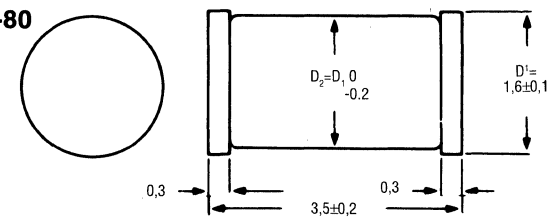

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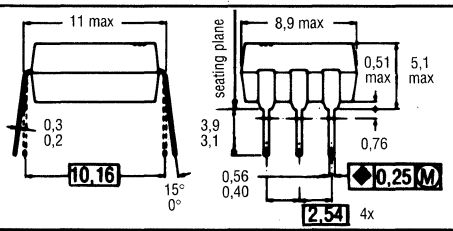

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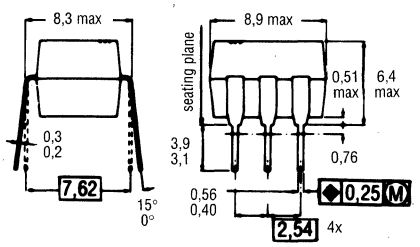

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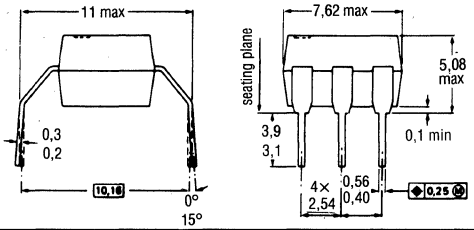

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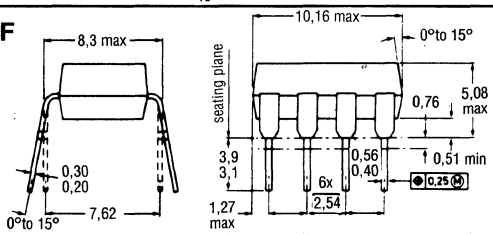

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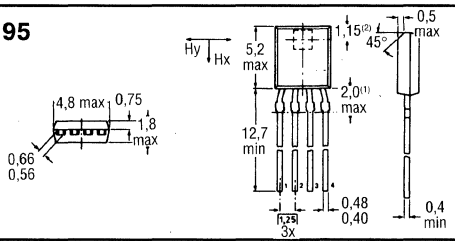

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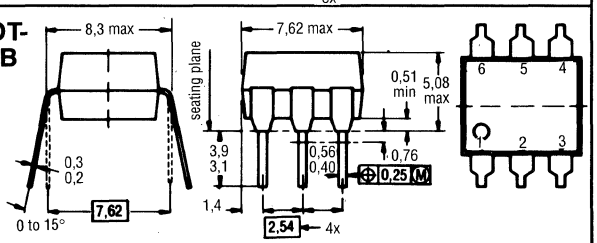

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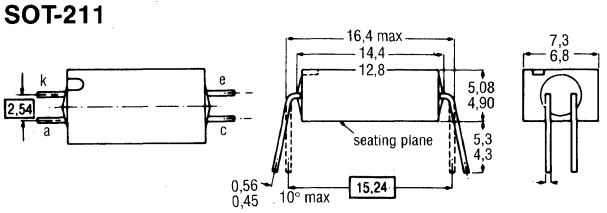

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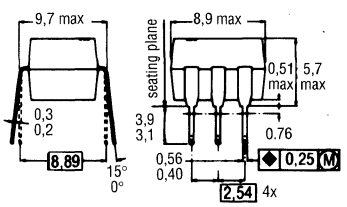

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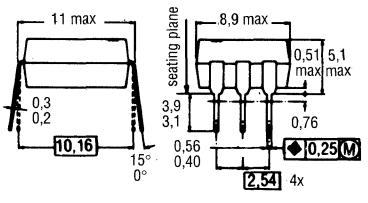

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SHARP®
Optoelectronics

Photocouplers

Classification chart

Photocouplers
- PC100 series — VDE approved (long creepage distance type)
- PC300 series — Opaque mini-flat package type
- PC400 series — Opaque mini-flat package, OPIC* type
- PC700 series — DIP 6-pin, Viso:5kVrms
- PC800 series — Opaque 4-pin x N (N = 1,2,3,4), Viso: 5kVrms
- PC900 series — OPIC*
- 6N series — Standard 6N series (OPIC*)

Phototriac couplers

Photothyristor couplers

Features

Various output methods:
- Single phototransistor
- Darlington phototransistor
- OPIC*
- Bidirectional output transistor
- Phototriac
- Photothyristor

Various package formats:
- Standard dual-in-line package
- Flat package
- Mini-flat package
- Dual-in-line package for long creepage distance

Wide line-up of products meeting international safety standards:
UL, VDE, TÜV, BS, SEMKO, DEMKO, EL-FEMKO
High isolation voltage: PC100/PC700/PC800 series, etc.

Photointerrupters

Classification chart

Photointerrupters
- Transmissive type
  - GP1S series — Single phototransistor output
  - GP1L series — Darlington phototransistor output
  - GP1A series — OPIC*
- Reflective type
  - GP2S series — Single phototransistor output
  - GP2L series — Darlington phototransistor output
  - GP2A series — OPIC* or amplier built-in type

Features

Various output methods
- Single phototransistor
- Darlington phototransistor
- OPIC*
  - Single-phase digital output
  - Two-phase digital output (transmissive type)

Various mounting methods
- Snap-in mounting type
- PWB mounting type
- Both-side mounting type
- Either-side mounting type (transmissive type)
- Side-mounting type (transmissive type)

Transmissive type — Line-up of products with a detecting accuracy of slit width ranging from 0.15 to no slit.

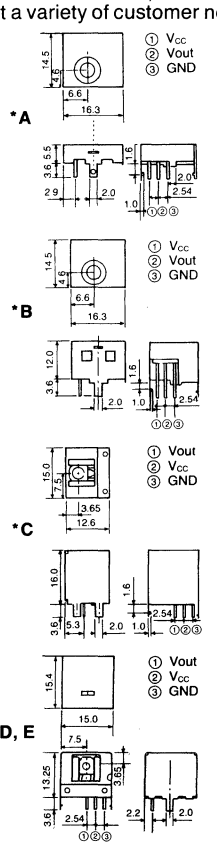
Reflective type — Line-up of products with detecting distance ranging from 0.4 to 15mm (optimum).

Transmissive type — Line-up of products having an object passing width ranging from the light emitter and detector gap of 0.9 to 10mm.

Versions with cover case, 3-pin connector terminal, and super-compact products are available to meet a variety of customer needs.

Light Detecting Units for Remote Controller

Series		GP1U56 Series	*2GP1U50X Series	*3GP1U52X Series	*4GP1U52Y Series	*1GP1U52Q Series
Viewing direction		Top viewing	Top viewing	Top viewing	Side viewing	
Height		5.5mm	12mm	16mm	13.25mm	
Dimensions		*A	*B	*C	*D	*E
Absolute Maximum Ratings	V_{cc} (V)	6.3				
	T_{opr} (°C)	−10 ~ +60				
	I_{cc} (mA)	5				
Electrical Characteristics	V_{OH} (V)	V_{CC} ~ −0.5				
	V_{OL} (V)	0.45				
	T_1 (µs) MIN.	400	440	400	400	400
	T_1 (µs) MAX.	800	770	800	800	800
	T_2 (µs) MIN.	400	440	400	400	400
	T_2 (µs) MAX.	800	770	800	800	800
CR filter		—	○	○	○	○
	40kHz	GP1U56	GP1U50X	GP1U52X	GP1U52Y	GP1U52Q
	38kHz	GP1U561	GP1U501X	GP1U521X	GP1U521Y	GP1U521Q
	36.7kHz	GP1U562	GP1U502X	GP1U522X	GP1U522Y	GP1U522Q
	32.75kHz	GP1U563	GP1U503X	GP1U523X	GP1U523Y	GP1U523Q
	41.7kHz	GP1U565	GP1U505X	GP1U525X	GP1U525Y	GP1U525Q
	48kHz	GP1U566	GP1U506X	GP1U526X	GP1U526Y	GP1U526Q
	56.8kHz	GP1U567	GP1U507X	GP1U527X	GP1U527Y	GP1U527Q
	39kHz	GP1U568	GP1U508X	GP1U528X	GP1U528Y	GP1U528Q
	35kHz	GP1U569	GP1U509X	GP1U529X	GP1U529Y	GP1U529Q



*1 With conductive film for eliminating electro-magnetic induction noise
*2 Also available with mesh window (GP1U70R Series)
*3 Also available with mesh window (GP1U72R Series)
*4 Also available with mesh window (GP1U72Q Series)

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SHARP® Optoelectronics

Laser Diodes

Laser Diodes

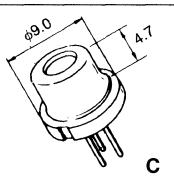
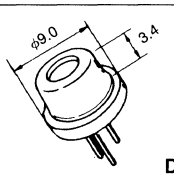
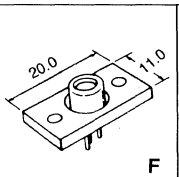
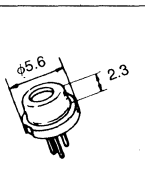
Sharp's laser diodes use a double hetero junction of gallium, aluminum and arsenide compound (GaAlAs). Long life and high reliability are realized by use of our original VSIS structure (V-channeled Substrate Inner Stripe).

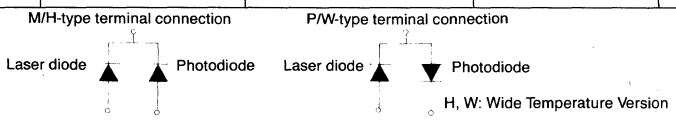
Features

- High power type, low noise type, wide temperature ranges and short wavelength type are included in the scope of products.
- High precision package. PIN photodiodes are built in, and optical power output control is easy.
- The line-up is full, from the ultra compact (ϕ5.6 mm packages) type to the single positive power supply p/w type.
- Long life, high reliability.
- Stable single transverse mode, low threshold current.

Model No.	Wavelength (nm)	Optical power output (mW) TYP.	Optical power output (mW) MAX.	Features	Main applications
LT030 Series	750	3	5	Short wavelength	High-speed laser printers, Bar code readers
LT031 Series		7	10	Short wavelength	High-speed laser printers
LT020MC	780	3	5	General use	Measuring instruments, Bar code readers
LT021 Series		10	15	High power	High-speed laser printers, Medical apparatus
LT022 Series		3	5	Low noise	CD-ROMs, Fiber Optic Communication
LT023 Series		3	5	Low noise (Multi-mode)	VD players, Analog devices, Fiber Optic Communication
LT022/023 WIDE TEMP. Series		3	5	Low noise Wide Temperature (−30 to 85°C)	Fiber Optic Communication Factory Automation Equipment
LT024 Series		20	30	High power	Optical disk memories, Magneto-optical disk systems
LT025 Series		30	40	High power	Optical disk memories, Magneto-optical disk systems
LT026 Series		3	5	Small astigmatism	General use laser printers
LT027 Series		7	10	General use	Medium-speed laser printers
LT080MD		3	5	Stabilized wavelength	Measuring instruments, Laser printers, Bar code readers
LT091MD		14	20	2 channels*	High speed laser printers
LT010 Series	810	3	5	General use	Measuring instruments, Fiber Optic Communications
LT016 Series		30	40	High power	YAG laser excitation, Optical disk memories, Magneto-optical disk systems
LT017 Series		40	50		
LT015 Series	830	30	40	High power	Optical disk memories, Optical memory cards, Medical Apparatus
LT090 Series		80	100	High power (3 channels)	Medical apparatus, Optical range finders
LT011MS	840	3	5	Long wavelength	Fiber Optic communications

*Independent channel control

Package (mm) Wavelength (nm)	Maximum optical power output (mW)	 C	 D	 F	 S
750	5	—	LT030MD	LT030MF	—
	10	—	LT031MD	LT031MF	—
780	5	LT020MC	—	—	—
	15	LT021MC	LT021MD	LT021MF	—
	5	LT022HC/MC	LT022MD/PD/WD	LT022MF	LT022HS/MS/WS/PS
		LT023HC/MC	LT023MD	LT023MF	LT023HS/MS/WS/PS
	30	—	LT024MD/PD	LT024MF	—
	40	—	LT025MD/PD	LT025MF	—
	5	—	LT026MD	LT026MF	LT026MS/PS
	10	—	LT027MD	LT027MF	—
	5	—	LT080MD	—	—
	20	—	LT091MD	—	—
810	5	LT010MC	LT010MD	LT010MF	—
	40	—	LT016MD	LT016MF	—
	50	—	LT017MD	—	—
830	40	—	LT015MD/PD	LT015MF	—
	100	—	LT090MD	LT090MF	—
840	5	—	—	—	LT011MS/PS



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Optoelectronics

OPIC Light Detectors

OPIC Light Detectors

OPIC is a registered trademark of Sharp and stands for Optical IC.
It has a light detecting element and peripheral circuits integrated onto one chip.

(Ta = 25°C)

Model No.	Features	Package	Absolute maximum ratings				Electro-optical characteristics							
			V_{CC} (V)	P (mW)	I_{OL} (mA)	Topr (°C)	E_{VLN} (1x) MAX.	E_{VLN} (1x) MAX.	V_{cc} (V)	t_{PLH} (μS) TYP.	t_{PHL} (μS) TYP.	V_{CC} (V)	E_V) (1x)	R_L (Ω)
IS435	Built in Schmitt trigger ckt amplifier and voltage regulator	Resin with lens	$-0.5 \sim +17$	250	50	−25 ~ +85	—	35	5	5	3	5	50	280
IS436			$-0.5 \sim +17$	250	50	−25 ~ +85	35	—	5	3	5	5	50	280
IS437			$-0.5 \sim +35$	250	50	−25 ~ +85	—	35	5	5	3	5	50	280
IS438			$-0.5 \sim +35$	250	50	−25 ~ +85	35	—	5	3	5	5	50	280
IS486			$-0.5 \sim +17$	250	50	−25 ~ +85	35	—	5	3	5	5	50	280

OPIC Light Detectors

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It has a light detecting element and peripheral circuits integrated onto one chip.

(Ta = 25°C)

Model No.	Features	Package	Absolute maximum ratings				Electro-optical characteristics						
			V_{CC} (V)	P (mW)	I_{OL} (mA)	Topr (°C)	V_{OL} MAX. (V)	V_{OH} MIN. (V)	t_{PLH} MAX. (μS)	t_{PHL} MAX. (μS)	V_{CC} (V)	R_L (Ω)	External distributing light illuminance E_V(lx)
IS440	Pulse drive circuit and sync. detection circuit are built-in in the light emitting side	Transparent epoxy resin	$-0.5 \sim +16$	250	50	−25 ~ +60	0.35	4.97	670	670	4.5 ~ 16	280	7,200 TYP
IS441F IS471F	Pulse drive circuit and sync. detection circuit are built-in in the light emitting side	Transparent epoxy resin	$-0.5 \sim +16$	250	50	−25 ~ +60	0.35	4.97	670	670	4.5 ~ 16	280	4,500 TYP
IS450	Built-in amp circuit sync. signal circuit and modification circuit	Epoxy resin	$-0.5 \sim +9$	150	16	−25 ~ +60	0.35	4.97	670	670	4.5 ~ 16	280	7,200 TYP

Model No.	Features	Package	Absolute maximum ratings				Electro-optical characteristics							
			V_{CC} (V)	P (mW)	I_{OL} (mA)	Topr (°C)	I_{CC} (ma) MAX.	E_V (lx)	I_{01} (ma) MIN.	E_V (lx)	I_{02} (ma) MAX.	E_V (lx)	I_{OD} (ma) MAX.	E_V (lx)	λP (nm) TYP.
IS445	Linear output built in amplifier and voltage regulator	Transparent epoxy resin (side viewing)	$-0.5 \sim +8$	250	−10	−25 ~ +85	0.2	0	−6.5	10	−0.65	1,000	−500	0	700
IS455	Voltage regulator	Epoxy resin (top viewing)	$-0.5 \sim +8$	150	−10	−25 ~ +85	0.2	0	−6.5	10	−0.65	1,000	−500	0	700

Model No.	Features	Package	Absolute maximum ratings				Electro-optical characteristics							
			V_{CC} (V) MAX	V_{OH} (V)	I_{OL} (ma)	Topr (OL)	V_{OH} (V) MIN	V_{OL} (V) MAX	H&L Thresh illumin 1	H&L Thresh illumin 2	H&L Prop time TPHL	L&H Prop time TPLH	tr	tf
IS456	For laser beam printer	Epoxy resin	7	7	20	−25 ~ +80	4.9	0.6	600	5800	400 ns max	400 ns max	200 ns max	100 ns max

Model No.	Type	Package	Absolute maximum ratings			Electro-optical characteristics					
						Sensitivity Rp (mVμW) TYP.		Response frequency fc (MHz) TYP.			
			V_{CC} (V)	P (mw)	Top (°C)	V_A, V_B, V_C, V_D, V_E, V_F	VRF	V_A, V_B, V_C, V_D	V_E, V_F	VV_{RF}	R_R (kΩ)	C_L (Pf)
IS1603	6 divisions on a chip built in high speed amplifier	Transparent epoxy resin	6	210	−20 ~ +65	24.5	30	25	250	25	10	10

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High Speed
Spectrally Enhanced
UV - Visible - IR
Low Noise
Linear
Photoconductive
Photovoltaic
Low Capacitance
High Voltage Breakdown
Reliable and Low Cost

SD – XXX – XX – XX – XXX

ACTIVE AREA SIZE
(Expressed in inches — effective diameter)
ie: 020 = .020 inch diameter
200 = .200 inch diameter
444 = .444 inch diameter

PRODUCT SERIES
11 Single element, Red IR Enhanced
12 Single element, Blue Enhanced
13 Single element, U.V. Enhanced
21 Single Axis Position Sensing (PSC)
22 Dual Axis Position Sensing (PSC)
23 Quadrant Detector
24 Bi-Cell Detector
31 Photopic Detector
32 Red Photopic Detector
41 Opto Hybrid Red/IR Enhanced
42 Opto Hybrid Blue Enhanced
43 Opto Hybrid U.V. Enhanced

PACKAGE CODE
011-TO-18
211-TO-18 Isolated
021-TO-5
221-TO-5 Isolated
041-TO-8
042-TO-8 UV Window
241-TO-8
242-TO-8 Isolated UV
251-Jumbo TO-8
252-Jumbo TO-8 UV
171-BNC Std. Window
172-BNC UV Window
022-Std. TO-5 Header/UV Window
222-Iso. TO-5 Header/UV Window
042-Std. TO-8 Header/UV Window
242-Iso. TO-8 Header/UV Window
181-1.6" Diameter BNC Pkg.
231-Iso. TO-5 Tall Cap
232-Iso. TO-5 Tall Cap UV Wind
261-Jumbo TO-8 Std. Window
262-Jumbo TO-8 UV Window
391-Plastic Pkg. Exp. Window
040-No Window Cap Ins. Wire Bd
051-Std. Jumbo TO-8 Head Std. Window

DETECTOR APPLICATION
11- Photovoltaic—Ultra Low Noise/Medium Frequency Red I.R. Enhanced
12- Photovoltaic—Ultra Low Noise/Medium Frequency Blue Enhanced
13- Photovoltaic—Ultra Low Noise/Medium Frequency U.V. Enhanced
21- Photoconductive—High Frequency Red I.R. Enhanced
22- Photoconductive—High Frequency Blue I.R. Enhanced
23- Photoconductive—High Frequency U.V. Enhanced

Single Element
Bi-Cells
Quadrant
Detector Hybrids
Position Sensors
Filter Detector
Multi-Element Arrays
Custom Hybrids
Calibration
Opto-Assemblies
Mil-STD-883 Screening

SINGLE ELEMENT DETECTORS—PHOTOVOLTAIC GROUP SPECIFICATIONS (23°C)

MODEL NUMBER	SPECTRAL ENHANCEMENT	ACTIVE AREA AREA (mm^2)	RESPONSIVITY AT SPECTRAL PEAK (A/W)	MIN. DYNAMIC RESISTANCE 0 Volts (MΩ)	JUN CAP 5 Volts (pF)	RESP TIME 5 Volts (ns)	TYP DARK CURRENT-I 5 Volts (nA)	TYP. NEP SPECTRAL PEAK 0 Volts 1 kHz ($W/\sqrt{Hz}$)
SD-020-11-11-011 (ISOLATED)-211	RED/IR	0.20	.55	800	25	7	.10	7
SD-020-12-12-011 (ISOLATED)-211	BLUE/VISIBLE	0.20	.55	800	25	7	.10	7
SD-041-11-11-011 (ISOLATED)-211	RED/IR	0.85	.55	500	39	10	.13	10
SD-041-12-12-011 (ISOLATED)-211	BLUE/VISIBLE	0.85	.55	500	39	8	.13	8
SD-076-11-11-011 (ISOLATED)-211	RED/IR	2.91	.55	200	132	10	.45	10
SD-076-12-12-011 (ISOLATED)-211	BLUE/VISIBLE	2.91	.55	200	132	30	.45	30
SD-100-11-11-021 (ISOLATED)-211	RED/IR	5.1	.55	100	232	15	.75	15
SD-100-12-12-021 (ISOLATED)-221	BLUE/VISIBLE	5.1	.55	100	232	34	.75	34
SD-100-13-13-022 (ISOLATED)-222	UV	5.1	.55	100	232	34	.75	34
SD-172-11-11-021 (ISOLATED)-221	RED/IR	15.0	.55	70	682	30	2	30
SD-172-12-12-021 (ISOLATED)-221	BLUE/VISIBLE	15.0	.55	70	682	94	2	94
SD-172-13-13-022 (ISOLATED)-222	UV	15.0	.55	70	682	94	2	94
SD-200-11-11-041 (ISOLATED)-241	RED/IR	20.3	.55	50	923	45	3	45
SD-200-12-12-041 (ISOLATED)-241	BLUE/VISIBLE	20.3	.55	50	923	128	3	128
SD-200-13-13-042 (ISOLATED)-241	UV	20.3	.55	50	923	128	3	128
SD-290-11-11-041 (ISOLATED)-241	RED/IR	42.6	.55	20	1,936	67	7	67
SD-290-12-12-041 (ISOLATED)-241	BLUE/VISIBLE	42.6	.55	20	1,936	216	3 @ 1 V	216
SD-290-13-13-042 (ISOLATED)-242	UV	42.6	.55	20	1,936	216	3 @ 1 V	216
SD-444-11-11-171 (ISOLATED)-251	RED/IR	100	.55	10	4,545	200	15	200
SD-444-12-12-171 (ISOLATED)-251	BLUE/VISIBLE	100	.55	10	4,545	510	7 @ 1 V	510
SD-444-13-13-172 (ISOLATED)-252	UV	100	.55	10	4,545	510	7 @ 1 V	510

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SINGLE ELEMENT DETECTORS—PHOTOCONDUCTIVE GROUP SPECIFICATIONS (23°C)

MODEL NUMBER	SPECTRAL ENHANCEMENT	ACTIVE AREA Area (mm²)	RESPONSIVITY AT SPECTRAL PEAK (A/W)	MAX DARK CURRENT-Id 50 Volts (nA)	DYNAMIC RESISTANCE-Rp 0 Volts (MΩ)	JUN CAP 50 Volts (pF)	RESP TIME 50 Volts (ns)	TYP. NEP Spectral Peak 50 Volts 1 kHz (W/√ Hz)
SD-020-11-21-011 (ISOLATED)-211	RED/IR	0.20	.55	2	600	1	3.5	3.5
SD-020-12-22-011 (ISOLATED)-211	BLUE/VISIBLE	0.20	.55	2	600	1	3.5	3.5
SD-041-11-21-011 (ISOLATED)-211	RED/IR	0.85	.55	6	300	2	3.7	3.7
SD-041-12-22-011 (ISOLATED)-211	BLUE/VISIBLE	0.85	.55	6	300	2	4.5	4.5
SD-076-11-21-011 (ISOLATED)-211	RED/IR	2.91	.55	20	130	6	3.8	3.8
SD-076-12-22-011 (ISOLATED)-211	BLUE/VISIBLE	2.91	.55	20	130	6	6.3	6.3
SD-100-11-21-021 (ISOLATED)-221	RED/IR	5.1	.55	35	70	11	4.6	4.6
SD-100-12-22-021 (ISOLATED)-221	BLUE/VISIBLE	5.1	.55	35	70	11	8.6	8.6
SD-100-13-23-022 (ISOLATED)-222	UV	5.1	.55	35	70	11	8.6	8.6
SD-172-11-21-021 (ISOLATED)-221	RED/IR	15.0	.55	105	50	33	10	10
SD-172-12-22-021 (ISOLATED)-221	BLUE/VISIBLE	15.0	.55	105	50	33	18	18
SD-172-13-23-022 (ISOLATED)-222	UV	15.0	.55	105	50	33	18	18
SD-200-11-21-041 (ISOLATED)-241	RED/IR	20.3	.55	140	30	44	20	20
SD-200-12-22-041 (ISOLATED)-241	BLUE/VISIBLE	20.3	.55	140	30	44	23	23
SD-200-13-23-042 (ISOLATED)-241	UV	20.3	.55	140	30	44	23	23
SD-290-11-21-041 (ISOLATED)-241	RED/IR	42.6	.55	300	13	91	15	15
SD-290-12-22-041 (ISOLATED)-241	BLUE/VISIBLE	42.6	.55	200 @ 10 V	13	212 @ 10 V	103 @ 10 V	103 @ 10V
SD-290-13-23-042 (ISOLATED)-251	UV	42.6	.55	200 @ 10 V	13	212 @ 10 V	103 @ 10 V	103 @ 10V
SD-444-11-21-171 (ISOLATED)-251	RED/IR	100	.55	700	7	214	20	20
SD-444-12-22-171 (ISOLATED)-251	BLUE/VISIBLE	100	.55	500 @ 10 V	7	500 @ 10 V	230	230
SD-444-13-23-172 (ISOLATED)-252	UV	100	.55	500 @ 10 V	7	500 @ 10 V	230	230
SD-1100-11-21-181	RED/IR	613	.55	6000 @ 10 V	1	3040	300 @ 10 V	300 @ 10V
SD-1100-12-22-181	BLUE/VISIBLE	613	.55	6000 @ 10 V	1	3040	300 @ 10 V	300 @ 10V

BI-CELL AND QUADRANT SILICON DETECTORS (23°C)

Detector Model Number	Photosensitive Surface/Element Size (mm)	Photosensitive Surface/Element Effective Area (mm²)	GAP (mm)	Dark Current I_D @ V_R = 10V (nA)	Shunt Resistance = 10mV) Typ (MΩ)	Junction Capacitance C_j @ V_R = 10V (pF)	Spectral Range (nm)	Radiant Sensitivity (A/W) He-Ne Laser (633nm)	Radiant Sensitivity (A/W) GaAs LED (930nm)	Radiant Sensitivity (A/W) YAG Laser (1060nm)	NEP (W/Hz$^{1/2}$) @ 633nm	Response Time (@ 655nm) t_r @ V_R = 10v (ns)
Bi-Cell (Two Element Detectors)												
SD 066-24-21-011	1.19 x 0.58	0.7	0.02	0.4	2000	5	400-1100	0.35	0.50	0.20	8×10^{-15}	40
SD 113-24-21-021	2.54 x 1.22	3.1	0.10	2.0	500	20	400-1100	0.35	0.50	0.20	1.6×10^{-14}	50
SD 160-24-21-021	4.57 x 0.51	2.3	0.02	1.5	500	10	400-1100	0.35	0.50	0.20	1.6×10^{-14}	50
SD 385-24-21-041	4.83 x 4.23	20.4	0.13	25.0	300	70	400-1100	0.35	0.50	0.20	2.1×10^{-14}	50
Quadrant (Four Element Detectors)												
SD 055-23-21-011	0.50 x 0.50	0.25	0.015	0.15	2000	8	400-1100	0.35	0.50	0.20	8×10^{-15}	40
SD 085-23-21-021	1.50 x 1.50	2.25	0.01	1.5	500	10	400-1100	0.35	0.50	0.20	1.6×10^{-14}	50
SD 118-23-21-021	1.27 x 1.27	1.6	0.13	1.0	500	12	400-1100	0.35	0.50	0.20	1.6×10^{-14}	50
SD 197-23-21-041	5.00 dia	4.8	0.03	2.5	500	20	400-1100	0.35	0.50	0.20	1.6×10^{-14}	50
SD 225-23-21-040	5.72 dia	5.4	0.13	2.8	500	25	400-1100	0.35	0.50	0.20	1.6×10^{-14}	50
SD 380-23-21-051	9.65 dia	17.8	0.10	10.0	250	90	400-1100	0.35	0.50	0.20	2.3×10^{-14}	80
SD 380-23-21-251	9.65 dia	17.8	0.10	10.0	250	90	400-1100	0.35	0.50	0.20	2.3×10^{-14}	80

OPTO HYBRIDS (DETECTOR AMPLIFIER HYBRID) SPECIFICATIONS (23°C)

MODEL NUMBER	Active Area (mm²)	Spectral Enhancement	Responsivity PEAK	Dynamic Resistance (0 Volts)	Junction Capacitance at 0V / at 5V	Dark Current (nA) 1V 5V	Typical NEP (w√Hz) Spectral Peak, 1KHz at 0V
SD100-41-11-231	5.1	Red/IR	.55	100	510 / 232	.75 @ 5V	1.7×10^{-14}
SD100-42-12-231	5.1	Blue/Vis	.55	100	510 / 232	.75 @ 5V	1.7×10^{-14}
SD100-43-13-232	5.1	UV	.55	100	510 / 232	.75 @ 5V	1.7×10^{-14}
SD444-41-11-261	100	Red/IR	.55	10	10K / 4.545	15 @ 5V	5.1×10^{-14}
SD444-42-12-261	100	Blue/Vis	.55	10	10K / 4.545	7 @ 5V	5.1×10^{-14}
SD444-43-13-262	100	UV	.55	10	10K / 4.545	7 @ 1V	5.1×10^{-14}
SD100-41-21-231	5.1	Red/IR	.55	70	75 / 11 @ 50V	35 @ 10V	1.4×10^{-13} @ 50V
SD100-42-22-231	5.1	Blue/Vis	.55	70	75 / 11 @ 50V	35 @ 10V	1.4×10^{-13} @ 50V
SD100-42-22-232	5.1	Blue/Vis	.55	70	75 / 11 @ 50V	35 @ 10V	1.4×10^{-13} @ 50V
SD444-41-21-261	100	Red/IR	.55	7	1,500 / 215 @ 50V	700 @ 50V	6.2×10^{-13} @ 10V
SD444-42-22-261	100	Blue/Vis	.55	7	1,500 / 215 @ 50V	500 @ 10V	5.3×10^{-13} @ 10V
SD444-43-23-262	100	UV	.55	7	1,500 / 215 @ 50V	500 @ 10V	5.3×10^{-13} @ 10V

Amplifier Specifications (23°)
- Input Offset Voltage-------- 3.0 mV (max)
- Input Offset Current-------- 3.0 mV (typ)
- Input Bias Current---------- 15.0 pz (typ)
- Slew Rate 60 V/US
- Gain Bandwidth Prodnt 26 mHz
- Power Supply ± 5 to 15 Volts.

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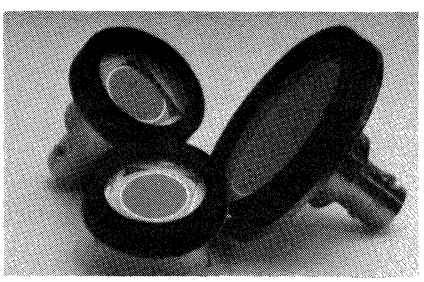
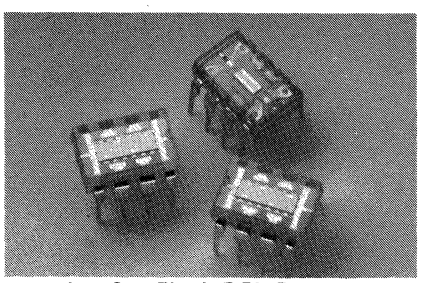
MODEL NUMBER	SPECTRAL ENHANCEMENT	ACTIVE AREA Area (mm^2)	RESPONSIVITY AT SPECTRAL PEAK (A/W)	MAX DARK CURRENT-Id 50 Volts (nA)	DYNAMIC RESISTANCE-Rp 0 Volts (MΩ)	JUN CAP 50 Volts (pF)	RESP TIME 50 Volts (ns)	TYP. NEP Spectral Peak 50Volts 1 kHz (W/√Hz)
SD 020-11-31-011	I.R.	0.20	.55	6	500	.10	6.0	3.8×10^{-14}
SD 041-11-31-011	I.R.	0.85	.55	20	500	.50	6.0	7.8×10^{-14}
SD 076-11-31-011	I.R.	2.91	.55	50	100	2.0	6.0	9×10^{-14}
SD 100-11-31-021	I.R.	5.1	.55	80	100	4.0	6.0	1×10^{-13}
SD 172-11-31-021	I.R.	15.1	.55	240	50	10.0	6.0	2.3×10^{-13}
SD 200-11-31-041	I.R.	20.3	.55	320	50	15.0	6.0	2.9×10^{-13}
SD 290-11-31-041	I.R.	42.6	.55	630	25	25.0	6.0	4×10^{-13}
SD 444-11-31-171	I.R.	100	.55	1000	10	50.0	6.0	5.6×10^{-13}

LOW COST PLASTIC, P-DIP DETECTORS GROUP SPECIFICATIONS (23°C)

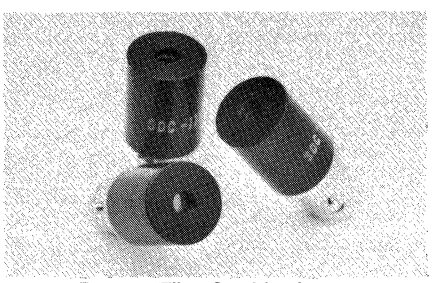
MODEL NUMBER	SPECTRAL ENHANCEMENT	ACTIVE AREA Area (mm^2)	NO OF ELEMENTS	RESPONSIVITY AT SPECTRAL PEAK A/W	MAX DARK CURRENT-Id 10 Volts (nA)	DYNAMIC RESISTANCE-Rp 0 Volts (MΩ)	JUN CAP 10 Volts (pF)	RESP TIME 10 Volts (ns)	TYP. NEP Special Peak 50 Volts 1 kHz (W/√Hz)
SD 172-11-21-090	RED/IR	15.0	1	.55	10.0	250	45.0	25	1.6×10^{-14}
SD 113-11-21-090	RED/IR	3.1	2	.55	2.0	500	20.0	50	1.1×10^{-14}
SD 085-11-21-090	RED/IR	2.25	4	.55	1.5	500	10.0	50	1.1×10^{-14}
SD 058-11-21-090	RED/IR	.41	4	.55	1.25	500	3.5	40	1.1×10^{-14}
SD 117-11-21-090	RED/IR	1.61	4	.55	5.0	500	6.0	50	1.1×10^{-14}



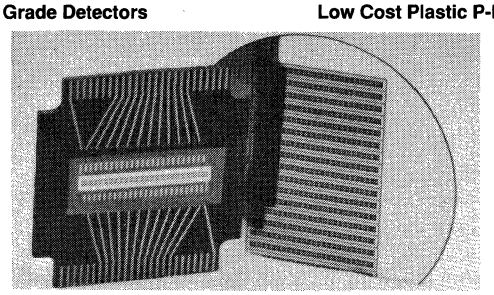
Instrument Grade Detectors



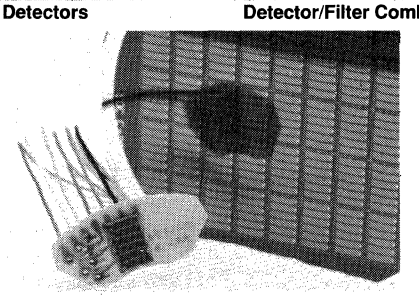
Low Cost Plastic P-Dip Detectors



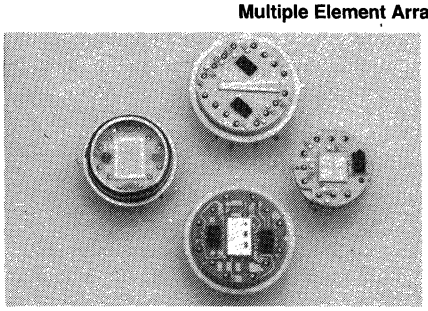
Detector/Filter Combination



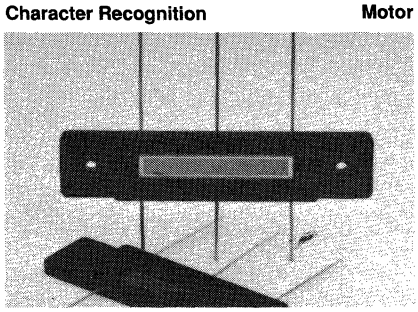
Multiple Element Array Character Recognition



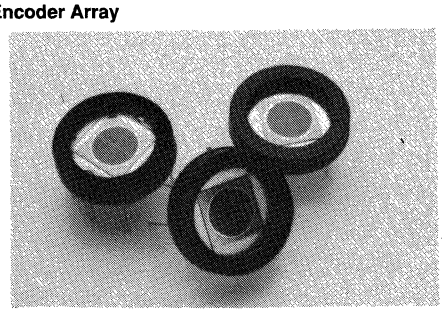
Motor Encoder Array



Detector Amplifier Hybrid



Position Sensor Lateral Effect Cell



Position Sensoring - Quadrant Detector

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CdS & CdSe PHOTOCELLS

Cell Type No.	Spectral Response Peak nm	Typical 2.0 Ftc. Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt	Max. Power mW.	Description
NSL-4440	515	67.0	50.0	1000	1000	1" Cell in Hermetically sealed package. Plastic Encapsulated versions available.
NSL-4450	515	14.5	15.0	1000	1000	
NSL-4460	515	6.5	5.0	1000	1000	
NSL-4470	515	3.0	0.500	1000	1000	
NSL-4960	515	9.5	4.0	320	500	TO-8 Hermetically sealed package. Additional resistance ranges available.
NSL-4970	515	4.10	0.540	320	500	
NSL-4980	515	64.00	100.0	320	500	
NSL-5910	550	1.5	0.100	170	500	
NSL-5920	550	3.0	0.200	170	500	
NSL-6910	690	0.25	0.067	170	500	
NSL-6940	690	1.50	1.0	170	500	
NSL-7910	615	7.50	1.5	250	500	
NSL-9910	550	11.00	7.3	170	500	
NSL-4932	515	0.95	0.400	80	250	TO-8 Plastic Encapsulated Package. Additional resistance ranges available.
NSL-4942	515	0.40	0.050	80	250	
NSL-4952	515	22.50	32.0	320	250	
NSL-5912	550	1.50	0.100	170	250	
NSL-5932	550	6.00	0.400	250		
NSL-5942	550	29.0	0.600	250	250	
NSL-6922	690	0.51	0.300	170	250	
NSL-6952	690	2.70	0.720	170	250	
NSL-9912	550	11.00	7.3	170	250	
NSL-3510	725	2.70	18.0	120	200	TO-5 Hermetically sealed package. Additional resistance ranges available.
NSL-4510	515	24.0	65.0	120	200	
NSL-4520	515	10.5	15.0	120	200	
NSL-5510	550	3.3	0.220	120	200	
NSL-5520	550	10.0	0.670	120	200	
NSL-6510	690	0.6	0.400	120	200	
NSL-6520	690	1.2	0.800	120	200	
NSL-7510	615	2.7	0.450	120	200	
NSL-7530	615	10.0	6.7	120	200	
NSL-9510	550	30.0	20.0	120	200	
NSL-4532	515	4.5	1.8	120	125	TO-5 Plastic Encapsulated Package. Additional resistance ranges available.
NSL-4542	515	1.9	0.250	120	125	
NSL-4552	515	185.0	200.0	320	125	
NSL-5532	550	165.0	11.0	320	125	
NSL-5542	550	30.0	20.0	120	125	
NSL-6522	690	1.2	0.800	120	125	
NSL-6532	690	30.0	20.0	320	125	
NSL-7542	615	100.0	67.0	250	125	
NSL-7552	615	600.0	400.0	320	125	
NSL-9512	550	32.0	20.0	120	125	
NSL-3110	725	6.0	40	100	50	TO-18 Hermetically sealed package. Additional resistance ranges available.
NSL-4120	515	42.0	10	80	50	
NSL-4140	515	8.0	0.200	80	50	
NSL-5110	550	10.0	0.670	100	50	
NSL-5130	550	84.0	5.6	100	50	
NSL-6110	690	2.0	1.3	100	50	
NSL-6120	690	4.0	2.6	100	50	
NSL-7110	615	6.0	1.0	100	50	
NSL-7120	615	66.0	11.0	100	50	
NSL-9110	550	15.0	10.0	60	50	
NSL-4152	515	310.0	100.0	320	50	TO-18 Plastic Encapsulated Package. Additional resistance ranges available.
NSL-4162	515	146.0	100.0	320	50	
NSL-4172	515	62.0	50.0	320	50	
NSL-4182	515	28.0	5.0	160	50	
NSL-5152	550	15.0	10.0	70	50	
NSL-5162	550	100.0	67.0	100	50	
NSL-6112	690	2.0	1.3	100	50	
NSL-7142	615	4.5	3.0	70	50	
NSL-7152	615	24.0	16.0	100	50	
NSL-9122	550	100.0	67.0	100	50	

UV SENSITIVE LDRs

Cell Type No.	Typical 1.0 Ftc Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt	Max. Power MW	Description
NSL-2129/3	1.7	0.2	80	200	0.5" Plastic Case with Phosphor-Coated Quartz Window
NSL-2129/6	17.0	1	320	200	

PIN PHOTODIODES

NSL Type No.	Light Current* MA	Dark Current nA	Rise Time nS	Fall Time nS	Description
NSL-530	0.3	10	3	6	TO-18 Package
NSL-580	1.5	30	5	8	TO-5

*At 500 Ftc (25 MW/cm²) 2870°K Source

SILONEX inc

331 Cornelia St.
Plattsburgh, NY 12901 TEL: (518) 561-3160
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Montreal Que. H4M 1T7 TEL: (514) 774-5507
Northwich, Cheshire CW9 7TN TEL: 0606 41999

FAX 514 747 3906
FAX 0606 49706

PHOTODETECTOR LAMP/LED ASSEMBLIES

Module Type No.	Emitter Volts	Emitter Current mA	Emitter MAX ON Res. Ω	Emitter MIN OFF Res. MΩ	Detector MAX Volts	Detector MAX Power mW	Description
PL-1033-1	10	15	100	10	80	250	Cube Package. Pin Leads for P.C. Board mounting.
PL-1036-1	10	15	400	50	320	250	
PL-2H33-1	200	2	100	10	80	250	
PL-2H36-1	200	2	400	50	320	250	
PL-5S33-1		25	250	10	80	250	
PL-5S36-1		25	2000	100	320	250	
PLT-10384	10	15	250	10	80	100	Tube Package. Axial leads.
PLT-10387	10	15	3000	50	320	100	
PLT-2H384	200	2	500	10	80	100	
PLT-2H387	200	2	10000	50	320	100	
NSL-26		16	2000	10	120	200	Tube Package. Axial leads.
NSL-28		16	400	10	100	50	
NSL-32		20	500	0.500	60	50	
NSL-36		40	400	0.500	220	200	

INFRARED EMITTING DIODIES

Cell Type No.	λpK (nm)	Typical Output Power Po (mW)	Description
SLED56-1L	940	3.0	GaAs IR LED in a lensed or flat window hermetic package
SLED56-1F	940	3.0	
SLED56-2L	880	4.5	GaAlAs IR LED in a lensed or flat window hermetic package
SLED56-2F	880	4.5	

Special Selections Available

SILICON NPN PLANAR EPITAXIAL PHOTOTRANSISTORS

Cell Type No.	Light Current 5mW/cm²	BV_{CEO} @ .1mA	Dark Current I_D (nA)	Description
SLT50-L1	≥.6mA	≥40V	25	NPN planar epitaxial phototransistors in a hermetic package with lensed window
SLT50-L2	≥1.2	≥40	25	
SLT50-L3	≥2.4	≥40	25	
SLT50-L4	≥4.0	≥40	25	
SLT50-L5	≥6.0	≥40	100	
SLT50-L6	≥15.0	≥40	100	
SLT50-F1	≥.2mA	≥30V	25	NPN Planar epitaxial phototransistors in a hermetic package with flat window
SLT50-F2	≥.4	≥30	25	
SLT50-F3	≥1.0	≥30	25	
SLT50-F4	≥2.5	≥30	100	

Special Selections Available

SILICON PHOTODIODES

Cell Type No.	Min. Short Ct* Curr. mA	Min. Open Ct* Volt.	Dark Curr. μA @ 1V @25°C.	Reverse Voltage Recom. Max.	Description
NSL-801-1	0.325	0.275	1.5	10	.1" × .2" Chip, with Leads
NSL-701-9	0.30	0.35	3	5	9 Element cell, 0.1" Spacing
NSL-802	0.65	0.275	2.5	10	.2" × .2" Chip with Leads
NSL-803	1.5	0.275	7.5	10	.2" × .4" Chip with leads
NSL-805	4.77	0.275	12.5	10	.76" × .354" Chip with leads
NSL-806	3.0	0.275	10	10	.4" × .4" Chip with leads
NSL-807	3.5	0.275	12.5	10	.2" × 1" Chip with leads
NSL-808	1.4	0.275	7.5	10	.1" × 1" Chip with leads
NSL-810	0.150	0.275	0.5	10	TO-18 case
NSL-881	0.3	0.275	2.5	10	TO-5 Hermetic Case

*At 500Ftc (25mW/cm² 2870°K Source

SILICON PLANAR PHOTODIODES

Cell Type No.	Short Ck. Current 5mW/cm² (μA)	Dark Current @ – 100mV (nA)	Junction Cap.max. (pF)	Area (cm²)	Description
SLD69	150	100	400	0.193	Featuring high linearity, low dark current and fast response in a low cost ceramic package. Available with visible blocking epoxy filter
SLD70C1	20	25	50	0.025	
SLD70C2	75	50	200	0.126	

SILICON PLANAR PHOTODETECTORS

Cell Type No.	Min. Short Ct.* Curr. μA	Min. Open Ct.* Volt.	Dark Curr. NA@5V @25°C	Break-down Voltage (V)	Description
NSL-811	100	0.4	5	40	TO-18, Flat Window
NSL-812	310	0.4	5	40	TO-17, Low Lens
NSL-813	220	0.4	5	40	TO-18, High Lens
NSL-814	90	0.4	5	40	TO-52, Flat Window
NSL-815	240	0.4	5	40	TO-52, Low Lens
NSL-883	360	0.4	10	20	TO-5, Flat Window
NSL-893	800	0.4	20	10	TO-8, Flat Window

*At 500 Ftc, 2870°K Source

NSL-811 and NSL-883 are available in dual and quad versions in TO-5 and TO-8 packages.

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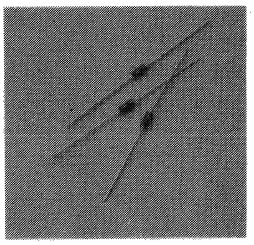
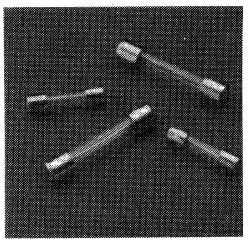
FUSE PRODUCTS





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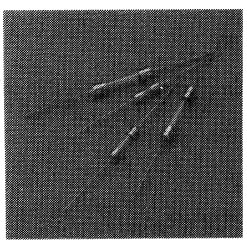

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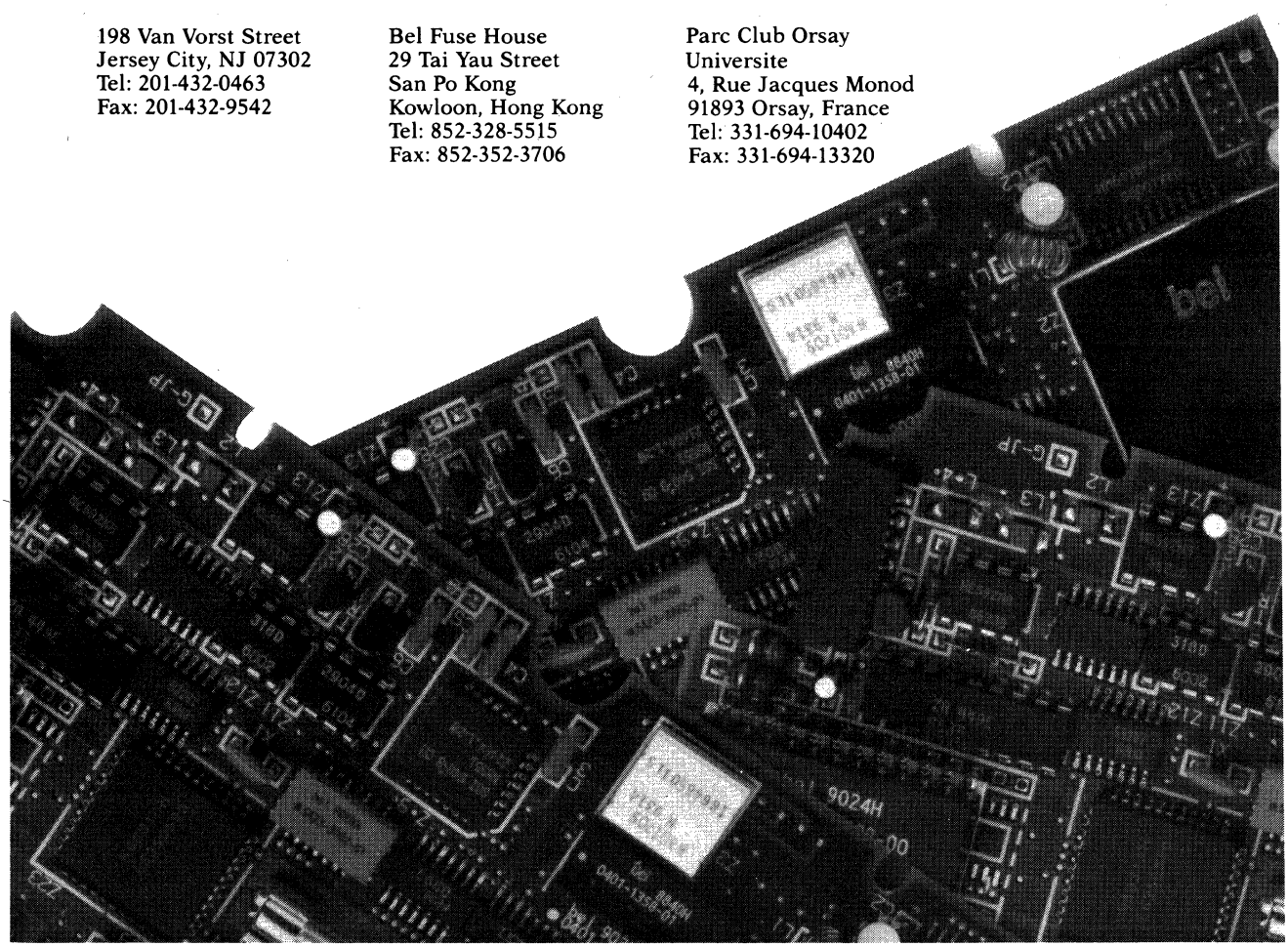

CIRCUIT BREAKERS, LIMITERS, SUPPRESSORS

Manufacturer	Starting EEM Page No.	Circuit Breakers	Limiters/ Protectors, Surge	Sup-pressors, Transient Voltage	Data Line Protectors	Conformance			
						UL	CSA	Semko	MIL
Airpax/Cambridge Div.	B•1348	√				√	√		√
Altech Corporation	B•1349	√				√			
Amber Ind. Inc.	B•1351		√	√	√	√			
Carlingswitch Inc.	B•1356	√				√	√		
ETA Circuit Breakers	B•1361	√				√	√		
Globtek Inc.	B•1367		√	√	√	√			
Heinemann Electric Co.	B•1368	√				√	√		√
Littelfuse	B•1372	√				√	√		
MCG Electronics	B•1375			√	√	√			
Mechanical Products	B•1378	√				√	√		
Polyphaser Corp	B•1385		√	√	√				
PPD	B•1386		√	√		√			
Rodale Technical Sales	B•1388	√				√	√		
Wickmann USA	B•1392		√						

FUSES

Manufacturer	Starting EEM Page No.	Normal Action	Slow Blowing	Fast Action	Failure Indicat-ing	Rectifier	Mini-ature & Submin.	Clips & Holders	Conformance			
									UL	CSA	SEMKO	MIL
Bel Fuse Inc.	B•1352	√	√	√			√	√	√	√	√	
Littelfuse	B•1372	√	√	√	√	√	√	√	√	√	√	√
Panel Components	B•1382		√	√			√	√	√	√	√	
Shurter Inc.	B•1389	√		√			√	√	√	√	√	
Therm-O-Disc	B•1391	√							√	√	√	
Wickmann USA	B•1392	√	√	√			√	√				

CIRCUIT BREAKERS

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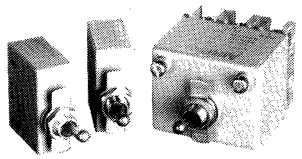
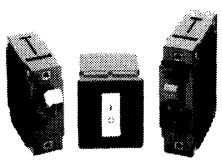


Models AP and UP**

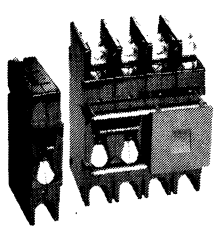
Hermetically sealed. DC, 50/60 Hz or 400 Hz versions. Various delays to meet your needs. UP version has wide glass terminals.
Specifications: 1 to 3 poles. Ratings: 0.05-20A, 240 VAC, 50 VDC, Interrupting capacity: AP MIL, 500A @120 VAC, 50 VDC; 300A @ 240 VAC. UP 1000A @ 32 VDC, 240 VAC.
Approval: QPL: MIL-C-39019 Lloyds

**(UP, single pole, series only)



Models SNAPAK®, IEG and IEL

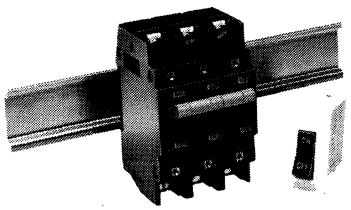
All conform to VDE and IEC spacing requirements.
Specifications: SNAPAK: 1 or 2 pole ratings. 7.6 to 15A at 32 VDC/125 VAC, 0.10 to 7.6A at 50 VDC/250 VAC.
2-pole only (2-pole breaking) and ratings: 7.6 to 15A at 125/250 VAC, 32/50 VDC. Interrupting capacity: 1000A at 125 VAC, 250 VAC, 32 VDC AND 65 VDC
Approval: IEC VDE* Lloyds
IEG and IEL Ratings: 0.05-30A, 277 VAC, 65 VDC (Model IEG). 0.05-50A, 277 VAC, 65 VDC (Model IEL). Interrupting capacity: 3500A, 277 VAC max., 2000A, 65 VDC (Model IEG). 5000A, 277 VAC max., 2000A, 65 VDC (Model IEL).
Approval: VDE*



Model 209

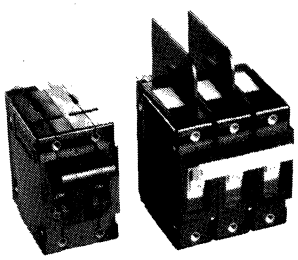
Ideal for branch circuits. Mounts in switch boards, panel enclosures, panel boards, junction boxes. Series includes 219 manual motor controller, 229 appliance controller, 249, 259 and 269 marine power selectors.
Specifications: 1 to 6 poles. Ratings: 0.10-100A, 125 VDC; 0.10-77A, 600 VAC; 0.10-100A, 120, 240 277 and 480 VAC. Interrupting capacity: 5000A.
Approval: Lloyds

*Limited approvals, consult factory



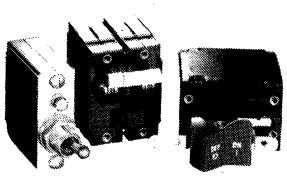
Models 203 and IELHR

203 is a front panel mounting device which combines over-current protection, ON-OFF switching and pilot light. Series, shunt or relay trip.
Specifications: 1 to 3 poles. Ratings: 0.05-10A, 250 VAC, 50 VDC, 10.1-20A, 120 VAC, 32 VDC. Interrupting capacity: 1000A.
Approval: Lloyds
IELHR designed for 35 mm symmetrical DIN rail; quick mounting, easy removal. Handle assembly available in 7 colors.
Specifications: Ratings: 0.05-50A, 65VDC and 250 VAC. Operating temperature: -40°C to + 85°C.



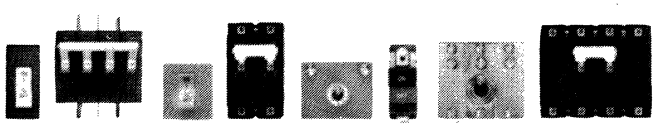
Models APL/UPL and 205

These breakers offer precision operation for critical service. Series, shunt and relay configuration options. Choice of delays, ratings. 205 is dust-sealed for harsh environments.
Specifications: 1 to 9 poles. Model APL/UPL Ratings: 0.05-20A, 277 VAC; 0.05-50A, 250 VAC; 0.05-100A, 65 VDC. Interrupting capacity: 5000A, 120 VAC; 2000A, 65 VDC. Model 205 Ratings: 0.05-20A, 277/480 VAC; 0.05-50A, 250 VAC; 0.05-100A, 32 VDC. Interrupting capacity: 5000A, 277/480 VAC; 5000A, 250 VAC; 2000A, 32 VDC.
Approval: QPL: MIL-C-55629 Lloyds



Models APG/UPG/IPG

Low-cost, precision operation. Multi-pole assemblies, single or multi-handle. For data processing, broadcast equipment, vending machines, controllers, etc.
Specifications: 1 to 4 poles. Ratings: 0.02-30A, 277 VAC, (Model IPG, 250 VAC), 65 VDC, 31-50A, 50 VDC. Interrupting capacity: 1000A, 277 VAC; (Models IPG, 250 VAC), 2000A, 65 VDC; and at 5000A, max. ratings of 30 A 120 VAC, 20A at 250 VAC, 10A at 277 VAC, (Model IPG, 250 VAC).
Approval: QPL: Mil-C-55629 Lloyds Model IPG-VDE*



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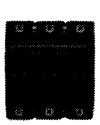

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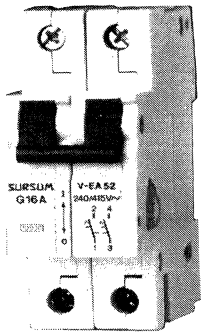
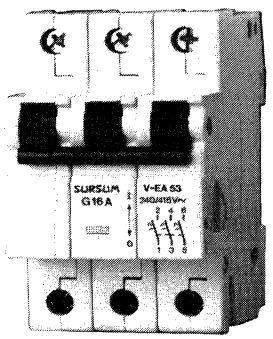
- Toggle lever indicates ON/OFF position
- International approvals
- Selection of trip delays



Single-Pole



Two-Pole



Three-Pole

G-SERIES

Rated Current	Single-Pole		Two-Pole		Three-Pole	
	Type	Cat. #	Type	Cat. #	Type	Cat. #
.3	1G030	15.1003	2G030	15.2003	3G030	15.3003
.5	1G050	15.1005	2G050	15.2005	3G050	15.3005
.80	1G080	15.1008	2G080	15.2008	3G080	15.3008
1.0	1G1.0	15.1010	2G1.0	15.2010	3G1.0	15.3010
1.6	1G1.6	15.1016	2G1.6	15.2016	3G1.6	15.3016
2.0	1G2.0	15.1020	2G2.0	15.2020	3G2.0	15.3020
2.5	1G2.5	15.1025	2G2.5	15.2025	3G2.5	15.3025
3.0	1G3.0	15.1030	2G3.0	15.2030	3G3.0	15.3030
3.5	1G3.5	15.1035	2G3.5	15.2035	3G3.5	15.3035
4.0	1G4.0	15.1040	2G4.0	15.2040	3G4.0	15.3040
5.0	1G5.0	15.1050	2G5.0	15.2050	3G5.0	15.3050
6.0	1G6.0	15.1060	2G6.0	15.2060	3G6.0	15.3060
8.0	1G8.0	15.1080	2G8.0	15.2080	3G8.0	15.3080
10.0	1G .10	15.1100	2G .10	15.2100	3G .10	15.3100
12.0	1G .12	15.1120	2G .12	15.2120	3G .12	15.3120
15.0	1G .15	15.1150	2G .15	15.2150	3G .15	15.3150
20.0	1G .20	15.1200	2G .20	15.2200	3G .20	15.3200
25.0	1G .25	15.1250	2G .25	15.2250	3G .25	15.3250
30.0	1G .30	15.1300	2G .30	15.2300	3G .30	15.3300
40.0	1G .40	15.1400	2G .40	15.2400	3G .40	15.3400
50.0	1G .50	15.1500	2G .50	15.2500	3G .50	15.3500
60.0	1G .60	15.1600	2G .60	15.2600	3G .60	15.3600

• Please inquire about circuit breakers with switched neutral and four pole versions

TECHNICAL INFORMATION

Voltage Ratings: 415 VAC, and 48VDC (single pole)
100VDC (two pole)
Current Ratings: 0.3A to 60A
Short Circuit Breaking Capacity: up to 15000 AMPS, to IEC157-1
Frequency Range: DC to 400HZ
Opening Time (t_E): 7ms
Contact Life: 20,000 operations

ACCESSORIES

Auxiliary Switch

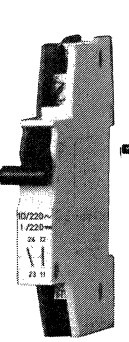
Contact Configuration	Type	Cat. No.	Std. Pack
1 n.o. 1 n.c.	H1	15.5011	10
1 n.o. 2 n.c.	H2	15.5012	10
2 n.o. 1 n.c.	H3	15.5021	10

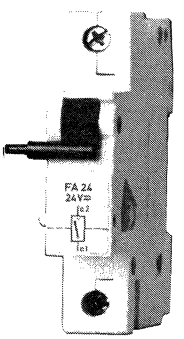
Electrical Ratings: 10A 220VAC, 3A 110VDC, 1A 220VDC

Remote Operated Shunt Trips

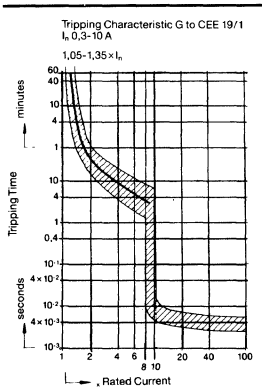
Voltage AC/DC	Current	Type	Cat. No.	Std. Pack
12V	1.3A	FA.12	15.6120	5
24V	.6A	FA.24	15.6240	5
48-72V	.2A	FA.48	15.6480	5
110V	.25A	FA.110	15.6110	5
220V	.5A			

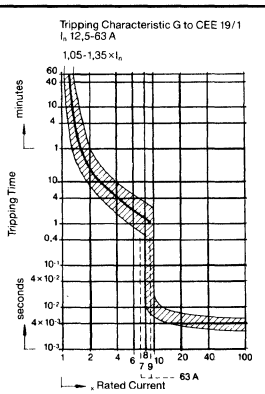
• Full line of enclosures are available
• 1, 2 and 3 phase busbars on request


Auxiliary Switch



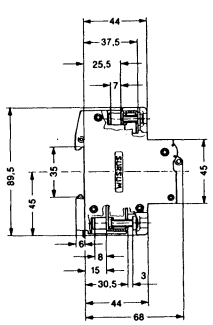
Shunt Trip





DIMENSIONS

Outside dimensions as shown
Face of breaker is DIN standard 45mm (1.77 in.)
Single pole breaker is one step wide 18mm (.71 in.)
Two-pole breaker is two steps wide 36mm (1.42 in.)
Auxiliary switch is one-half step wide 9mm (.35 in.)
Shunt trip is one step wide 18mm (.71 in.)



SEE OUR ENCLOSURES IN SECTION 1400 C•1006/SEE OUR TERMINAL BLOCKS IN SECTION 2100 C•1164/SEE OUR SWITCHES IN SECTION 5100 B•1643

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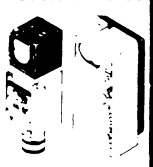
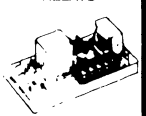
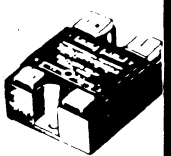
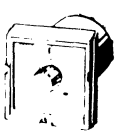

PHOTOELECTRICS


RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS


TERMINAL BLOCKS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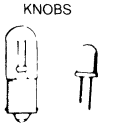
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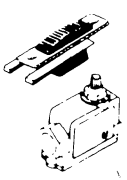
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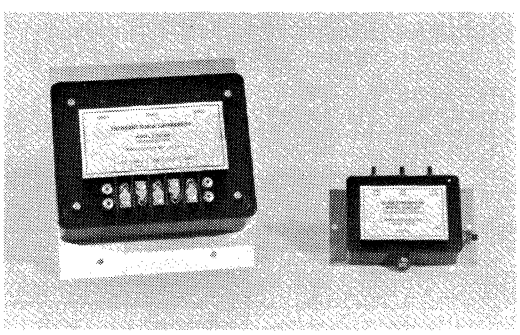
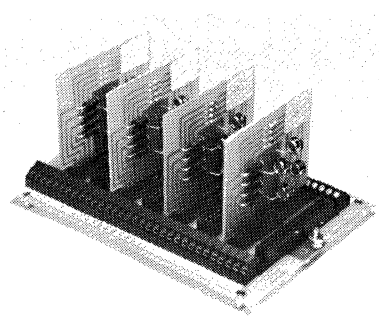
AC POWER LINE AND DATA LINE TRANSIENT SUPPRESSORS









SINGLE PHASE PROTECTION

Both the OEM series and CM series AC transient suppressors attenuate spikes and fill notches throughout the full 360 degrees of the AC sinewave. Unlike other suppressors which merely clamp a transient hundreds of volts above or below reference, Amber operates within +/– 1 volt variation of the sinewave instantaneous voltage. The CM series adds common mode protection (hot to ground and neutral to ground). Both OEM and CM series are UL 1449 approved (file #E103476). Models are available with either screw terminals or wire leads. Models are also available for DC power and "line cord" protection. Not only does Amber outperform other approaches in both categories of IEEE-587; it also outperforms the competition in the new (1992) IEC and ANSI standards.

THREE PHASE PROTECTION

Amber's three phase protection is available for either the OEM or full facilities protection. The small size and mounting profile allow them to be used in many locations where mounting larger units would be impractical or impossible. These protectors are designed so as to be installed in either the user's electrical panel or the equipment manufacturer's enclosure. The 1135 models have built-in self diagnostics and alert of any fault. Both OEM and facilities models are available for all service types and voltages. Amber's three phase protectors are among the most cost effective on the market today. The OEM version of the three phase protector is UL approved to 1449 (file #E103476).

DATA LINE PROTECTION

The Amber ACS system protects digital data lines, sensor and transducer lines, plus 4-20mA current loops. Each ACS enclosure will protect up to 32 single-ended data lines or 16 differential pairs or 4-20mA loops or 8 RS-232 sets. A Nema type 1 enclosure is standard, with type 4 or type 12 available as options. Each line is separately protected up to 3000 surge amps with only 10 ohms maximum impedance. The modular construction of the ACS system allows different data types to be protected in the same enclosure.

THE AMBER DIFFERENCE

Amber Industries Inc. is a technological leader in single phase, three phase and data line surge suppression. We invite you to let us know what your specific requirements are. Our applications and engineering departments will work directly with your engineers to assure a quality design based on the most up-to-date suppression technology available.

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CAGE #OF816

FUSES/UL, CSA & SEMKO 1-1/4" x 1/4" & 1" x 1/4"

TYPE 3AG/3AP NORMAL BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	3AG Inches	3AG (mm)	3AP Inches	3AP (mm)	Pigtail Leads Inches	Pigtail Leads (mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.032	(0.813)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3AG100	1/10	250	3AG1.5	1-1/2	250
3AG125	1/8	250	3AG1.6	1-6/10	250
3AG150	15/100	250	3AG1.75	1-3/4	250
3AG175	.175	250	3AG2	2	250
3AG187	3/16	250	3AG2.3	2-3/10	250
3AG200	2/10	250	3AG2.5	2-1/2	250
3AG250	1/4	250	3AG3	3	250
3AG300	3/10	250	3AG3.5	3-1/2	250
3AG375	3/8	250	3AG4	4	250
3AG400	4/10	250	3AG4.5	4-1/2	250
3AG500	1/2	250	3AG5	5	250
3AG600	6/10	250	3AG6	6	250
3AG750	3/4	250	3AG7	7	250
3AG800	8/10	250	3AG8	8	250
3AG1	1	250	3AG10	10	125
3AG1.25	1-1/4	250			

Listed by Underwriters Laboratories and certified by Canadian Standards Association through 10 Amperes.

Type 3AG fuses, described as normal blow, are medium to quick acting protectors for use in general circuit applications. Suitable for most circuits where high surges or transients are not anticipated. Pigtail leads (Type 3AP) are available when direct soldering into circuits is desirable.

TYPE 3WO/3WOP SLOW BLOW GLASS TUBE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum

MECHANICAL DIMENSIONS

Dimensions	3WO Inches	3WO (mm)	3WOP Inches	3WOP (mm)	Pigtail Leads Inches	Pigtail Leads (mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.039	(1.0)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating
3WO6	6	125
3WO7	7	125
3WO8	8	125
3WO10	10	125
3WO12	12	125
3WO15	15	125

Listed by Underwriters Laboratories and Certified by Canadian Standards Association from 6 to 15 Amperes.

The 3WO fuses, described as slow blow, are suitable for use in microwave ovens and in general circuit applications. Pigtail leads (Type 3WOP) are available when direct soldering into circuits is desired.

TYPE 3SB/3SBP SLOW BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum

MECHANICAL DIMENSIONS

Dimensions	3SB Inches	3SB (mm)	3SBP Inches	3SBP (mm)	Pigtail Leads Inches	Pigtail Leads (mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.032	(0.813)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3SB062	1/16	250	3SB1.25	1-1/4	250
3SB100	1/10	250	3SB1.5	1-1/2	250
3SB125	1/8	250	3SB1.6	1-6/10	250
3SB150	15/100	250	3SB1.8	1-8/10	250
3SB175	.175	250	3SB2	2	250
3SB187	3/16	250	3SB2.25	2-1/4	250
3SB200	2/10	250	3SB2.5	2-1/2	250
3SB250	1/4	250	3SB2.8	2-8/10	250
3SB300	3/10	250	3SB3	3	250
3SB375	3/8	250	3SB3.2	3-2/10	250
3SB400	4/10	250	3SB3.5	3-1/2	250
3SB500	1/2	250	3SB4	4	250
3SB600	6/10	250	3SB4.5	4-1/2	250
3SB700	7/10	250	3SB5	5	250
3SB750	3/4	250	3SB6	6	250
3SB800	8/10	250	3SB7	7	250
3SB1	1	250	3SB8	8	250
3SB1.2	1-2/10	250			

Listed by Underwriters' Laboratories through 8 amperes. Certified by Canadian Standards Association through 8 amperes.

Type 3SB fuses, described as slow blow, are designed to prevent unnecessary blowing in circuits where transient surges are anticipated. Protection against short circuit or continued overload is still maintained. Pigtail leads (Type 3SBP) are available when direct soldering into circuits is desired.

TYPE 3SF/3SFP QUICK ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	$2I_n$ Max.	$2.75I_n$ Min.	$2.75I_n$ Max	$4I_n$ Min.	$4I_n$ Max	$10I_n$ Max.
50 to 100 mA inclusive	20 s	2 ms	200 ms	1 ms	30 ms	5 ms
Above 100 mA to 10 A	20 s	20 ms	1500 ms	8 ms	400 ms	80 ms

MECHANICAL DIMENSIONS

Dimensions	3SF Inches	3SF (mm)	3SFP Inches	3SFP (mm)	Pigtail Leads Inches	Pigtail Leads (mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.032	(0.813)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3SF050	.05	250	3SF800	.800	250
3SF063	.063	250	3SF1	1	250
3SF080	.080	250	3SF1.25	1.250	250
3SF100	.100	250	3SF1.6	1.600	250
3SF125	.125	250	3SF2	2	250
3SF160	.160	250	3SF2.5	2.500	150
3SF200	.200	250	3SF3.15	3.15	150
3SF250	.250	250	3SF4	4	150
3SF315	.315	250	3SF5	5	60
3SF400	.400	250	3SF6.3	6.3	60
3SF500	.500	250	3SF8	8	60
3SF630	.630	250	3SF10	10	60

Approved by SEMKO from 315 mA through 10 A.

Type 3SF fuses are designed to meet the electrical and mechanical requirements of IEC 127, CEE 4, Standard Sheet IV. They carry the SEMKO mark in the values specified as SEMKO approved. They are mechanically interchangeable with Type 3AG, the 1/4×1-1/4 normal blow fuse. However, since the fusing characteristics specified in IEC 127 and UL 198G are different, it is important that the designer carefully compare the blowing curves of the two types before substituting one for the other. They permit manufacturers of equipment built to United States/Canadian standards to substitute a fuse acceptable and available in the European market without changing board layouts or fuse mountings. Pigtail leads (3SFP) are available when direct soldering into circuits is desired.

TYPE 8AG/8AP NORMAL BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	8AG Inches (mm)	8AP Inches (mm)	Pigtail Leads Inches (mm)
Diameter	.250 (6.35)	.270 (6.9)	.032 (.813)
Length	1.00 (25.4)	1..03. (26.2)	1.5 (38.1)

Catalog Number		Ampere Rating	Voltage Rating
8AG100	8AP100*	1/10	250
8AG125	8AP125	1/8	250
8AG250	8AP250	1/4	250
8AG375	8AP375	3/8	250
8AG500	8AP500	1/2	250
8AG750	8AP750	3/4	250
8AG1	8AP1	1	250
8AG1.5	8AP1.5	1-1/2	250
8AG2	8AP2	2	250
8AG2.5	8AP2.5	2-1/2	125
8AG3	8AP3	3	125
8AG4	8AP4	4	125
8AG5	8AP5	5	125
8AG6	A8P6	6	125
8AG7	8AP7	7	125

*Pigtail (AP)

Listed by Underwriters' Laboratories through 7 amperes. Certified by Canadian Standards Association through 5 amperes.

Type 8AG is designated as a normal blow fuse for use in general circuit protection. Their smaller size permits use where space limitations prevent use of Type 3AG. Pigtail leads (Type 8AP) are available when direct soldering into circuits is desired.

bel BEL FUSE INC. 198 Van Vorst Street/Jersey City. NJ 07302/(201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

FUSES/UL, CSA & SEMKO 5mm x 20mm

TYPE 5MF FAST ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5MF100	1/10	250	5MF1	1	250
5MF125	1/8	250	5MF1.25	1-1/4	250
5MF200	2/10	250	5MF1.6	1-6/10	250
5MF250	1/4	250	5MF2	2	250
5MF300	3/10	250	5MF2.5	2-1/2	250
5MF400	4/10	250	5MF3	3	250
5MF500	1/2	250	5MF4	4	125
5MF600	6/10	250	5MF5	5	125
5MF700	7/10	250	5MF6	6	125
5MF800	8/10	250	5MF7	7	125
			5MF8	8	125

Listed by Underwriters' Laboratory from 50 mA to 8 amperes. Certified by Canadian Standards Association through 8 amperes.

Type 5MF fuses, described as fast acting are manufactured to meet the requirements of UL 198G and CSA 22.2. They permit European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration. Pigtail leads (5MFP) are available when direct soldering into circuits is desired.

TYPE 5MT TIME LAG GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	2 minutes, maximum
1000%	10 milliseconds, minimum

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5 (0.197)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5MT100	1/10	250	5MT1	1	125
5MT125	1/8	250	5MT1.25	1-1/4	125
5MT200	2/10	250	5MT1.6	1-6/10	125
5MT250	1/4	250	5MT2	2	125
5MT300	3/10	250	5MT2.5	2-1/2	125
5MT400	4/10	250	5MT3	3	125
5MT500	1/2	250	5MT4	4	125
5MT600	6/10	250	5MT5	5	125
5MT700	7/10	250	5MT6	6	125
5MT800	8/10	250	5MT7	7	125

Listed by Underwriters' Laboratories from 50 mA to 5 amperes. Certified by Canadian Standards Association through 5 amperes.

Type 5MT fuses, described as time lag offer additional surge protection for circuits where momentary transients are anticipated. They are built to meet the specifications of UL 198G and CSA 22.2. They permit the European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration. Pigtail leads (5MTP) are available when direct soldering into circuits is desired.

TYPE 5SF QUICK ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	2.1 I_n Max.	2.75 I_n Min.	2.75 I_n Max.	4 I_n Min.	4 I_n Max.	10 I_n Max.
32 to 100 mA inclusive	30 min	10 ms	500 ms	3 ms	100 ms	20 ms
Above 100 mA to 6.3A	30 min	50 ms	2 s	10 ms	300 ms	20 ms

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5SF032	.032	250	5SF500	1/2	250
5SF040	.040	250	5SF630	.630	250
5SF050	1/20	250	5SF800	8/10	250
5SF063	1/16	250	5SF1	1	250
5SF080	.080	250	5SF1.25	1-1/4	250
5SF100	1/10	250	5SF1.6	1-6/10	250
5SF125	1/8	250	5SF2	2	250
5SF160	.160	250	5SF2.5	2-1/2	250
5SF200	2/10	250	5SF3.15	3.15	250
5SF250	1/4	250	5SF4	4	250
5SF315	.315	250	5SF5	5	250
5SF400	4/10	250	5SF6.3	6-3/10	250

Approved by SEMKO for 80 mA, 125 mA, and from 250 mA through 6.3A.

Type 5SF fuses, described as quick acting, low breaking capacity, are manufactured to the specifications of IEC 127, CEE 4, Standard Sheet II (Type F). Used throughout Europe, they carry the SEMKO mark in the ratings indicated. They are used for general circuit protection in electrical and electronic equipment where momentary transients are not anticipated. Pigtail leads (5SFP) are available when direct soldering into circuits is desired.

TYPE 5ST TIME LAG GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	2.1 I_n Max.	2.75 I_n Min.	2.75 I_n Max.	4 I_n Min.	4 I_n Max.	10 I_n Min.	10 I_n Max.
32 to 100 mA inclusive	2 min	200 ms	10 s	40 ms	3 s	10 ms	300 ms
Above 100 mA to 6.3A	2 min	600 ms	10 s	150 ms	3 s	20 ms	300 ms

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5ST032	.032	250	5ST500	1/2	250
5ST040	.040	250	5ST630	.630	250
5ST050	1/20	250	5ST800	8/10	250
5ST063	1/16	250	5ST1	1	250
5ST080	.080	250	5ST1.25	1-1/4	250
5ST100	1/10	250	5ST1.6	1-6/10	250
5ST125	1/8	250	5ST2	2	250
5ST160	.160	250	5ST2.5	2-1/2	250
5ST200	2/10	250	5ST3.15	3.15	250
5ST250	1/4	250	5ST4	4	250
5ST315	.315	250	5ST5	5	250
5ST400	4/10	250	5ST6.3	6-3/10	250

Approved by SEMKO from 63 mA through 6.3A.

Type 5ST fuses, described as time lag, low breaking capacity, are manufactured to the specifications of IEC 127, CEE 4, Standard Sheet III (Type T). They carry the SEMKO mark in the ratings indicated. They are used for general circuit protection in electrical and electronic equipment where momentary transients are anticipated. Pigtail leads (5STP) are available when direct soldering into circuits is desired.

TYPE 5TT SLOW BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum (3 seconds minimum for fuses with rating over 3 amp)

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5TT100	1/10	250	5TT1	1	250
5TT125	1/8	250	5TT1.25	1-1/4	250
5TT200	2/10	250	5TT1.6	1-5/10	250
5TT250	1/4	250	5TT2	2	250
5TT300	3/10	250	5TT2.5	2-1/2	250
5TT400	4/10	250	5TT3	3	250
5TT500	1/2	250	5TT4	4	125
5TT600	6/10	250	5TT5	5	125
5TT700	7/10	250	5TT6	6	125
5TT800	8/10	250	5TT7	7	125

Listed by Underwriters' Laboratories from 50mA to 5 amperes and certified by CSA through 5 amperes.

Type 5TT fuses, described as slow blow, are designed to withstand higher surge currents occurring at switching during the normal life of equipment than the 5MT series. They are built to meet the specifications of UL 198G and CSA 22.2. They permit the European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration.

Pigtail leads (5TTP) are available when direct soldering into circuits is required.

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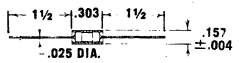
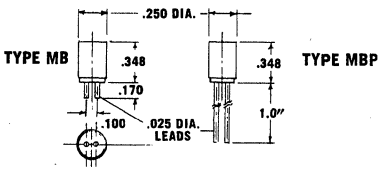
TYPE MB/MBP/MFA MICROBEL MICRO FUSE SERIES

TYPE MFA





ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
*150%	10 minutes, maximum
200%	5 sec. max.

*Not applicable to MFS

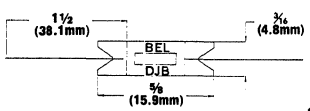
Catalog Number			Ampere Rating	Voltage Rating
MB125	MBP125	MFA125	1/8	125
MB250	MBP250	MFA250	1/4	125
MB375	MBP375	MFA375	3/8	125
MB500	MBP500	MFA500	1/2	125
MB750	MBP750	MFA750	3/4	125
MB1	MBP1	MFA1	1	125
MB1.5	MBP1.5	MFA1.5	1-1/2	125
MB2	MBP2	MFA2	2	125
MB2.5	MBP2.5	MFA2.5	2-1/2	125
MB3	MBP3	MFA3	3	125
MB3.5	MBP3.5	MFA3.5	3-1/2	125
MB4	MBP4	MFA4	4	125
MB5	MBP5	MFA5	5	125
MB7	MBP7	MFA7	7	125

MFA is UL listed through 7A while MB/MBP are UL listed and CSA certified through 7A.

MFA type fuses are subminiature and are color coded for current rating identification.

MB/MBP are designed for applications where space is a critical factor.

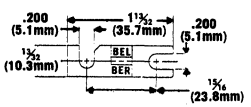
TYPE DJB FLAT PACK FUSE



ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
160%	25 seconds, maximum

TYPE BER FLAT PACK FUSE



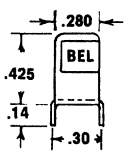
ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
135%	1 hour, maximum
200%	1 minute, maximum

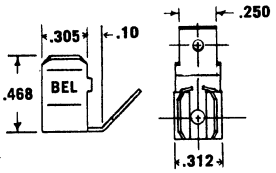
Catalog Number		Ampere Rating	Catalog Number		Ampere Rating
DJB250	BER250	1/4	DJB2	BER2	2
DJB300	BER300	3/10	DJB2.25	BER2.25	2-1/4
DJB400	BER400	4/10	DJB2.5	BER2.5	2-1/2
DJB500	BER500	1/2	DJB2.75	BER2.75	2-3/4
DJB600	BER600	6/10	DJB3	BER3	3
DJB750	BER750	3/4	DJB3.5	BER3.5	3-1/2
DJB875	BER875	7/8	DJB4	BER4	4
DJB1	BER1	1	DJB5	BER5	5
DJB1.25	BER1.25	1-1/4	DJB8	BER8	8
DJB1.5	BER1.5	1-1/2	DJB10	BER10	10

Fuse Clips Reel And Rail Packaging

CLIPS

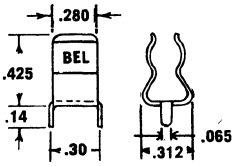


TYPE FC-101
3AG Clip
PC Board Mount
(Ear Stops)

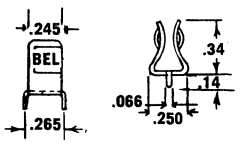


TYPE FC-107
3AG Clip
Hole Mount
(.250 Quick Connect)

TYPE FC-102
3AG Clip
PC Board Mount
(Earless)

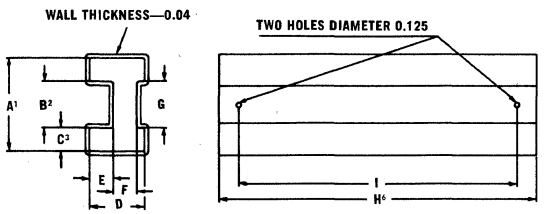


TYPE FC-201
5mm Clip
PC Board Mount
(Ear Stops)



All Bel Fuse clips are manufactured from .020 phosphor bronze stock and specially hardened to assure long life and minimum contact resistance. They are bright tin plated to facilitate soldering and prevent oxidation. In addition to the stock designs illustrated, clips can be quickly tooled to meet customer specifications.

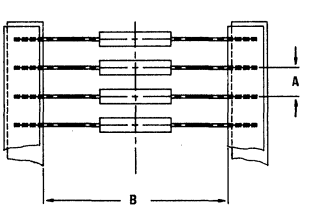
RAIL PACKAGING



Fuse Type	A	B	C	D	E	F	G	H	I
5mm x 20mm	1.00 +.02 −.00	.34 ±.01	.330	.55 +.02 −.00	.280	.20 +.02 −.00	.300 ±.010	13.2	12.60
	(25.4 +0.5 −.0)	(8.6 ±0.3)	(8.4)	(14.0 +0.5 −.0)	(7.1)	(5.1 +0.5 −.0)	(7.6 ±0.3)	(335.2)	(320.0)
¼ inch x 1¼ inch	1.45 +.03 −.00	.64 ±.01	.405	.73 +.025 −.000	.365	.26 +.025 −.000	.600 ±.010	15.75	15.08
	(36.8 +0.8 −.0)	(16.3 ±0.3)	(10.3)	(18.5 +0.6 −.0)	(9.3)	(6.6 +0.6 −.0)	(15.2 ±0.3)	(400.1)	(383)

To minimize assembly costs cartridge fuses can be supplied with clips attached. They are shipped in rails. Rail sizes are given above.

REEL PACKAGING



Leaded fuses can be supplied taped and reeled to assist in automatic assembly. Reeled fuses are supplied in quantity increments of 2500 pieces for microfuses and 1000 pieces for 1¼×¼ inch, 1500 pieces for 5×20mm fuses.

Fuse Type	A	B
Micro fuses (MF, MFS, MFA)	5.0 mm	52.4 mm
5×20 mm fuses	10.0 mm	85.0 mm
¼×1¼ inch fuses	10.0 mm	97.0 mm

Specifications Subject To Change Without Notice.

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MICRO FUSES

MQ QUICK ACTING

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
200%	5 seconds, maximum

MQ is recognized under the components program of the UL and certified by the CSA through 15 Amperes.

Catalog Number	Ampere Rating	Voltage Rating
MQ125	1/8	125
MQ250	1/4	125
MQ375	3/8	125
MQ500	1/2	125
MQ750	3/4	125
MQ1	1	125
MQ1.5	1.5	125
MQ2	2	125
MQ2.5	2.5	125
MQ3	3	125
MQ3.5	3.5	125
MQ4	4	125
MQ5	5	125
MQ7	7	125
MQ10	10	125
MQ12	12	125
MQ15	15	125

Marking

Current rating, voltage rating, MQ designation and Bel Fuse logo are printed on each fuse in white ink.

Lead diameter 0.025" except for 10, 12 and 15 Ampere fuses which have a lead diameter of 0.032".

MS SLOW ACTING

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
200%	30 sec., maximum
800%	12 millisecond, minimum

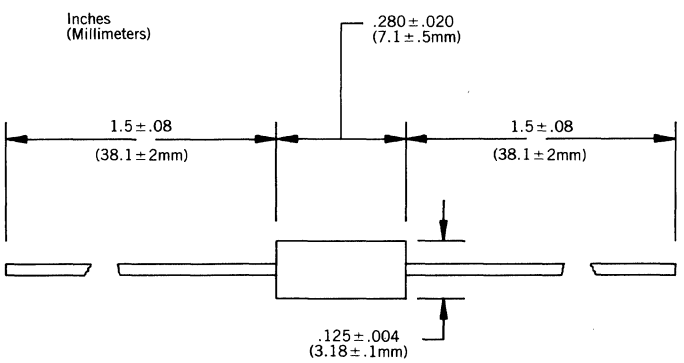
MS is recognized under the components program of the UL and certified by the CSA through 7 Amperes.

Catalog Number	Ampere Rating	Voltage Rating
MS250	1/4	125
MS375	3/8	125
MS500	1/2	125
MS750	3/4	125
MS1	1	125
MS1.5	1.5	125
MS2	2	125
MS2.5	2.5	125
MS3	3	125
MS3.5	3.5	125
MS4	4	125
MS5	5	125
MS7	7	125

Marking

Current rating, voltage rating, MS designation and Bel Fuse logo are printed on each fuse in green ink.

Lead diameter 0.032".



Specifications Subject To Change Without Notice

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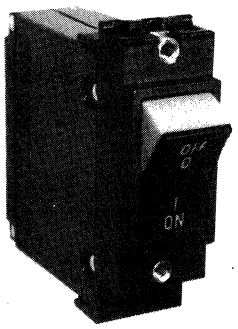
CARLINGSWITCH CIRCUIT BREAKERS

VISI-ROCKER® CIRCUIT PROTECTION

Unique molded-in two-color rocker actuator that indicates mode whether breaker is on or off/tripped. (Indicator and legend color are red with remainder of rocker black.) Available in series trip with 6-32 threaded mtg. inserts and push on .250" tab terminals. Rated @ 250 VAC/65 VDC. Series trip curve-34 (AC-DC type) trip point is 135% of rated current. Recognized by UL Inc., CSA and VDE certified.



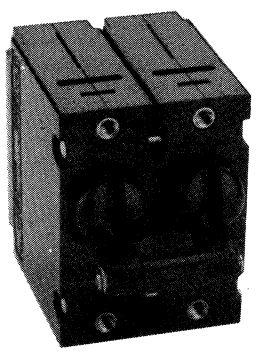
"AC1" Visi-Rocker Circuit Breaker

Type	Amps
(INDICATE ON)	
AC1-BO-34-450-131-D	5
AC1-BO-34-610-131-D	10
AC1-BO-34-615-131-D	15
AC1-BO-34-620-131-D	20
AC1-BO-34-625-131-D	25
AC1-BO-34-630-131-D*	30
(INDICATE OFF/ TRIPPED)	
AF1-BO-34-450-131-D	5
AF1-BO-34-610-131-D	10
AF1-BO-34-615-131-D	15
AF1-BO-34-620-131-D	20
AF1-BO-34-625-131-D	25
AF1-BO-34-630-131-D*	30

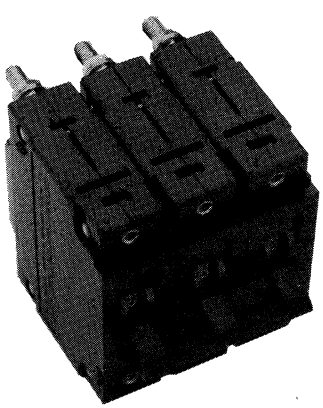
All "B" and "C" series magnetic circuit breakers are Recognized by UL Inc. and are CSA and VDE certified.

All products are of a "series trip" construction, with 6-32 threaded mounting inserts, dual "I-O/ON-OFF" markings on a black toggle actuator, and come with .250" tab (Q.C.) terminals on the "B" series, and 10-32 threaded stud terminals on the "C" series. All units are supplied with a general purpose medium, AC-DC delay curve #34, rated at 250VAC/65 VDC with trip times as shown below.

Percentage of Rated Current	135%	200%	400%	600%	800%	1000%
Trip Time (Seconds)	1.8-100	.60-20	.15-3	.03-1.3	.004-.60	.004-.110



"BA2" Circuit Breaker



"CA3" Circuit Breaker

Type	Amps
"BA1-SERIES" (1-POLE)	
BA1-BO-34-425-121-D	2.5
BA1-BO-34-450-121-D	5
BA1-BO-34-610-121-D	10
BA1-BO-34-620-121-D	20
BA1-BO-34-630-121-D *	30
"BA2-SERIES" (2-POLE)	
BA2-BO-34-450-121-D	5
BA2-BO-34-610-121-D	10
BA2-BO-34-615-121-D	15
BA2-BO-34-620-121-D	20
BA2-BO-34-630-121-D *	30
"BA3-SERIES" (3-POLE)	
BA3-BO-34-610-121-D	10
BA3-BO-34-620-121-D	20
BA3-BO-34-630-121-D *	30
"CA1-SERIES" (1-POLE)	
CA1-BO-34-450-121-D	5
CA1-BO-34-610-121-D	10
CA1-BO-34-615-121-D	15
CA1-BO-34-620-121-D	20
CA1-BO-34-630-121-D	30
CA1-BO-34-640-121-D	40
CA1-BO-34-650-121-D	50
"CA2-SERIES" (2-POLE)	
CA2-BO-34-450-121-D	5
CA2-BO-34-610-121-D	10
CA2-BO-34-615-121-D	15
CA2-BO-34-620-121-D	20
CA2-BO-34-630-121-D	30
CA2-BO-34-640-121-D	40
CA2-BO-34-650-121-D	50
"CA3-SERIES" (3-POLE)	
CA3-BO-34-450-121-D	5
CA3-BO-34-610-121-D	10
CA3-BO-34-615-121-D	15
CA3-BO-34-620-121-D	20
CA3-BO-34-630-121-D	30
CA3-BO-34-640-121-D	40
CA3-BO-34-650-121-D	50

* On "A" and "B" series products, VDE requires end user to solder Q.C. terminal connections on current ratings above 25 amps (UL & CSA do not).

The information listed above is for standard Carlingswitch products. Consult Carlingswitch for additional product information.

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CARLINGSWITCH CIRCUIT BREAKERS

Circuit Options (Consult Factory)

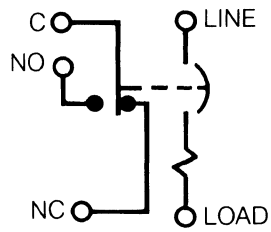
Series Trip

A basic two (2) terminal device usually used as a combination power switch and overload protector. The contacts and current sensing coil are connected in series with the line and load terminals.



Series Trip with Auxiliary Switch

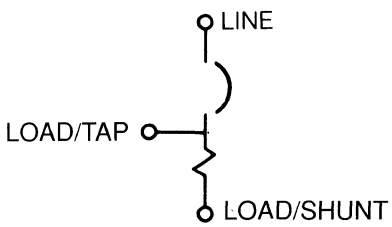
Same as "Series Trip" except with the addition of a SPDT snap-action switch which is *electrically isolated,* but *mechanically* linked to the movement of the main breaker contacts. Commonly used to remotely signal the status of the breaker (on or off/tripped).



B AND C SERIES

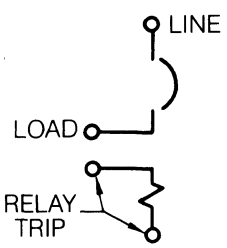
Shunt Trip

A three (3) terminal device similar to a "Series Trip" with the addition of a third terminal between the contacts and coil. This circuit is usually used to control two separate loads from the same power source, while sensing overload current in only one load.



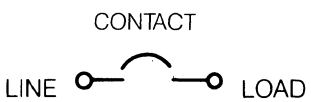
Relay Trip

A four (4) terminal device in which the contact and coil circuits are *electrically isolated* but are still *mechanically* linked to each other. An overload in the coil circuit will cause the contact circuit to open. Both circuits may be of opposite polarity to each other. Commonly used in "dump" circuit or "remote shut down" applications. (Note: World Approval Agencies may require an extra "Series Trip" pole for this function.)



Switch Only

Same as a "Series Trip" device without a sensing coil. Provides low cost, heavy duty switch capability when overload protection is not needed.



Note: The preceding circuits may be mixed on multi-pole units for special application requirements—(consult factory).

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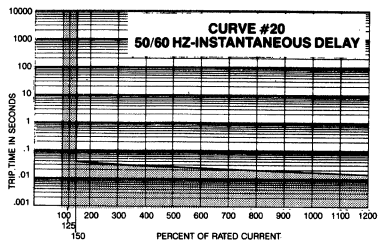
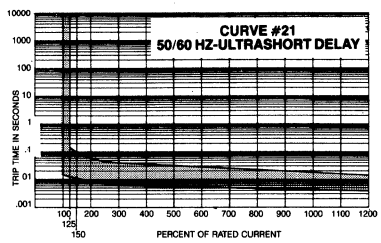
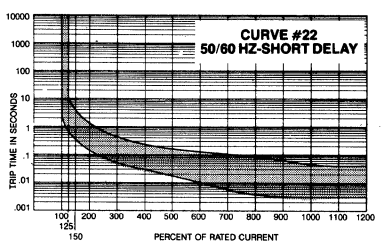
CARLINGSWITCH CIRCUIT BREAKERS

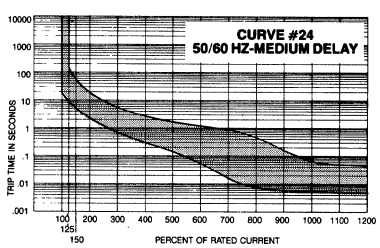
Time Delay Options (Consult Factory)

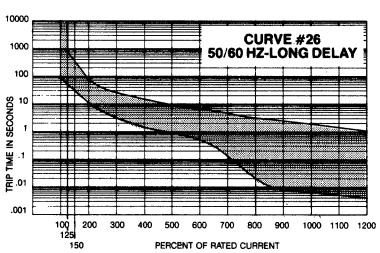
AC



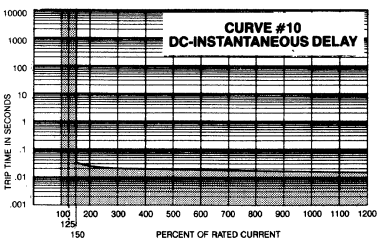


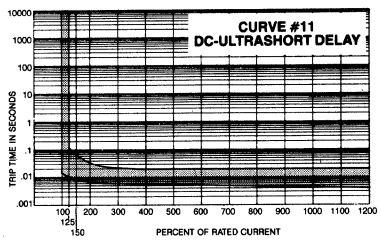


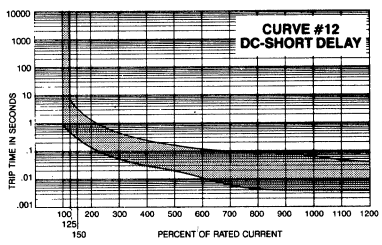


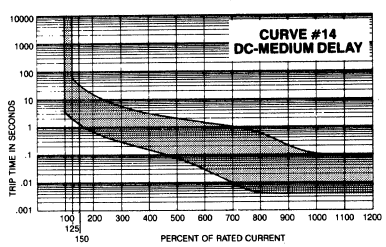


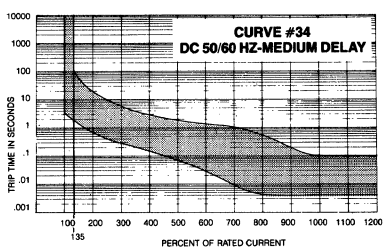
DC











Curve #34 is a combination AC/DC Time Delay Curve.

Notes:

High Inrush Time Delay Curves #42, 44, 46 are also available

Time Delay Curves (#11, 12, 14, 21, 22, 24 & 26):

Breakers must hold 100%, may trip between 101% to 125%, must trip at 125% of rated current and above within time limits shown in curves.

Time Delay Curve (#34):

Breaker must hold 100%, may trip between 101% to 135%, must trip at 135% of rated current and above within time limits shown in curve.

Instantaneous Curves (#10 & 20):

Breakers must hold 100%, may trip between 101% to 150%, must trip at 150% of rated current and above within maximum times shown in curves.

All Curves:

Curve data shown represents breaker response at ambient temperature of 77°F (25°C) with no preloading. Breakers are mounted in standard wall-mount position.

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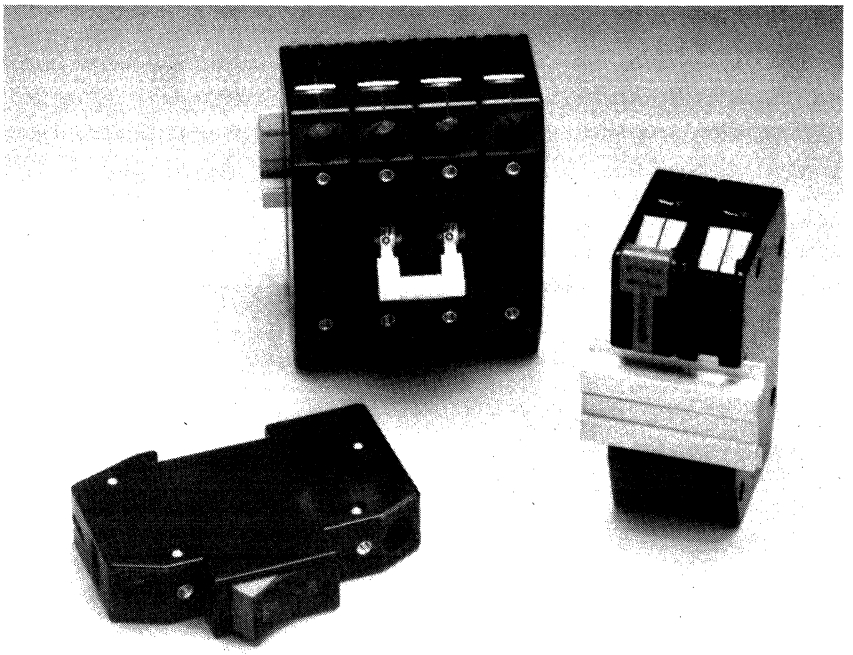
CARLINGSWITCH CIRCUIT BREAKERS

D Series - DIN Rail Rocker/Handle Actuator

(WORLD MARKET DESIGN)



Similar to the C Series magnetic circuit breaker but designed for snap-on-back panel rail mounting on either a 35mm x 7.5mm, or a 35mm x 15mm Symmetrical Din Rail. This design allows rapid and simple mounting and removal of the breaker. It features recessed, wire-ready, touch-proof, shock resistant terminals suitable for automatic screwdriver assembly, as well as "Dead Front" construction characteristics.

This breaker is available with the exclusive Visi-Rocker™ two-color actuator, an industry first, which can be specified to indicate either the ON mode or the TRIPPED/OFF mode. Rockers are available in three Visi-color combinations and seven solid colors. The D Series is also available with a standard handle type actuator. Both rocker and handle types fit in the same industry standard panel cutouts.

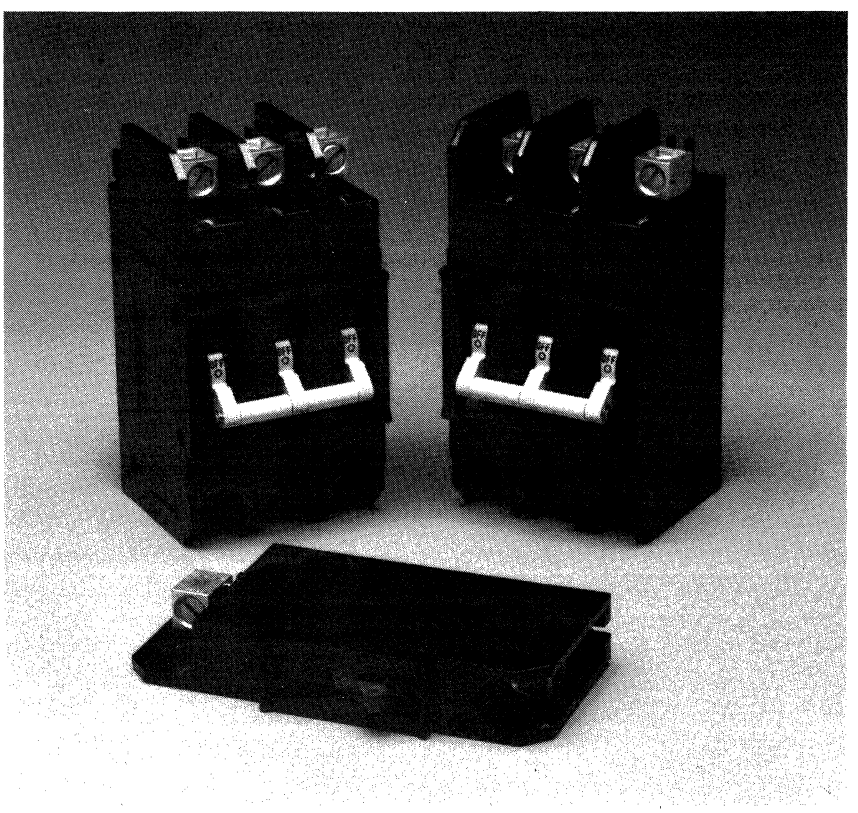
.1 - 50amps, up to 480VAC or 65 VDC, 1 - 4 poles (handle); 1 - 3 poles (rocker), with a choice of time delays.

AGENCY APPROVALS

UL Recognized under Component Recognition Program as Protectors, Supplementary (Guide QVNU2, File E75596), UL Standard 1077. CSA Certified under Class 3215 01, File LR47848.

E Series - Handle Actuator

(WORLD MARKET DESIGN)



The E Series is ideally suited for large current applications. Available with front or back mounting, screw terminals, stud terminals and heavy duty box wire connectors for solid wire or a pressure plate connector for stranded wire.

The E Series is UL Listed and CSA Certified for Branch Circuit Protection which does not require a fuse backup. It is also UL Recognized and CSA Certified as a Supplementary Protector and as a Manual Motor Controller.

This World Market product is designed in accordance with the 8mm spacing requirements of IEC Publications 380, 435, 950 and VDE specifications 0805/0806.

1 - 6 poles, .1 to 100 amps, up to 600 VAC or 125 VDC. Available with a choice of circuits, time delays and actuator colors.

AGENCY APPROVALS

UL LISTED Circuit Breaker Guide DIVQ, File E129899, under UL Standard 489.

UL Recognized under the Component Recognition Program as Protectors, Supplementary (Guide QVNU2, File E75596) UL Standard 1077 and as Industrial Control Equipment - Motor Controllers, Manual (GuideNLRV2, File E135367) UL Standard 508.

CSA Certified Circuit Breaker, Class 1432 01, File LR93910, under CSA Standard C22.2 No. 5.

CSA Certified Supplementary Protectors, Class 3215 01, File LR47848 under Standard C22.2 No. 235.

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION
WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
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Filters, Signal, Product Selection Guide **A**•1651
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Keyboards & Keypads, Product Selection Guide **B**•1794
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Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
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Power Supplies, DC, Product Selection Guide **D**•1501
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Switches, Product Selection Guide **B**•1639
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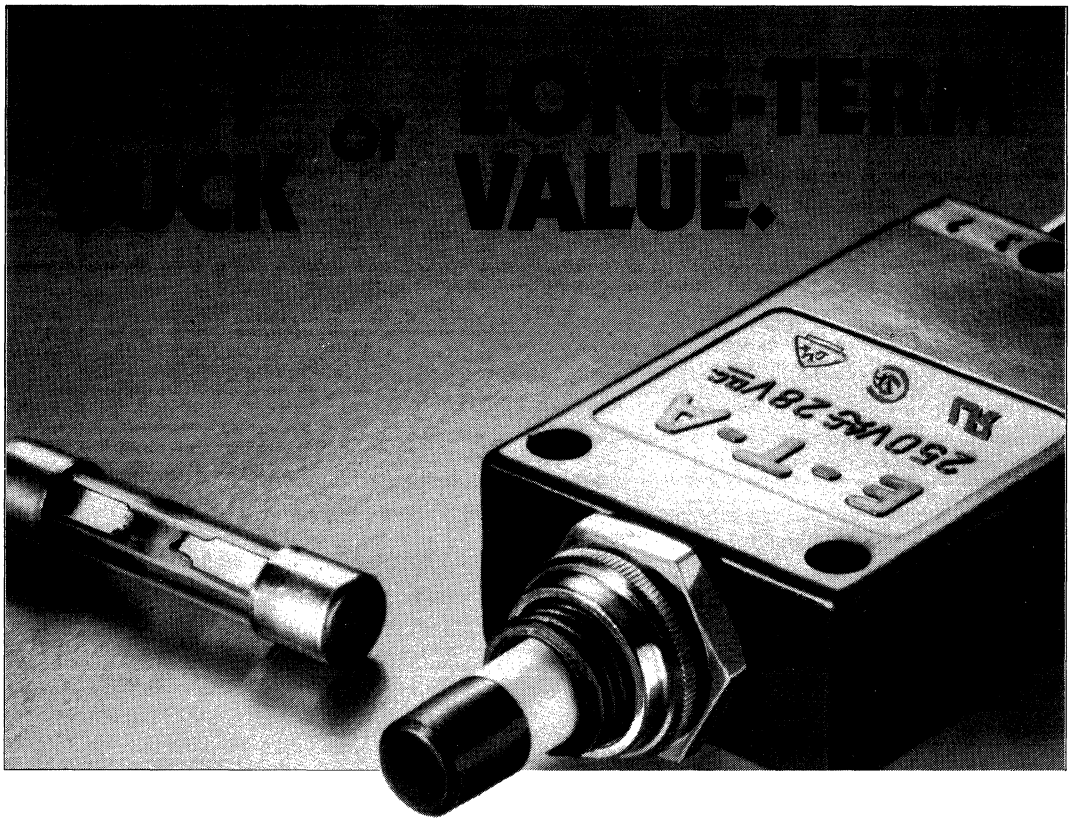
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

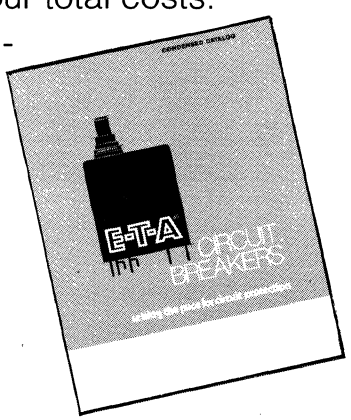


If your only concern is initial cost, then you'll save a few bucks by choosing fuses over E-T-A Circuit Breakers.

But fuses blow . . . and can drive up your total operational costs including warranties, replacement, service, even product liability.

E-T-A Circuit Breakers, on the other hand, add value to your product. They provide better circuit protection and performance characteristics than fuses. They're trip free and foolproof . . . and can actually lower your total costs.

So forget the fast buck. Go for the long-term value of E-T-A Circuit Breakers . . . 100% quality tested and approved for use worldwide.



E-T-A®
CIRCUIT BREAKERS GROUP

setting the pace for circuit protection

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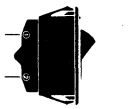
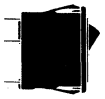
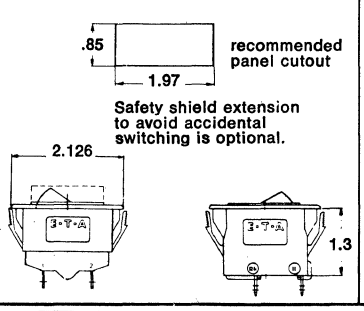
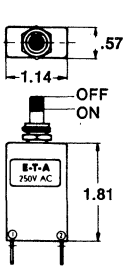
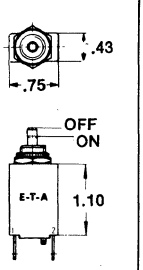
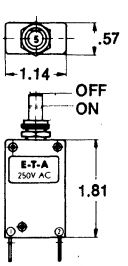
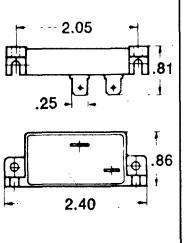
© 1989 E-T-A Circuit Breakers

E-T-A setting the pace for circuit protection	ON-OFF Switch Circuit Breakers			Single Pole Circuit Breakers		
	 -F30/31  -G10	 3120-F621 fits panel cutout Heinemann TX2 and AIRPAX 203-11 2 pole.		 41-04  41-05  41-06		
Series	41-10-P10/41-11-P10	3120-F321	45-700-IG1-P10-DD	41-04-PR 41-05-P30 41-06-P30	45-700-IG1-P10	46-500-P10
Description	Single pole, series trip Rocker, Toggle or Baton handles in many colors. (Illumination Optional)	Double pole, identical Snap-in mounting of single pole 41-10/41-11 series (Illumination Optional)	Single pole, series trip B/W button trip indicator Push ON/Push OFF Switching	Series trip, miniature. 41-04-PR: PC Board Mount 41-05-P30: Snap-in Mount 41-06-P30: Panel Mount	Series trip	Series trip automatic reset
Current ratings	0.1 thru 16A	0.1 thru 16A	0.05 thru 25A	0.05 thru 10A	0.05 thru 25A	0.1 thru 15A
Maximum voltage ratings	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc
Maximum interrupting capacity depending on current rating. UL 1077 approved breakers have been tested to 2000A.	10 times rated current normal use. UL up to 2000A.	10 times rated current 0.1-2A. 300A for ratings 2.5-16A. UL tested to 2000A.	10 times rated current normal use. UL up to 2000A.	6 times rated current. UL up to 1000A. 5 times for ratings 3.5 thru 5A, 4 times for ratings 6 thru 10A.	10 times rated current of circuit breaker, normal use. UL up to 2000A.	6 times rated current of circuit breaker, 60A maximum
Current capacity of auxiliary contacts, NO, NC.	NA	5A resistive 3, .110″ quick connect NO-NC-COM	NA	NA	NA	NA
Life	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 10,000 mechanical	2000 cycles at rated current	6000 cycles at rated current	10,000 cycles at 200% rated current
Terminals	.250 quick connect	.250 quick connect	.250 quick connect	.110 quick connect	.250 quick connect	.250 quick connect
Shunt circuit—A3, optional 	Optional; specify—A3	Optional	Optional; specify—A3	Optional; specify—A3	Optional; specify—A3	Optional; specify—A3
Approvals E-T-A also has European approvals, such as VDE etc. Additional info upon request	UL 1077; E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE	UL: E29255 CSA: 16186 VDE
Design notes See technical data sheets for data	41-10 is unlighted 41-11 is illuminated	Options: • handle colors • handle marking • Illumination • Amp ratings • Dust/water seal	Aircraft styling B/W reset button. Ideal for marine control panels. Screw terminals, (—S10) optional.	Smallest full feature circuit breaker. .250 quick-connect avail. non-standard (—P10)	Screw terminals available, non-standard. Version for Class 2 transformers available: Specify 45-700-P10-CL2 3.2 or 5A.	Screw terminals 1, 2 available (—S20), non-standard
Technical Data Sheet	Catalog Sheet 40129 Catalog Sheet 40130	Catalog Sheet 40136	Catalog Sheet 40132	Catalog Sheet 40127	Catalog Sheet 40119	Catalog Sheet 40701
Physical Dimensions in Inches All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.				 Shown: 41-06-P30		

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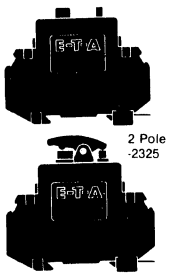
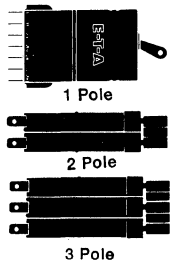
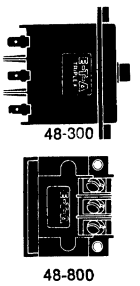
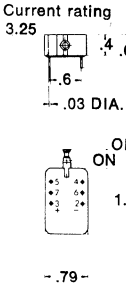
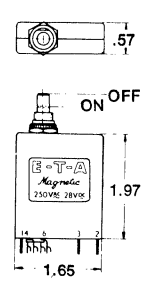
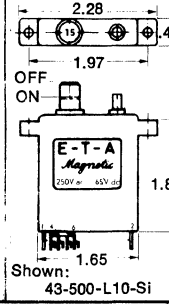
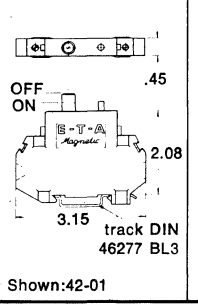
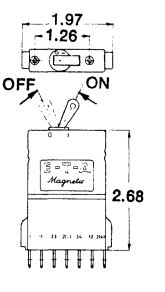
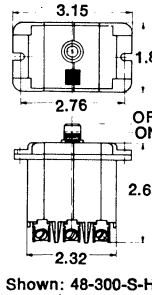
E-T-A setting the pace for circuit protection

	Magnetic	Thermal-Magnetic Circuit Breakers				Three Pole Overload
		 2 Pole -2325	 2 Pole -2325	 1 Pole 2 Pole 3 Pole	 48-300 48-800
Series	**48-08**	**43-400-L10**	**43-500-L10 43-500-L10-2325**	**42-01 42-01-2325**	**2210**	**48-300-S 48-800-S**
Description	Magnetic, undelayed trip, PC board mount, NO and NC contacts. ON-OFF switching.	Series trip, two auxiliary contacts NO, NC optional (-Si). Fast Acting: specify series 43-300	Series trip, UL approved for primary ON-OFF switching. Two pole version: order -2325, has rocker handle.	Series trip, ON-OFF switching. DIN track 3 mounting. Adapter for DIN track 1 available.	Series trip, ON-OFF switching. Aux. contacts std. 1, 2 or 3 pole configuration.	Series trip, ON-OFF switch (-H) optional, auxiliary contacts NO, NC (suffix-Si) optional. Auto-reset version 0.1-5A: 48-800.
Current ratings	0.01 thru 3.25A	0.05 thru 15A	0.05 thru 15A	0.1 thru 15A	0.1 thru 16A	0.5 thru 15A
Maximum voltage ratings	115V ac or 60V dc	250V ac or 65V dc	250V ac or 65V dc	250V ac or 65V dc	250V ac or 65V dc	0.5—5A: 500V ac 5.5—15A: 380V ac
Maximum interrupting capacity depending on current rating, UL 1077 approved breakers have been tested to 2000A.	40A at 115Vac/ 60V dc 60A at 48V ac/dc 100A at 24V ac/dc	200A normal use. UL up to 1000A. 1500A/250V ac version, current ratings 8-15A. E-T-A series 43-4-P10 not-Si)	200A normal use. UL up to 1000A. 1500A/250V ac version, current ratings 8-15A. E-T-A series 42-1-P10 (not-Si)	200A normal use. UL tested to 1000A.	500A normal use, not to exceed 100 times rated current	6 times rated current of circuit breaker
Current capacity of auxillary contacts, NO, NC.	NO contacts: 5A continuous at 24V	1A resistive 4 solder terminals optional	1A resistive 4 solder terminals optional (single pole only)	NA	1A resistive, 4 quick connects, standard	3A resistive at 250V ac, 4 solder terminals, optional
Life	10,000 cycles at rated current	4000 cycles at 200% rated current	6000 cycles (UL 1077) at rated current	6000 cycles (UL 1077) at rated current	10,000 cycles at rated current	5000 cycles at rated current
Terminals	PC board pins	Solder terminals	Solder terminals	Screw clamp terminals	.250 quick connect(7x)	Screw terminals
Shunt circuit— A3, optional	Can be arranged	Optional; specify—A3	Optional; specify—A3	NA	Standard	NA
Approvals E-T-A also has European approvals, such as VDE etc. Additional info upon request		UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL, CSA: upon request VDE	CSA: 16186 up to 3.5A VDE: up to 10A
Design notes See technical data sheets for data	Series 48-08 has extra low impedance.	Quick-connect or screw terminals avail., non-standard DUAL CONTROL available.	Quick-connect or screw terminals avail., non-standard. DUAL CONTROL available. UL approved for primary ON-OFF switching.	Half inch spacing makes this device especially attractive for modern control systems design.	Shunt and auxiliary contacts are standard. DIN track mountable via terminal block #17-P10-Si	ON/OFF version available (suffix—H). Quick-connect terminals (—P10) avail. non-std. For tech. data 48-800-S see Cat. sheet 40806
Technical Data Sheet	Catalog Sheet 42433	Catalog Sheet 40223	Catalog Sheet 40228	Catalog Sheet 40237	—	Catalog Sheet 40308 (48-800: Cat. Sheet 40806)
Physical Dimensions in Inches All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.	Current rating 		 Shown: 43-500-L10-Si	 Shown:42-01		 Shown: 48-300-S-H

E-T-A® CIRCUIT BREAKERS

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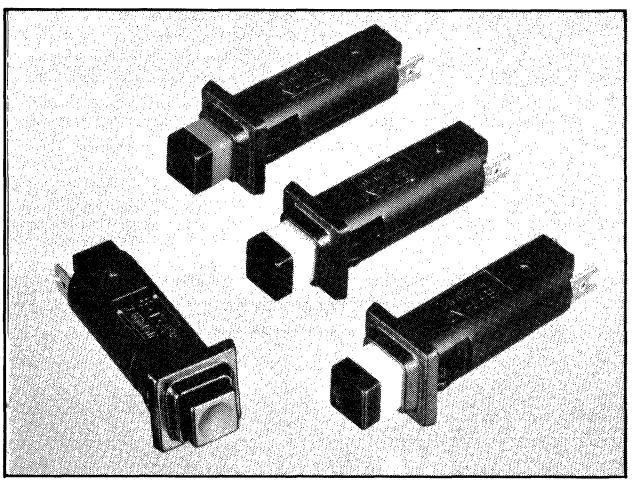
MINIATURE SWITCH/BREAKER COMBINATION

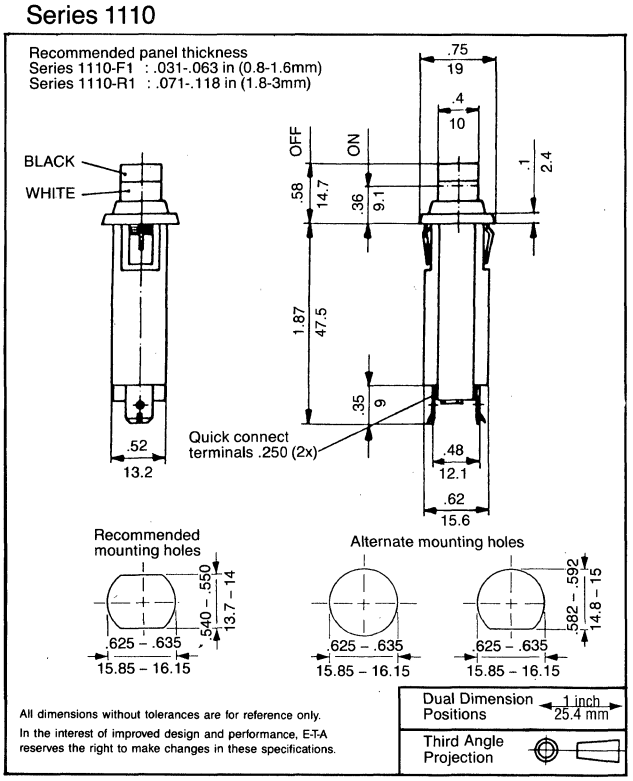
Series 1110-F-112-P1M1

SWITCH CIRCUIT BREAKER COMBINATION SINGLE POLE

- Snap in mounting
- Fits standard fuse holder cutout
- White band, trip indicator ring standard
- Fully trip free, Cannot be held closed on overload. If button is held, breaker will trip anyway on overload.
- UL 1077 recognition – File E67320
- CSA approved – File 16186
- VDE approved



Series 1110



Maximum voltage rating: 250 V ac or 28 V dc
Maximum interrupting capacity: 8 times rated current for amp ratings up to 6 A; 10 times rated current for ratings 8 A and up. UL tested up to 1000 A/125 V ac according to UL Standard 1077
Life: 6,000 cycles at rated current
Dielectric strength: 2000 V ac
Insulation resistance: 100 megohm
Operating temperature range: 0°C to +55°C (32°F to +131°F)
Shock resistance: 25 g (IEC 68-2-27, Ea)
Vibration resistance: 10 g (IEC 68-2-6, Fc)
Humidity: 95% at 40°C (EIC 68-2-30, Db)
Weight: 12 grams (.5 oz.) approx.

Standard current rating / internal resistance
Trip current is 140% of rated current:

amp	ohm	amp	ohm	amp	ohm
0.10	110	1.00	1.1	4.00	0.07
0.20	28	1.20	0.75	5.00	0.05
0.30	12	1.50	0.43	6.00	0.04
0.40	7	1.80	0.40	8.00	<0.02
0.50	4.4	2.00	0.27	10.00	<0.02
0.60	3.1	2.50	0.18	12.00	<0.02
0.70	2.3	3.00	0.13	15.00	<0.02
0.80	1.7	3.50	0.09	16.00	<0.02

Tripping time in seconds at 73°F (23°C)
at various overload levels:

100%	200%	300%	400%	500%	600%	1000%
0.1-6.5A						
No Trip	10-40	4-15	2-8	1.5-6	1-4	0.8-3
7.0-16.0A						
No Trip	8-40	2.5-8	1.5-4	1-3	0.6-2	0.3-1

Options:
Color trip indicator band for production quantities:

Red: 1110-F114-P1M1__ A

Yellow: 1110-F115-P1M1__ A

Green: 1110-F119-P1M1__ A

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Commercial & Military Approved Panel Mount Fuseholders



- Superior Clip Design for Solid Fuse Contact
- UL Recognized & C.S.A. Certified
- Most Commercial Models are recognized under the Marine Electrical and Fuel System (PEQZ2) as "Ignition Protected Devices"
- Blown Fuse Indicating & Non-Indicating
- High Impact Plastic for Superior Strength
- Dead-Front, Watertight
- Military Versions Meet MIL-F-19207

Commercial Fuseholders

All Recognized by Underwriters Laboratories

Model	Fuse Size	Qty	Indicating (I) or Non-Indicating (N)	Voltage AC/DC	UL Recognized Amps	UL Recognized Voltage
5000+	¼x1¼"	1	N	250	0-30	250 max
5100+	¼x1¼"	3	N	250	0-30	250 max
5200+	¼x1¼"	1	N or I	250	0-30	250 max
*5300+	¼x1¼"	2	N or I	250	0-30	250 max
*5400+	13/32x1½"	1	N	600	0-30	600 max
*5500+	13/32x1⅝"	3	N	600	0-30	600 max
*5600+	13/32x1½"	1	N or I	600	0-30	600 max
*5700+	13/32x1½"	2	N or I	600	0-30	600 max
*5800	9/16x2"	1	N or I	600	0-30	250 max
*5900	13/16x3"	1	N or I	600	31-60	250 max

*CSA Certified
+Ignition Protected Devices

Indicating models can be modified for use in low voltage applications.

Military Fuseholders

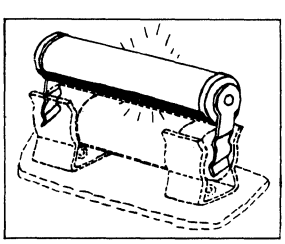
MIL-SPEC	Type	Fuse Size	Qty	Indicating (I) or Non-Indicating (N)	Amps	Volts	Moisture Protection
19207/1	FHL10U	¼x1¼"	2	I	0-30	90-250	Unsealed
19207/2	FHL11U	¼x1¼"	1	I	0-30	90-250	Unsealed
19207/3	FHL12U	13/32x1½"	1	I	0-30	90-500	Unsealed
19207/4	FHL13G	9/16x2"	1	I	0-30	90-500	Dripproof
19207/5	FHL14G	13/16x3"	1	I	31-60	90-500	Dripproof
19207/6	FHL15G	1 1/16x5⅞"	1	I	61-100	90-500	Dripproof
19207/7	FHL16G	1⅝x7⅛"	1	I	101-200	90-500	Dripproof
19207/17	FHN28WB	¼x1¼"	1	N	0-30	250 Max	Watertight Body Sealed
19207/18	FHL29G	¼x1¼"	2	I	0-30	12-90	Dripproof
19207/19	FHL30G	¼x1¼"	1	I	0-30	12-90	Dripproof
19207/21	FHL32W	¼x1¼"	1	I	0-30	90-250	Watertight
19207/22	FHL33W	¼x1¼"	2	I	0-30	90-250	Watertight
19207/23	FHL34W	13/32x1½"	2	I	0-30	90-500	Watertight
19207/24	FHL35W	13/32x1½"	1	I	0-30	90-500	Watertight
19207/25	FHN41WB	13/32x1½"	1	N	0-30	500 Max	Watertight Body Sealed
19207/30	FHN46WB	¼x1¼"	3	N	0-30	250 Max	Watertight Body Sealed
19207/31	FHN47WB	13/32x1½"	3	N	0-30	500 Max	Watertight Body Sealed

Blown Fuse Indicators

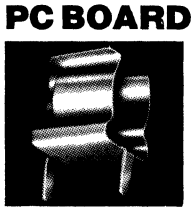
When A Fuse Blows, A Light Glows!®

Several Models To Choose From

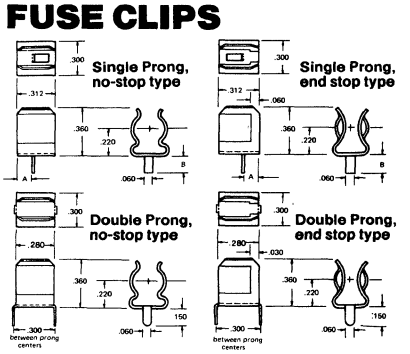
- Bolt Down for Rectifier Fuses
- Snap On for Ferrule Fuses
- Top Mounting for Knife Blade Fuses



PC BOARD FUSE CLIPS



Low profile clips (.360" high) are soldered to printed circuit boards eliminating eyeletting or riveting. Available in Spring brass, beryllium copper or spring bronze with various platings.



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■ REDMOND, WA	■ TEL: (206) 881-2442	■ FAX: (206) 885-3434
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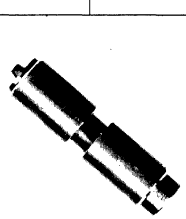
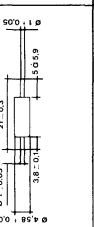
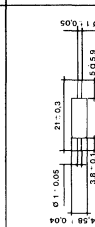
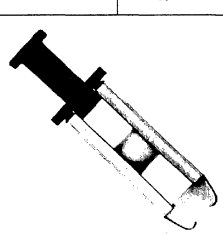
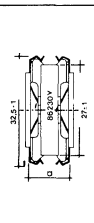
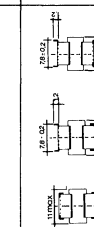
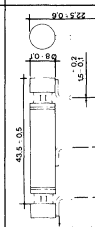
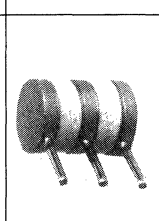
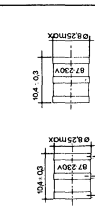
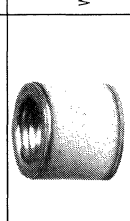
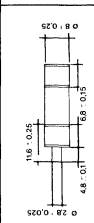
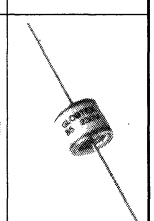
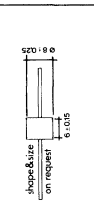
PRESENTATION	TYPE	DIMENSIONS	ELECTRICAL CHARACTERISTICS: D.C. Spark-over voltage — Nominal (V)	D.C. Spark-over voltage — Tolerance (%)	Impulse spark-over voltage (wave form 1 kV/µs)	Insulation resistance at 100 V.D.C	Capacitance: 1 kHz (pF)	Minimum sustaining voltage (V)	Arc voltage (V)	Impulse current — Wave-shape 8 × 20 µs	Impulse current — Wave-shape 10 × 1000 µs	50 Hz current — R.M.S. value (root mean square)	50 Hz current — Cycle	End of life (short circuit) — Nominal current (I)	End of life (short circuit) — Period of time(s)	APPLICATIONS
	CA 5[1]		275	±30%	≤ 1000 V	≥ 10^8	< 5	U = 75 V < 150 ms	< 20 (i < 1,5 A	10 times interval 2 mn 2,5 kA	200 times 100 A interval 30 s	5 A	1 s interval 5 mn 10 times			Terminal block
	CA 5 RA[1]		150 250 350	±12% ±12% ±12%	≤ 750 V	≥ 10^9	< 5	U = 75 V < 150 ms	< 20 (i > 1,5 A	20 times interval 15 s 5 kA	200 times 100 A interval 30 s	10 A	2 × 0,6 s interval 5 mn 10 times	2 à 20 A	approx. 50 / I	Terminal block Printed circuit board
	CA 8 BB[1]		250 400	±15% ±25%	≤ 750 V	≥ 10^9	< 5	U = 52 V < 150 ms	< 20 (i ≥ 1,5 A	20 times interval 15 s 10 kA	200 times 200 A interval 30 s	20 A	2 × 1 s interval 5 mn 10 times	10 à 30 A	approx. 50 / I	Junction box Subscriber box
	3 blade shapes available[2]		400	±25%	≤ 750 V	≥ 10^9	< 5	U = 150 V < 150 ms	< 25 (i ≥ 1,5 A)	1 time 10 kA	600 times 500 A interval 90 s	65 A	1 s interval 3 mn 5 times			Junction box Subscriber box
	CA 8[1]		250	±12%	≤ 750 V	≥ 10^9	< 5	U = 60 V < 150 ms	< 20 (i ≥ 750 mA)	10 times interval 30 s 10 kA		20 A	2 × 1 s interval 5 mn 10 times	5 à 50 A	approx. 200 / I	Junction box Subscriber box
	CA 8 T 11[2]		90 185 230 350	±15% ±15% ±15% ±15%	≤ 750 V	≥ 10^9	< 5	U = 150 V < 300 ms	< 35 (i = 1 A)	10 times interval 30 S 5 kA	600 times 100 A interval 90 s	5 A	1 s interval 3 mn 5 times			Terminal box M.D.F.
	CA 8 B WITH OR WITHOUT POST[2]		400	±25%	≤ 750 V	≥ 10^9	< 10	U = 150 V < 300 ms		once 10 kA	600 times 500 A					Subscriber box Terminal block N.I.D.
	CA 8 B6 WITH OR WITHOUT LEADS[2]		90 185 230 350	±20% ±20% ±15% ±15% ±15%	≤ 750 V	≥ 10^9	< 5	U = 150 V < 300 sm	< 35 (i = 1 A)	once 10 kA	600 times 500 A	65 A	1 s interval 3 mn 5 times			Subscriber box Terminal block N.I.D.

* Wave form 100 V/µs

1 TESTED IN ACCORDANCE WITH CCITT 2 MEETS PEG 1 & REA PE 80

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TEL: (201) 861-0246 • FAX: (201) 861-0740 • TELEX: 755-579 GLOBTEK

HEINEMANN® Circuit Breakers First in Features, First in Quality

Heinemann offers the widest choice of styles and current ratings in high-quality, reliable circuit protectors. Ratings range from 0.01A to as high as 700A. Their applications are as diverse as medical equipment, computers, industrial air conditioners, electric locomotives and telecommunications equipment.

Heinemann can also supply circuit breakers that provide auxiliary functions. For example, a heavy-duty relay, an on/off switch and a hydraulic-magnetic circuit breaker, all in one economical and compact unit.

Use this condensed guide to locate the type of circuit breaker that best meets your requirements. Then write or call us for a copy of the appropriate product bulletin containing detailed specifications and ordering information. Or call one of our technical assistance engineers to dicuss your particular application.

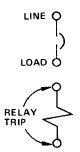
Technical assistance, important features and quality products...three reasons why it pays to look to Heinemann "When your reputation's on the line."

SPECIAL-FUNCTION CIRCUITS

Heinemann circuit breakers (except for PS1, KD, TX and Hector) can be furnished with a number of special-function internal circuits. They permit a single protector to perform the protection and control functions of several components.

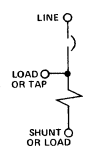
RELAY-TRIP

Permits remote actuation using a separate control circuit. Electrical isolation allows use of a different current or voltage from contact circuit. Both time delay and non-time delay constructions are available.



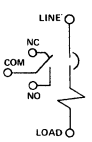
SHUNT/TAP

Use of third terminal permits remote tripping by utilizing line voltage with or without a time delay response. On breakers rated up to 1A, the trip point may be raised by shunting with an external resistor on the shunt/tap terminal.



AUXILIARY SWITCH

Used for logic functions, alarms, lights and other circuits. Miniature snap-action SPDT or DPDT switch is mounted on the back of the breaker, mechanically connected to the switching mechanism. Contact capacity: 10A at 125/250 V, 50/60 Hz; 4A resistive at 30 Vdc; 2.5A inductive at 30 Vdc. Minimum operating voltage 6 Vdc or ac, at 3 VA dc or ac.



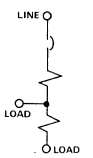
SERIES TRIP (Standard internal circuit)

Ideal for use as both power switch and overload protector. Usually installed in series with line and load terminals to provide circuit interruption in the protected circuit.



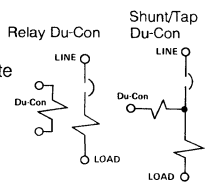
DUAL RATING

Two concentrically-wound sensing coils provide two discrete current ratings in the same breaker. Protects equipment designed to operate at two different current levels or supply voltages within certain limitations.



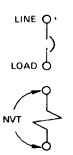
DU-CON™ (DUAL-CONTROL)

Provides sensing of both overcurrent and separate voltage signals in the same pole through a small, non-continuous-duty voltage sensing coil. DU-CON overload and voltage coils must be specified separately.



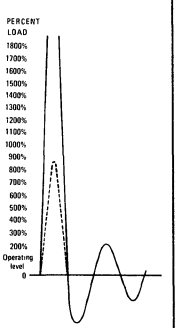
NO-VOLTAGE TRIP

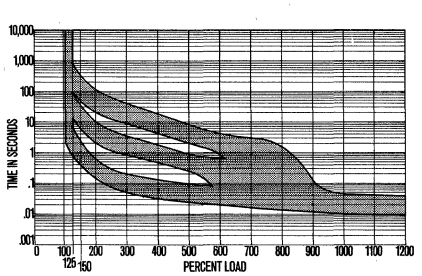
Prevents uncontrolled re-start of equipment after power outage. Used in ground-fault interrupters and other safety applications. Not intended for overload protection without one pole connected in series-trip configuration.



HIGH-INRUSH

Economical protection of high-reactance loads, which draw starting surges often as high as 30 times normal load current in a 50/60 Hz 1/2-cycle pulse, such as ferro-resonant power supplies and distribution transformers. Eliminates nuisance tripping without derating or special circuitry.





Typical Time Delay Curves

Circuit breakers are available in a variety of time-delay curves for applications such as high-inrush, 50/60 Hz and dc as well as with no intentional delay.

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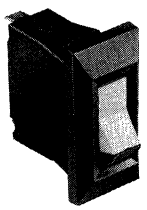
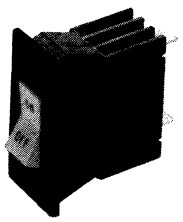
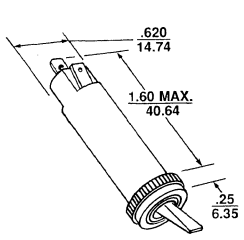
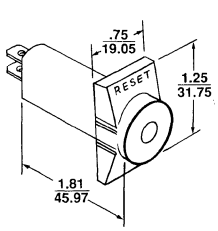
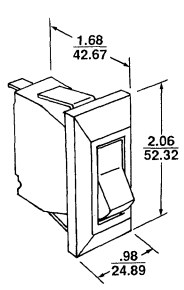
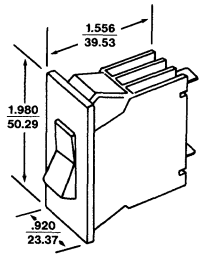
HEINEMANN® Circuit Breakers First in Features, First in Quality

	PS1 FUSE-SWITCH	RE-CIRK-IT® SERIES KD1	TYPE TX	SERIES RX
				
	Fuse-Switch provides ON/OFF control and fuse protection in a single low-cost component. Its use eliminates a hole and interconnecting wiring and makes it easy to re-fuse from the front panel. It accepts standard 1/4-inch diameter by 1¼-inch fuses. An adapter is available for 5 mm x 20 mm fuses. Can be supplied for normally open or normally closed operation.	A low-cost, pushbutton supplementary protector for electrical equipment, designed to fit in a standard 5/8-inch round or "D" fuseholder panel cutout. Resettable at up to 1000% of its rated current from 2.5A through 15A, 500% from 0.25A through 2A. Slide-on retaining ring included.	The attractively designed Type TX circuit protector doubles as an economical ON/OFF switch and with an optional lamp as a power indicator. Rocker arms available in a variety of colors; in one and two pole models. Its trip free design cannot be held closed against a fault. Features quick-connect terminals and snap-in mounting.	A compact hydraulic-magnetic circuit breaker featuring snap-in mounting and rocker handle operation. Over-the-center, non-teasable mechanism prolongs contact life by reducing arcing. Available with long, short and no deliberately imposed time delay.
APPLICATIONS	Consumer and industrial products that would otherwise use a separate ON/OFF switch and fuse holder.	Consumer and industrial products, office machines, appliances, power supplies, convenience outlets, electronic games.	Commercial and consumer products, power supplies, medical electronic equipment, office and reproduction equipment, data processing equipment.	OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment).
NO. OF POLES	1	1	1 and 2	1 and 2
CURRENT RATINGS	Determined by choice of fuse. To 20A	0.25-15A	2,3,5,7,10,15 and 20A	0.1 to 15A (ac) 0.1 to 20A (dc)
MAX. VOLTAGE	120 Vac @ 20A 250 Vac @ 15A 32 Vdc @ 20A	250 V, 50/60 Hz 50 Vac up to 10A 32 Vdc @ 15A 50 Vdc @ 10A	250 Vac (10A max.) 125 Vac (20A max.) 32 Vdc (20A max.)	250 Vac (7.5A max.) 125 Vac (15A max.) 32 Vdc (20A max.)
INTERRUPTING CAPACITY		1000A @ 250 V, 50/60 Hz 200A @ 32 Vdc and 50 Vdc per UL Std 1077 testing procedures	3500A (ac) with backup fusing 1000A (dc) with backup fusing	1000A 5000A with backup fusing
AGENCY RECOGNITION OR APPROVAL	UL recognized CSA certified SEV approved	UL recognized (Std 1077) CSA certified VDE approved SEV approved	UL recognized, Component Recognition Program CSA certified Suitable for VDE 0730 Equipment	UL recognized (Std 1077) CSA certified SEV, TUV, IEC and VDE approved
DIMENSIONS				

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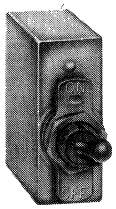
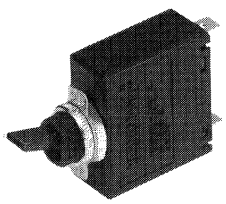
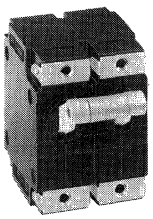
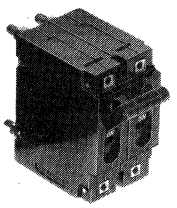
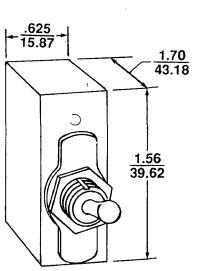
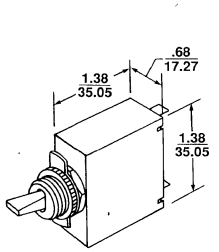
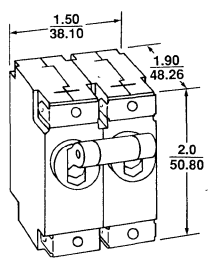
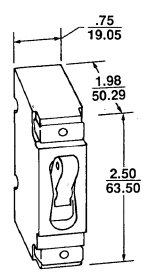
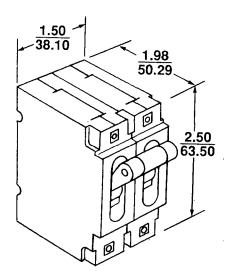
SERIES HM	SERIES L	SERIES J/S	SERIES AM	SERIES AM-MIL
				
Lightweight, subminiature, multi-frequency circuit breaker designed to withstand severe environmental extremes such as shock, vibration and high humidity. Housed in a corrosion-resistant brass case, nickel plated. Meets MIL-C-39019, is explosion- and fungus-resistant, operates in any position. Silver contacts provide good conductivity with low power loss.	This compact hydraulic-magnetic circuit protector provides the same quality, precision and choice of time delays found in larger Heinemann magnetic circuit breaker. Over-the-center, non-teasable mechanism provides snap-action operation that prolongs contact life by reducing arcing. Handles available in seven different colors for decorative or circuit-identification purposes.	Compact, lightweight, moderately-priced circuit breaker for single or multi-pole OEM applications. Also available with snap-in mounting or rocker handles. Sealed mount models are also available, single pole only. Series J/S breakers are suitable for domestic or world-market applications. Models also available for marine applications.	A low-cost, lightweight breaker available in single or multi-pole configurations, the Series AM features rear-connection studs, a high level of moisture resistance, and a current range up to 100A dc or 60A ac. Qualified under MIL-C-55629 to 50A dc and ac.	Heinemann Series AM-MIL breakers are specifically built and tested in accordance with the requirements of MIL-C-55629. Fungus- and moisture-resistance is provided by treating all ferrous parts with a special finish, and by using special springs and inherently fungus-resistant phenolic cases, covers and handles.
Military programs and commercial products, power supplies, mining and medical applications where hermetically-sealed circuit protection is required.	OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment).	OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment), control panels, marine equipment, field instrumentation.	OEM (data-processing equipment, mobile applications, humid environments).	OEM (data processing equipment, mobile applications, military equipment subject to humid, tropical environments).
1 and 2	1 and 2	1 to 4	1 to 4	1 to 3
0.050-20A	0.1 to 20A	0.02-50A	0.020-60A (ac) 0.020-100A (dc)	0.020-50A (ac and dc)
240 Vac, 60 or 400 Hz; 50 Vdc	250 Vac (7.5A max.) 125 Vac (15A max.) 32 Vdc (20A max.)	250 Vac (30A max.) 65 Vdc (50A max.) 80 Vdc (15A max.)	250 V, 50/60 or 400 Hz 277 V, 50/60 Hz, 1-phase 480 V, 50/60 Hz, 3-phase "Y" 65 Vdc AC/DC	240 V 50/60 Hz 240 V 400 Hz 50 Vdc
1000A @ 240 V, 60 Hz or 400 Hz and 50 Vdc per UL Std 1077 testing procedures	1000A 5000A with backup fusing	1000A 5000A with backup fusing	1000A 5000A with backup fusing	2000A @ 50 Vdc and 120 Vac 60 Hz 1500A @ 120 Vac, 400 Hz 1000A @ 240 Vac, 60 and 400 Hz
Not UL/CSA recognized or listed. Available as MIL-C-39019 QPL item.	UL recognized (Std 1077) CSA certified SEV approved IEC approved Designed to meet VDE	UL recognized (Std 1077) CSA certified SEV approved IEC approved VDE approved	UL recognized CSA certified	Not required for QPL items
				

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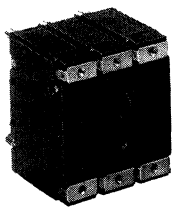
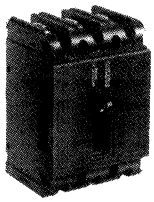
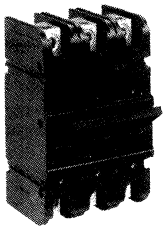
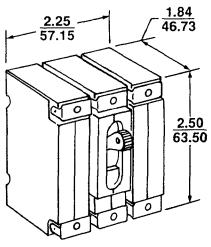
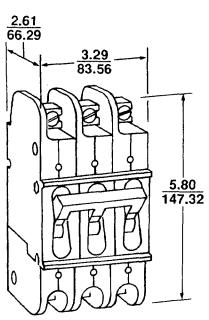
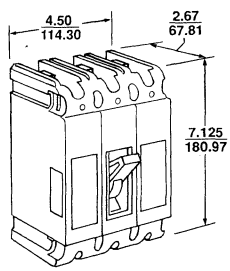
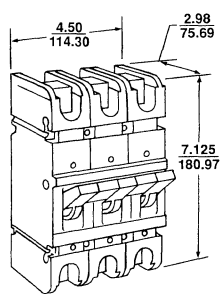
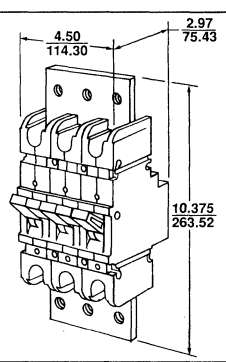
SERIES AM/S	SERIES CF E-FRAME	SERIES GH EH-FRAME	SERIES GJ	SERIES GJ1P
				
Series AM/S "world class" circuit breakers meet International Standard IEC 380 and German Standard VDE 0730. The 8-mm spacing requirement and dielectric-withstand specification are incorporated into the standard AM breaker housing without changes in size, thereby eliminating mounting procedure modifications or the need for adapter plates.	Priced considerably lower than competitive E-frame breakers, the Series CF is the most compact and versatile circuit breaker available for equipment and branch-circuit protection. Single- and multi-pole models are stocked in a wide range of standard ratings for fast, off-the-shelf delivery.	This rugged new EH-frame breaker offers all the advantages of a completely magnetic, three-pole breaker with 14,000A interrupting capacity for less than most thermal units. Compact, environmentally stable and to 100A at 480 Vac and 250 Vdc.	Where space is at a premium and current capacity up to 250A is called for, the Series GJ is the answer. Available in one-, two-, or three-pole models, it is especially suitable for panelboards, service entrances, and electric vehicles.	GJ1P parrallel-pole breakers incorporate Precision Current Equalization (PCE) to automatically distribute current equally through the current-sensing elements. PCE thereby minimizes nuisance tripping which can occur with conventional parallel-pole breakers. An optional shunt permits metering of current. Since shunt output is only 25 mv, light-gauge wiring can be used between shunt and meter.
OEM (data processing equipment, mobile applications, humid environments).	Panelboards, switchboards, branch circuits, EDP equipment, machine tools, environmental systems, single- and three-phase applications.	Motor controls, air conditioning, electric heating, computer main frames, transportation, indoor or outdoor installations.	Commercial, industrial, and residential service — entrance or panelboard applications; lighting, appliance, transformer, electric vehicles, EDP power supplies, heating, air conditioning, and electronic circuit protection.	Telecommunications, transportation, air conditioning, other outdoor "heat-loaded" equipment.
1 to 4	1 to 6	1 to 3	1 to 3	1
0.020-60A (ac) 0.020-100A (dc)	0.01-100A (ac) 1.0-100A (dc)	.5-100A (ac) .5-100A (dc)	100-250A	100-700A (dc)
250 V 50/60 Hz or 400 Hz 277 V 50/60 Hz 1-phase 65 Vdc 480 V 50/60 Hz 3-phase "Y"	240 V, 50/60 or 400 Hz 480 V, 1- and 3-phase 125 Vdc 600 V, 3-phase 125 Vdc	480 V, 50/60 Hz 250 Vdc	240 V, 50/60 Hz 125/250 Vdc	160 Vdc
1000A 5000A with backup fusing	10,000 @ 120 Vac 7500A @ 120/240 Vac 50/60 Hz; 240 Vac 50/60 Hz 5000A @ 120/240 Vac 400 Hz; 240 Vac 400 Hz 125 Vdc	14,000A (ac) 10,000A (dc)	18,000A @ 240 V, 50/60 Hz 10,000A @ 125/250 Vdc 14,000A @ 160 Vdc 25,000A @ 65 Vdc	10,000A @ 160 Vdc 25,000A @ 65 Vdc
UL recognized (Std 1077) CSA certified SEV approved IEC approved VDE approved	240 V, 50/60 Hz and 125 Vdc: UL listed Others: Recognized CSA certified	UL listed (ac) (3-pole) 480 Vac 15-100A	240 V, 50/60 Hz and 125/250 Vdc: UL listed	160 Vdc: UL listed
				

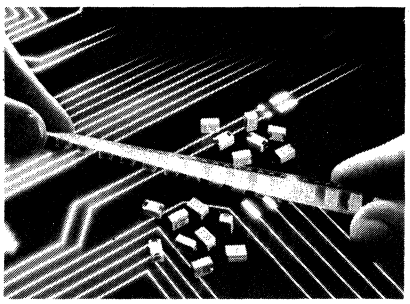
When your reputation's on the line

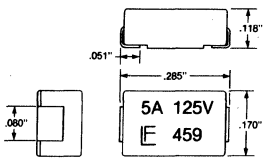
HEINEMANN® ELECTRIC COMPANY

P.O. Box 6800, Lawrenceville, NJ 08648-0800 USA • (609) 882-4800 • EasyLink 62886238 • FAX (609) 882-2183

Littelfuse® CIRCUIT PROTECTION DEVICES

SUBMINIATURE SURFACE MOUNT PICO-SMD™





EIA Case Code Number 7343

ELECTRICAL CHARACTERISTICS:

% of Ampere Rating	Very Fast-Acting Opening Time	Slo-Blo® Opening Time
100%	4 hours, **Minimum**	4 hours, **Minimum**
200%	1 second, **Maximum**	1 second, **Minimum** 60 seconds, **Maximum**
300%	0.1 seconds, **Maximum**	0.2 seconds, **Minimum**/ 3 seconds, **Maximum**
800%		0.02 seconds, **Minimum**/ 0.1 seconds, **Maximum**

APPROVALS: Recognized under the Components Program of Underwriters Laboratories and Certified by CSA.
INTERRUPTING RATING: Very Fast-Acting: 50 Amperes at 125VAC and 300 Amperes at 125 VDC. Slo-Blo®: 50 Amps at 125VAC and DC.
OPERATING TEMPERATURE: −55°C to +125°C
MATERIALS: Body—Molded Thermoplastic, Terminals—Plated Copper
SOLDERING METHODS:

	Very Fast-Acting	Slo-Blo
Infrared Reflow	500°F (260°C) Maximum Temperature	446°F (230°C) Maximum Temperature
Thru The Wave	500°F (260°C) 10 Seconds Maximum	500°F (260°C) 3 Seconds Maximum

COLOR CODING: Red indicates Very Fast-Acting. Blue indictes Slo-Blo®
PACKAGING: Fuses supplied on 12mm tape. 500 fuses per reel for use with automatic placement equipment per EIA Standard 481-1. Contact factory for other packaging options
PATENTS: Patented

ORDERING INFORMATION:

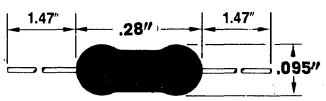
Very Fast-Acting Catalog Number	Slo-Blo® Catalog Number	Ampere Rating	Voltage Rating
R459.062	—	1/16	125V
R459.125	—	1/8	125V
R459.250	—	1/4	125V
R459.375	R460.375	3/8	125V
R459.500	R460.500	1/2	125V
R459.750	R460.705	3/4	125V
R459001	R460001	1	125V
R45901.5	R46001.5	1½	125V
R459002	R460002	2	125V
R45902.5	R46002.5	2½	125V
R459003	R460003	3	125V
R45903.5	R46003.5	3½	125V
R459004	R460004	4	125V
R459005	R460005	5	125V

PICO II™ SUBMINIATURE FUSES

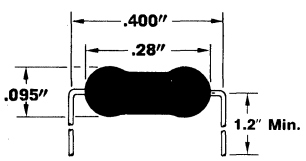
- World's smallest axial lead fuse for use in micro electronic circuits including computer and aerospace applications.
- Available on tape and reel.
- Low resistance values.
- Hi-speed action.
- Epoxy coated body for protection against environmental conditions.
- Withstand axial pull of 7 lbs.
- Available with or without color-coding per I.E.C. standards.
- Interrupting rating of 300A D.C. and 50A A.C. at rated voltage.

Opening Time: 100%, 4 hrs. min.; 200%, 1 sec. max. (1/16-7A) 3 sec. max. (10A) 10 sec. max. (12-15A).
U.L. Recognized and Certified by C.S.A. through 15 amperes.

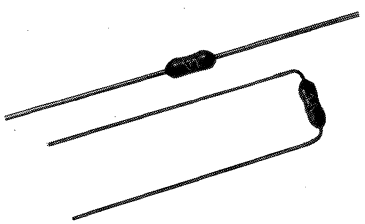
251 Series - Axial Leads



252 Series - Radial Leads



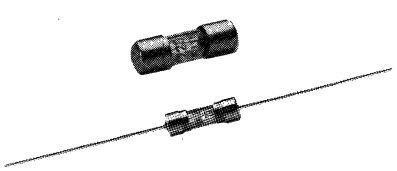
Note: Leads are solder-coated copper, .025" diameter for 1/16-10A, .032" diameter for 12-15A.



L.F. Number Axial Leads	L.F. Number Radial Leads	Amp Rating	Voltage Rating
251.062	252.062	1/16	125
251.125	252.125	1/8	125
251.250	252.250	1/4	125
251.375	252.375	3/8	125
251.500	252.500	1/2	125
251.750	252.750	3/4	125
251001	252001	1	125
25101.5	25201.5	1-1/2	125
251002	252002	2	125
25102.5	25202.5	2-1/2	125
251003	252003	3	125
25103.5	25203.5	3-1/2	125
251004	252004	4	125
251005	252005	5	125
251007	252007	7	125
251010	252010	10	125
251012	252012	12	32
251015	252015	15	32

Note: To order color-coded PICO II™ fuses, contact factory.

2AG SUBMINIATURE FUSES



Size .177" dia. × .58".

FAST ACTING TYPE

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max.; 200%, 1 sec. max.
Interrupting Rating: 1/10-1 amp — 10,000A (125V); 35A (250V). **1.5-3.5 amp** — 10,000A (125V); 100A (250V). **4-10 amps** — 10,000A (125V).
Approvals: U.L. Listed and Certified by C.S.A.
PATENTS: U.S. Patent 4,636,765

SLO-BLO® TYPE

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max.; 200%, 3 sec. min./20 sec. max.
Interrupting Rating: 1/4-1 amp — 10,000A (125V); 35A (250V). **1.5-3.5 amps** — 10,000A (125V); 100A (250V). **4-7 amps** — 400A (125V).
Approvals: U.L. Listed and Certified by C.S.A. thru 3.5 amps. U.L. Recognized 4-7 amps.
PATENTS: U.S. Patent 4,409,729 and 4,445,106.

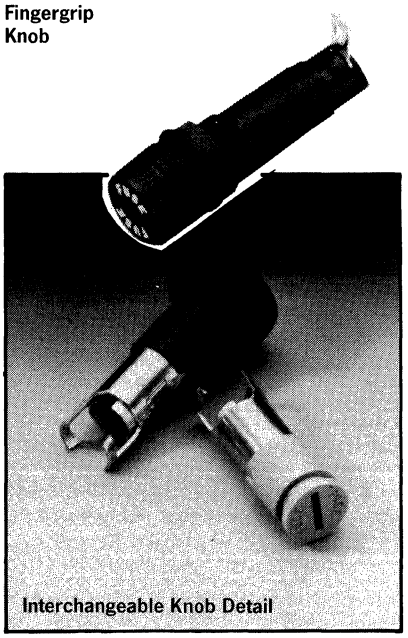
Littelfuse Number Fast-Acting	Littelfuse Number Slo-Blo	Ampere Rating	Voltage Rating
225.100	—	1/10	250V
225.125	—	1/8	250V
225.250	229.250	1/4	250V
225.375	229.375	3/8	250V
225.500	229.500	1/2	250V
—	229.600	6/10	250V
225.750	229.750	3/4	250V
225001	229001	1	250V
22501.5	22901.5	1-1/2	250V
225002	229002	2	250V
—	2292.25	2-1/4	250V
22502.5	22902.5	2-1/2	250V
225003	229003	3	250V
22503.5	22903.5	3-1/2	250V
225004	229004	4	125V
225005	229005	5	125V
225006	229006	6	125V
225007	229007	7	125V
225008	—	8	125V
225010	—	10	125V

Note: To order fast-acting fuses with axial leads, change **225** to **224**; to order Slo-Blo® fuses with axial leads, change **229** to **230.**

Littelfuse® CIRCUIT PROTECTION DEVICES

INTERNATIONAL SHOCK-SAFE FUSEHOLDER

Low Profile
Fingergrip
Knob



FEATURES:

- Designed to eliminate the possibility of electrical shock, as defined in IEC standards 65 and 257.
- Universal fuseholder body will accept 3AG, 5 × 20mm, and 2AG fuse sizes depending on knob selected. Permits inventory reduction of bodies and provides knob interchange versatility.
- Available with two knob styles—screwdriver slot or fingergrip. Drip-proof option is available on screwdriver slot knob style.
- Available in three terminal styles—dual-purpose for soldering or 3/16" quick connect; 3/16" NEMA quick connect; and 1/4" NEMA/DIN quick connect.

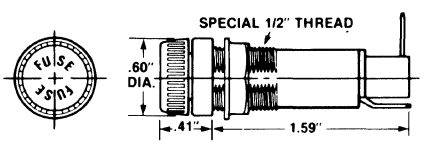
APPROVALS:

	3AG	5 × 20mm	2AG
UL*	20A 250V	10A 250V	10A 250V
CSA	20A 250V	10A 250V	10A 250V
SEMKO	6.3A 250V	6.3A 250V	—
VDE	10A 250V	10A 250V	—

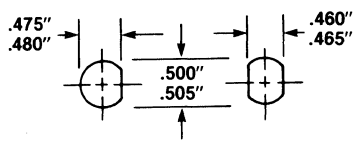
*Recognized under the Components Program of Underwriter Laboratories

DIMENSIONAL DRAWINGS

LOW PROFILE FINGERGRIP KNOB



SUGGESTED MOUNTING HOLES



ORDERING INFORMATION

EXAMPLE: 345 3 LS 7 L N (Complete Assembly with options)

Series Number

Fuse Size

- 2 — 2AG .177" x .588"
- 3 — 3AG .250" x 1.250"
- 5 — 5 x 20mm .197" x .787"

Body Type – Knob Type

- LF — Low Profile Body Black Fingergrip Knob
- RF — Rear Mount Body Black Fingergrip Knob
- Fingergrip Knob 2AG – Blue Letters 3AG – White Letters 5 x 20mm – Red Letters
- HS — High Profile Body Screwdriver Slot Knob
- LS — Low Profile Body Screwdriver Slot Knob
- QS — Quick Mount Body Screwdriver Slot Knob
- Screwdriver Slot Knob 2AG – Blue Knob 3AG – Grey Knob 5 x 20mm – Black Knob

Terminals

- 1 — 3/16" (Rt. Angle) Dual Purpose Solder/QC
- 2 — 3/16" (Straight) Dual Purpose Solder/QC
- 3 — 3/16" (Rt. Angle) NEMA QC
- 4 — 3/16" (Straight) NEMA QC
- 7 — 1/4" (Rt. Angle) NEMA/DIN QC
- 8 — 1/4" (Straight) NEMA/DIN QC

Options*

- L — Lockwasher
- N — Neoprene Washer
- P — Drip-Proof "O" Ring**

*Options (L,N,P) can be ordered individually or in combination.

**Screwdriver slot knob only.

LITTELFUSE, Inc. • Dept. EM, 800 E. Northwest Highway • Des Plaines, IL 60016 • (708) 824-0400 • FAX (708) 824-3024

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

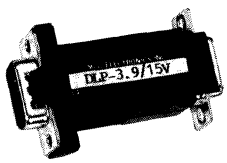
Z
ZIF zero insertion force

Comprehensive Surge Protection for Data Lines

Features 50 joule hybrid circuits offering clamp voltages at +/-6V, 10V, 15V, 25V and 200V
Special low Z, high band pass protectors on request.

Computer/Terminal Protection

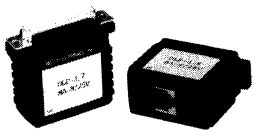
The DLP-3 series of in-line RS232 protectors prevent costly I/O port damage and failures. The DLP-3.1 uses standard 25 pin connectors; the DLP-3.9 uses a 9 pin connector.



DLP-3.1 (UL) *listed*

Telephone Line Protectors

The DLP-3.7 and DLP-3.8 telephone line protectors offer RJ11 and RJ45, respectively, at the input and 25 pin "D" connectors at the output.



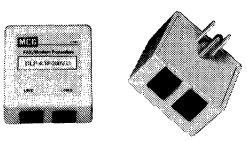
Dial-Up/Leased Line Protectors

The DLP-4.2 and DLP-4.4 protect 2 or 4 wires and install between your sensitive equipment and telephone or leased lines using RJ11 jacks.



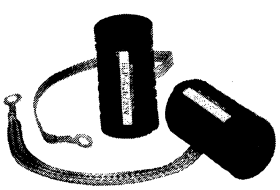
Optimum Fax/Modem Protection

The DLP-4.3 plugs into the same local AC outlet as the equipment being protected. Vulnerable equipment is then plugged directly into the protectors' RJ11 jacks.



Compact Telco Protectors

The DLP-4.6 and DLP-4.8 will protect any equipment using dial-up telephone lines. The DLP-4.6 uses RJ11 jacks on the line and load side; the DLP-4.8 employs RJ45 jacks.



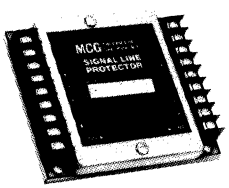
Video/High Speed Data Protection

The DLP-5 series offers in-line protection for video and wide band applications. DLP-5.1 is for use with BNC/coaxial systems; the DLP-5.2 is used with twinaxial systems.



Multiple Signal/ Data Line Protection

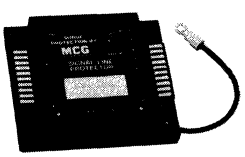
DLP-10, 20, 30 and 33 provide multiple line protection for 2 to 24 wires. These "universal" protectors are hard-wired to install anywhere.



DLP-10, 20, 30 (UL) *listed*

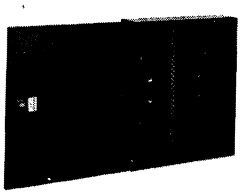
Ten Wire Protector

The DLP-35 is designed to protect 10 wire (5 pair) configurations. The unit features a "no tools required" terminal strip installation.



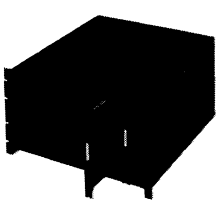
PABX/Key System Protection

DLP-36 series protect security systems, PABX systems, port selectors, etc. Provides telephone line protection (25 pair) using 50 pin RJ21X connectors.



Rackmount Protection Systems

The DLP-40 and DLP-55 series provide for termination of wires using plug-in cards housed in a standard 19" rack enclosure.



MCG ELECTRONICS INC.

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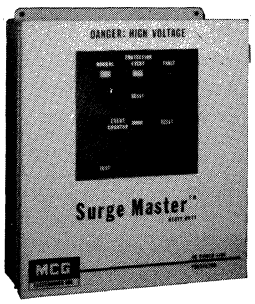
Maximum Surge Protection for AC Power Lines

Lightning and power switching transients surge along AC power lines producing costly damage to computers, electronic equipment and other sensitive electrical devices. Prevent these problems with high speed, brute force MCG protectors.

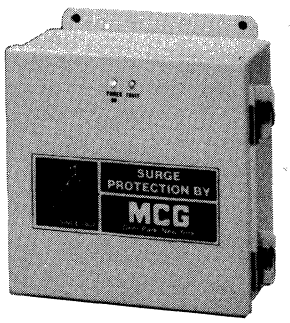
Major Facility Protectors
Surge Master

Superior, triple redundant protection for facilities or major equipment. Exceptional transient absorption capability. On-board diagnostics and modular construction simplify field maintenance. Models available for protecting 100 to 5000A service panels for 120/208, 240 or 480 VAC systems, wye and delta power configurations.



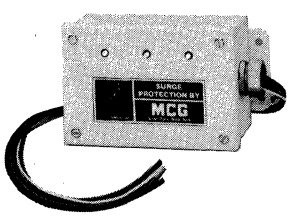
Service Entrance/ Panelboard Protectors
SPC/SPB

The SP series are rugged, yet cost-effective, shunt-installed panel protectors. They are ideal for applications where heavy-duty surge suppression is required, but extensive diagnostics are unnecessary. Choose the SPC for service entrance protection; the SPB for panelboard protection. All popular voltage ratings available.



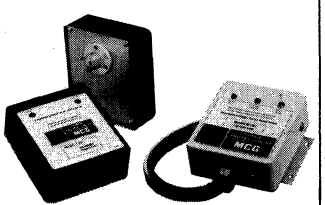
Branch Panel Protectors
SPA

The shunt-installed SPA is ideal when a plug-in protector is not enough and a larger protector would be overkill for the application. The unit provides up to 1680 joules total surge energy absorption.



Commercial/Residential Protectors - P100/160

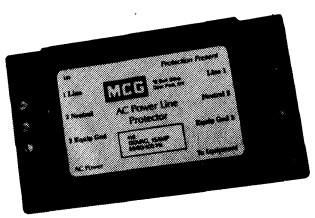
The P100 and 160 series AC voltage surge suppressors are internally-fused, high speed, solid state devices designed for residential and commercial applications. The P100 series employs a twist-lock plug for easy installation; the 160 series offers the flexibility of hardwired installation and the assurance of an audible alarm. LED status indicators verify the presence of power and protection.



P100 Series UL *listed*

Compact OEM Protectors - 407, 415 - 417

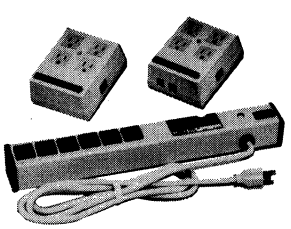
The 407, 415, 416 and 417 are equipment-level protectors installed "within" a piece of equipment. The units employ a sophisticated combination of brute force surge protection and impulse filtering to prevent equipment damage or malfunction. Reaction time is less than 1 nanosecond with automatic reset after the transient has passed. Absorption capability to 800 joules.



415, 416 and 417 UL *listed*

Plug-in Protectors 200 Series

Plug-in protectors guard computer hardware and peripherals from AC power line transients. The 200 Series offers two, four and six protected outlets (5-15R). They are designed for a very low voltage transient "let thru" and a very high energy handling capability (720 joules total, depending on model). Model 293 adds fax and modem protection via RJ11 connections.



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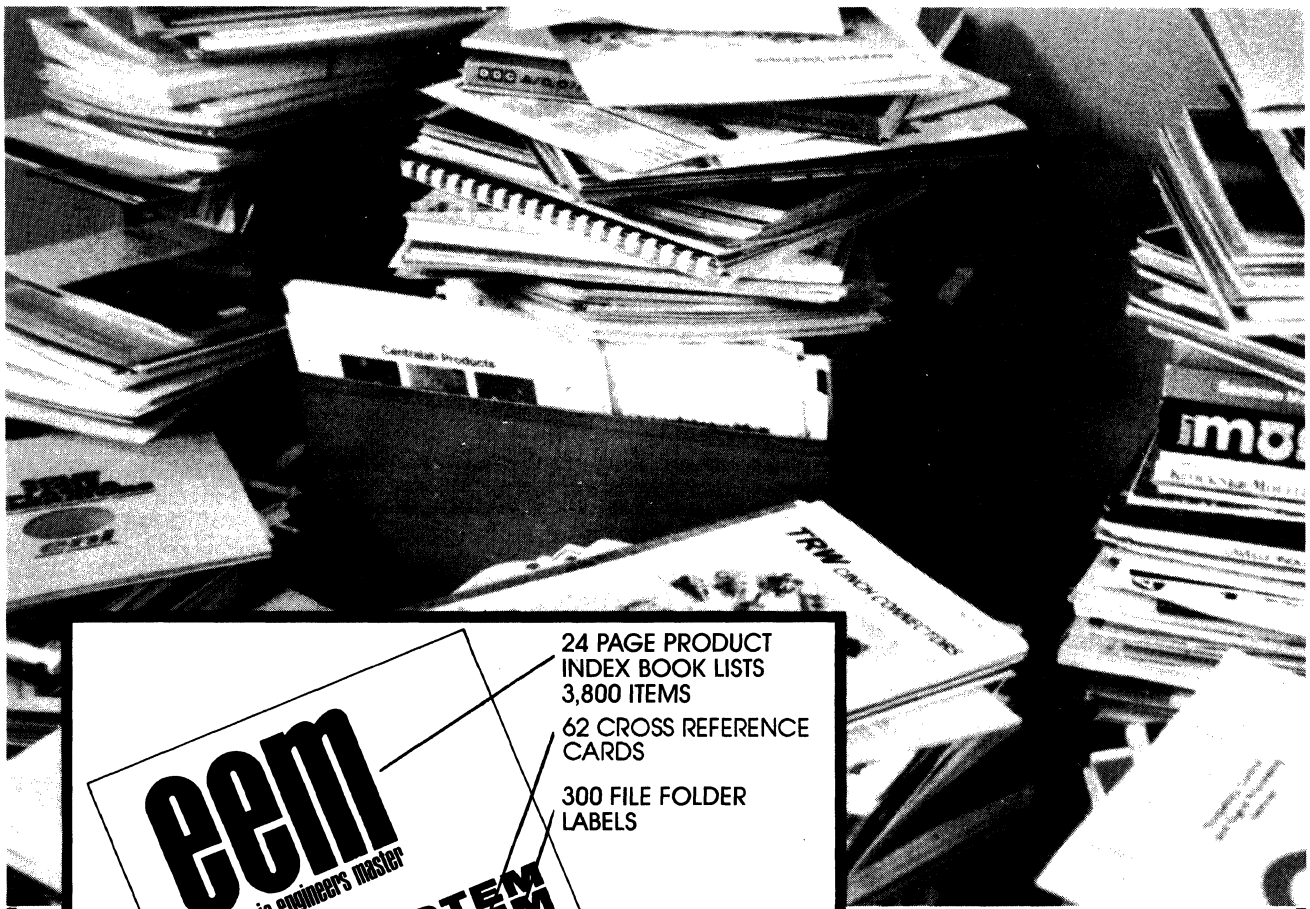

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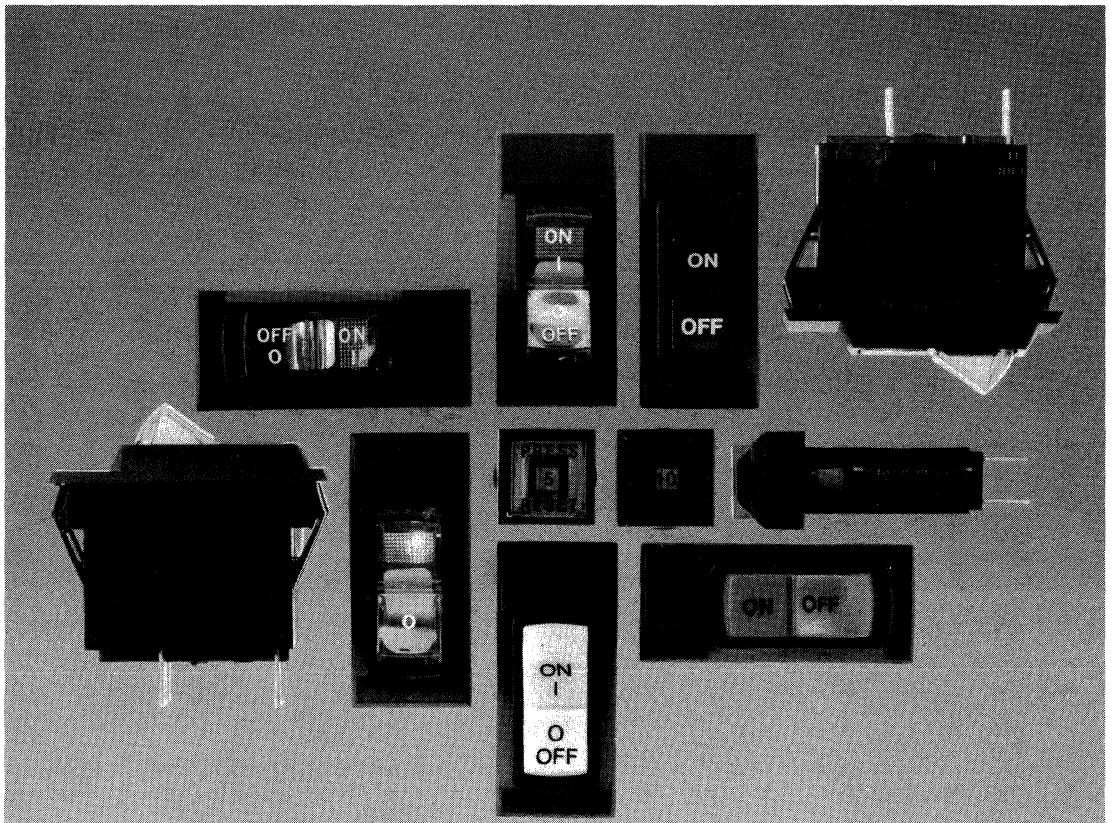

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MP

04

MECHANICAL PRODUCTS, INC.

QUICK REFERENCE GUIDE

CONFIGURATION

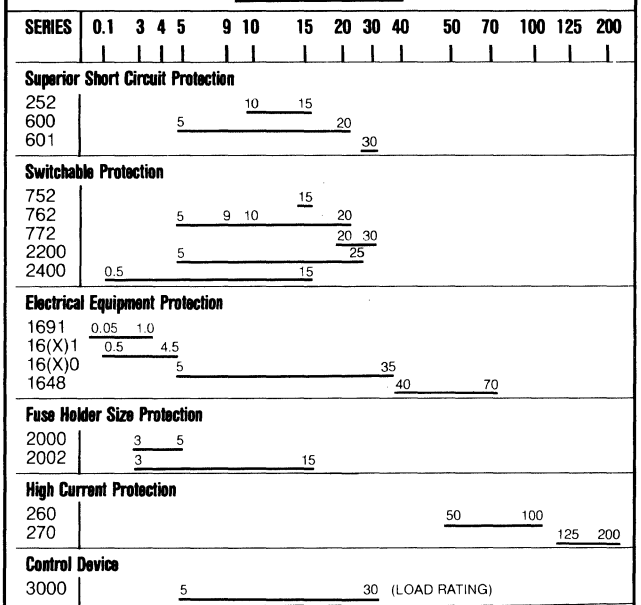
Series	Push To Reset	Switchable	Control	Comments
252 600 601	* * *			Superior Short Circuit Protection
752 762 772 2200 2400		* * * * *		Switchable Protection
1691 16(X)1 16(X)0 1648	* * * *			Electrical Equipment Protection
2000 2002	* *			Fuse Holder Size Protection
260 270		* *		High Current Protection
3000			*	Control Device

REGULATORY APPROVALS

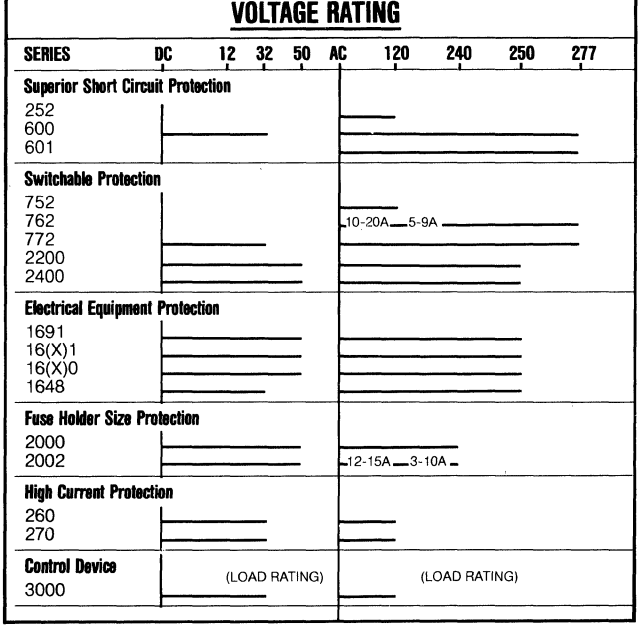
SERIES	UL	CSA	VDE	NONE
Superior Short Circuit Protection				
252	*	*		
600	*	*		
601	*	*		
Switchable Protection				
752	*	*		
762	*	*		
772				*
2200	*	*	*2	
2400	*2	*2	*2	
Electrical Equipment Protection				
1691	*			
16(X)1	*		*1	
16(X)0	*		*1	
1648				*
Fuse Holder Size Protection				
2000	*	*		
2002	*	*		
High Current Protection				
260				*
270				*
Control Device				
3000				*

1. Limited Available Models (Consult Factory)
2. Designed to Meet, Consult Factory For Approval Status

AMPERE RATING



VOLTAGE RATING



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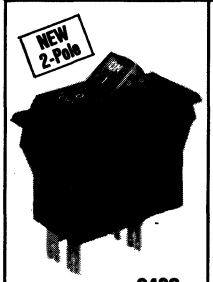
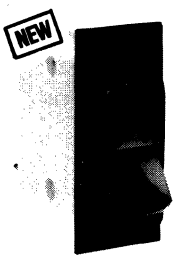
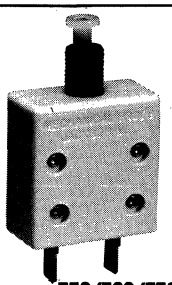
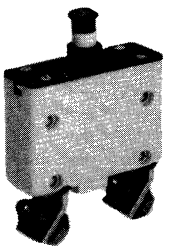
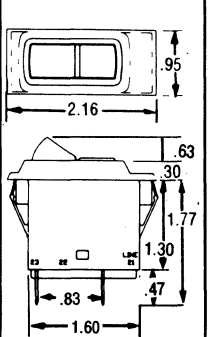
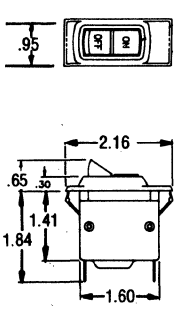
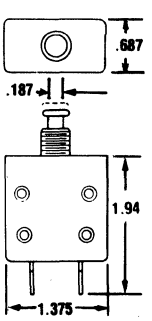
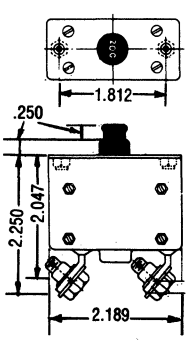
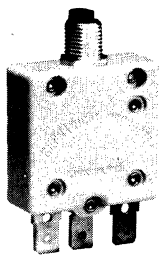
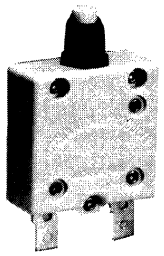
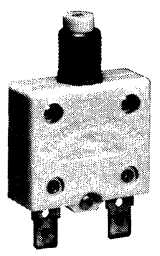
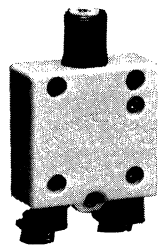
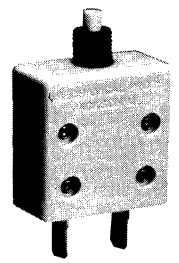
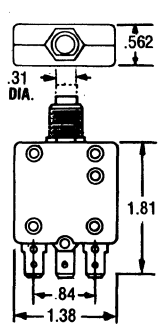
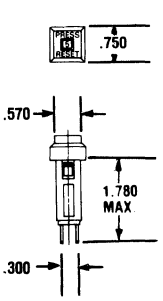
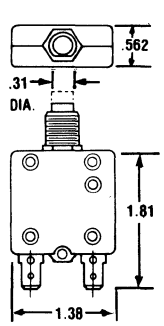
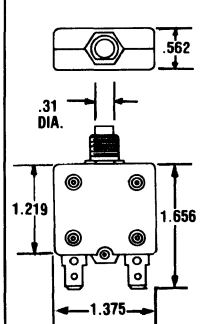
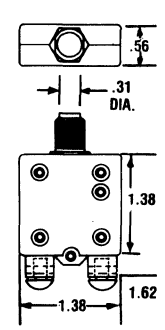
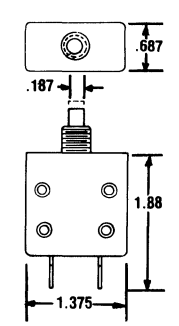
SWITCHABLE

SERIES NO(S):	 NEW 2-Pole **2400**	 NEW **2200**	 **752/762/772**	 **260/270**
DESCRIPTION:	Power 'ON/OFF' Switch Combined with Circuit Protection - compact 1 or 2 pole package	Power 'ON/OFF' Switch Combined with Circuit Protection	"Double Break", High Interrupt, Trip Free Circuit Protector/Breaker	High Current Capacity Trip Free Circuit Protection
CURRENT RATING:	0.1 to 16 Amperes	5 to 25 Amperes	752 Series-15 Amperes 762/772 - 5 to 40 Amperes	260 Series 50 to 100 Amperes 270 Series 100 to 200 Amperes
MAXIMUM VOLTAGE RATING:	250VAC, 50VDC	250VAC, 50VDC	752 Series-120 VAC, 762/772 Series-277VAC, 32VDC (Ampere Rating, Dependent)	120VAC, 28VDC
CALIBRATION @ 25° C, (PERCENT OF RATING):	100% Hold 140% Trip-within one hour (balanced)	100% Hold 125% Trip-within one hour	100% Hold 125% Trip-within one hour	100% Hold 150% Trip-within one hour
OVERLOAD TRIP TIME: (in sec.) 200% 500% 1000%	8.0 to 40.0 1.0 to 3.0 0.2 to 1.0	3.0 to 35.0 0.4 to 2.8 0.18 to 1.3	5.0 to 30.0 0.5 to 3.3 0.15 to 0.9	10.0 to 80.0 1.2 to 6.5 0.4 to 2.0
INTERRUPTION:	2,000 Amperes at 250VAC 1,000 Amperes at 50VDC	2,000 Amperes at 250VAC 1,000 Amperes at 50VDC	752 Series-5,000 Amperes (Per UL489: 762/772 Series-Ampere Rating Dependent) 1,000/5,000 Amperes (Per UL1077)	3,000 Amperes at 28VDC 2,500 Amperes at 115VAC
AGENCY:	UL1077, CSA Designed to meet both VDE 642 & IEC 934	UL1077, CSA Designed to meet both VDE 642 & IEC 934	752 Series-UL Listed (UL489), CSA, 762 Series-UL1077/CSA	None
NOTES:	Lighted actuator options Snap-in Mounting Inductive Load Rated at 250VAC Meets Class A clearances per UL1077	Endurance: 50,000 switch cycles at rated load Snap-in Mounting Inductive Load Rated at 250VAC Meets Class A clearances per UL1077	752 Series is a Listed UL489 Molded Case Circuit Breaker. A minimum of ½" needed between terminals and grounded metal parts.	Switchable for heavy-duty systems Extra heavy contacts and terminals Trouble free contact life Vibration/shock resistant
PHYSICAL DIMENSIONS: (INCHES) Note: Reference information only. Specific technical data is contained in catalogs by series.				

CONTROL	PUSH TO RESET				
					
3000	**Amlit® 2000/2002**	**1601/1681/1691**	**1600/1680**	**1648**	**252/600/601**
Circuit Protector with Shunt Trip or Isolated Control Circuit Configerations	Unique, Low Cost, Front Panel, Fuse Holder Replacement, Circuit Protector	Low Ampere "Snap-Acting." Circuit Protector	Low Cost, "Snap Acting," Circuit Protection	Heavy Duty, High Ampere Circuit Protector	"Double Break", High Interrupt. Circuit Protection/ Breaker
Load-5 to 35 Amperes Control-0.1 to 7 Amperes	3 to 15 Amperes	0.05 to 4.0 Amperes	5 to 35 Amperes	40 to 70 Amperes	252 Series-10 & 15 Amperes 600/601 Series-5 to 30 Amperes
Load: 250VAC, 30VDC Control: 40VAC or DC	240VAC, 50VDC	250VAC, 50DC	250VAC, 50VDC	250VAC, 32VDC	252 Series-120VAC 600/601 Series-277 VAC, 32VDC
Consult Factory	100% Hold 135% Trip-within one hour	100% Hold 125% Trip-within one hour. 1601/1681: 145% Trip-within one hour, 1691	100% Hold 125% Trip-within one hour	100% Hold 140% Trip-within one hour	100% Hold 125% Trip-within one hour
Varies with Application	2.2 to 15.0 0.35 to 1.1 0.12 to 0.4	10.0 to 45.0 2.4 to 6.2 (NA)	5.0 to 30.0 0.5 to 2.8 0.15 to 0.78	5.0 to 30.0 0.5 to 2.8 0.15 to 0.78	5.0 to 30.0 0.5 to 3.3 0.15 to 0.9
Load Circuit-1,000 Amperes (Per UL1077) Control Circuit-Not Applicable	1,000 Amperes (Per UL1077)	1,000 Amperes (Per UL1077)	1,000 Amperes (Per UL1077)	1,000 Amperes (Per UL1077)	252 Series-5,000 Amperes (Per UL489) 600/601 Series up to 5,000 Amperes (Per UL1077)
None	UL, CSA	UL, CSA, VDE	UL, CSA, VDE	None	252 Series-UL489 (Recognized) CSA, 600/601 Series-UL1077/CSA
Not all combinations of load and control parameters are compatible. Please consult factory for assistance.	Snap-in mount fits panel thicknesses 0.020 to 0.075. Mounting size incl. 5/8" dia. double D and square holes. Inductive Load Rated at 120VAC (240VAC through 10A)	Various mounting sizes and termination styles available including "Snap-in"	Various mounting sizes and termination styles available including "Snap In".	Several customers have obtained agency approval for their product utilizing the 1648. Terminal type is screw.	The 252 is a UL recognized (UL 489). Molded Case Circuit Breaker. A minimum of ½" is needed between terminals and grounded metal parts.
					

International "Touchproof" Fuseholders

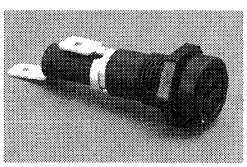
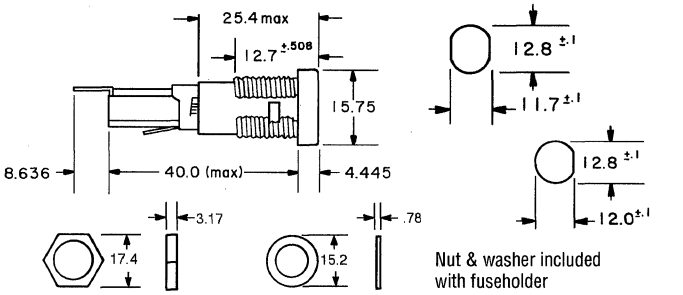
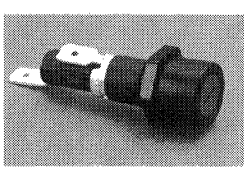
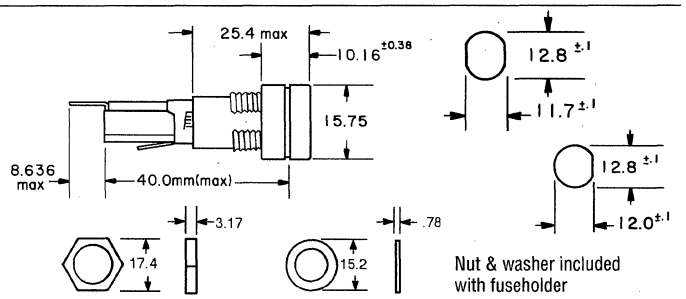
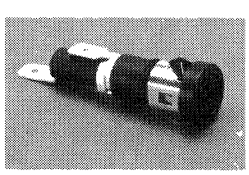
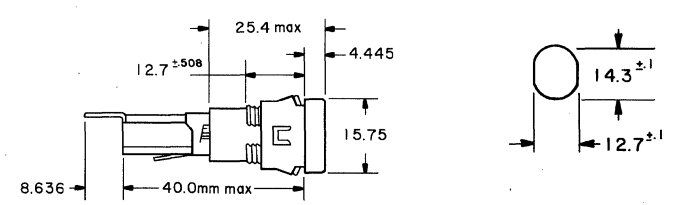
Interpower™fuseholders accept both sizes of fuses that are used in the world today: the North American 3AG (1/4 x 1-1/4"/6.3 x 32mm) and the international 5x20mm fuses. International "touchproof" fuseholders have four important characteristics:

1. Fuseholder is accessible with a tool only
2. Contacts are recessed and protected
3. Fuse carrier is insulated
4. Fuse carrier is retained in a spring-loaded carrier.

Three body styles are available, each with four contact styles. Order fuses separately.

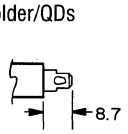
Maximum panel thickness: .762mm (.30")
Materials: Body molded from polyphenylene sulfide thermoplastic resin; contacts, tin-plated brass. UL 94-V0 flam. rating.
Markings: All parts are marked "80910"
Approvals, Ratings & Approval File Numbers:

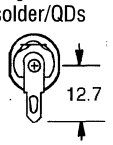
UL recog.	20A/250V	File #E126146
CSA cert.	16A/250V	File #073106
VDE	10A/250V	File #12344-1370-1700/A1
SEMKO	10A/250V	File #9023030

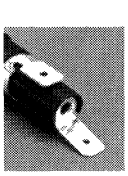
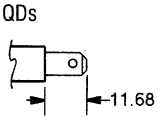
Body Style	Part Number	Contact style	Drawings	Mounting
Low Profile • Rear Hex Nut 	**80910010**	4.8mm solder/QD		Nut & washer included with fuseholder
	80910020	angled 4.8mm solder/QD		
	80910030	6.3mm solder/QD		
	80910040	angled 6.3mm solder/QD		
High Profile • Rear Hex Nut 	**80910050**	4.8mm solder/QD		Nut & washer included with fuseholder
	80910060	angled 4.8mm solder/QD		
	80910070	6.3mm solder/QD		
	80910080	angled 6.3mm solder/QD		
Low Profile • Snap-in 	**80910090**	4.8mm solder/QD		
	80910100	angled 4.8mm solder/QD		
	80910110	6.3mm solder/QD		
	80910120	angled 6.3mm solder/QD		

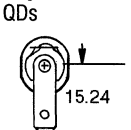
Dimensions are in mm

Contact Styles


In-line 4.8mm solder/QDs



Angled 4.8mm solder/QDs



In-line 6.3mm QDs



Angled 6.3mm QDs


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Interpower™ IEC 127 International 5 x 20mm Fuses Ⓢ

Fuses conform to IEC 127. SEMKO approved. Rated at 250VAC. Contact us for performance characteristics.Minimum order: 1 box

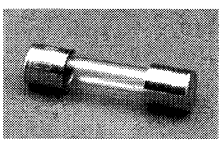
Quick-acting, low-breaking capacity



IEC 127–II; DIN 41661; SEMKO 104-1976; 250VAC

Model Number	Rated Current I_n	Break. Cap. at 250V cosφ1
81411101	32* mA	
81411181	71	
81411221	100	
81411241	125	
81411261	160	
81411281	200	
81411301	250	
81411321	315	35 A
81411341	400	
81411361	500	
81411381	630	
81411401	800	
81411421	1 A	
81411441	1.25	
81411461	1.4	
81411481	1.6	
81411501	2	
81411521	2.5	
81411541	3.15	
81411561	4	
81411581	5	10 I_n
81411601	6.3	

Quick-acting, high-breaking capacity

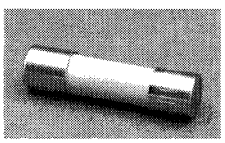


IEC 127–I; DIN 41660; SEMKO 104-1976; 250VAC

Model Number	Rated Current I_n	Break. Cap. at 250V cosφ1
81413421	1 A	1500A: at 250V, 50I cosφ 0.7-0.8
81413441	1.25	
81413481	1.6	
81413501	2	
81413601	6.3	

* not included in applicable standards

Time-lag, low-breaking capacity



IEC 127–III; DIN 41662; SEMKO 104-1976; 250VAC

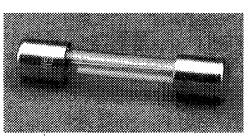
Model Number	Rated Current I_n	Break. Cap. at 250V cosφ1
81412161	63 mA	
81412181	71	
81412221	100	
81412241	125	
81412261	160	
81412281	200	
81412301	250	
81412321	315	35 A
81412341	400	
81412361	500	
81412381	630	
81412401	800	
81412421	1 A	
81412441	1.25	
81412461*	1.4	
81412481	1.6	
81412501	2	
81412521	2.5	
81412541	3.15	
81412561	4	
81412581	5	10 I_n.
81412601	6.3	

North American 1/4 x 1-1/4" fuses Ⓤ ᵲᵘ Ⓒ

Fuses conform to UL 498, CSA C22.2 No. 59. UL listed/recognized, CSA certified fuses; contact us for performance characteristics.

Non-time delay

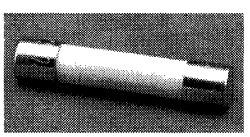
UL & CSA, 250V; glass



Model Number	Rated Current I_n
AGC-1/8	1/8A
AGC-1/4	1/4
AGC-1/2	1/2
AGC-3/4	3/4
AGC-1	1
AGC-1-1/2	1-1/2
AGC-2	2
AGC-3	3
MTH-4	4
MTH-5	5
MTH-6	6
GLH-10	10 (125V)

Time delay

UL & CSA, 250V; ceramic

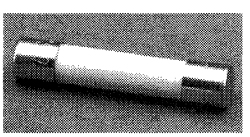


Model Number	Rated Current I_n
ABC-1/2	1/2
ABC-1	1
ABC-2	2
ABC-3	3
ABC-5	5
ABC-6	6
ABC-8	8
ABC-10	10
ABC-15	15
ABC-20	20*

*15A, CSA

Time delay

UL & CSA, 250V; ceramic



Model Number	Rated Current I_n
MDA-1/2	1/2
MDA-3/4	3/4
MDA-1	1
MDA-2	2
MDA-3	3
MDA-4	4
MDA-5	5
MDA-7	7
MDA-8	8
MDA-10	10
MDA-15	15
MDA-20	20

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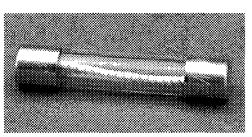
Time delay

UL & CSA listed, 250V; glass*



Model Number	Rated Current I_n
MSL-1/4	1/4
MSL-1/2	1/2
MSL-3/4	3/4
MSL-1	1
MSL-2	2
MSL-3	3
MSL-4	4
MSL-5	5
MSL-6	6
MSL-8	8

*spiral wound element for moderate inrush I.

MINIGLOSSARY TIMERS

Accuracy
The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

Adjustability
The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

Contact Rating
The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

Delayed Interval Timing Function
Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

Also called: single shot.

Delay-On-Operate Timing Function
Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

Also called: Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

Delay-On-Release Timing Function
Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

Also called: Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

Frequency Sensor
A device that monitors a predetermined overfrequency and/or underfrequecy condition, and changes output state when these conditions exist.

Hysteresis
The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

Interval Timer Timing Function
Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

Also called: Delay Interval, One Shot.

Output Control
The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

Phase Sensor
A device that monitors for proper phase rotation in 3-phase systems.

Programmability
Ability to modify function, time delay or input voltage of a timer.

Recovery Timer

(Delay-On-Operate/Interval Timer)
The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

(Delay-On-Release)
The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

Recycle Time

(Delay-On-Operate or Interval Timer)
The minimum time that input voltage must be interrupted after the timing cycle is completed to assure a successive timing cycle within the repeatability specified.

(Delay-On-Release)
The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

Repeat Cycle Timer Timing Function
Application of power automatically initiates continuous off-on cycling of the output relay.
Also called: flasher, intervalometer

Reset Time
The time required for the contacts to return to normal position when power is removed.

Reverse Polarity Protection
Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

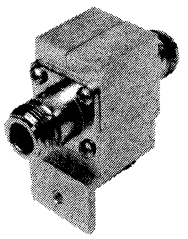
Tolerance
The difference between specified and actual timing or sense point (factory setup tolerance).

Transient Protection
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

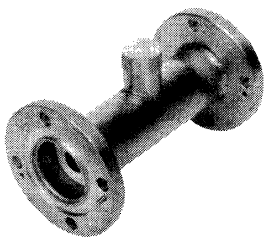
Trip Point
The predetermined point at which a sensing device is set to change the output state.

Voltage Sensor
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.

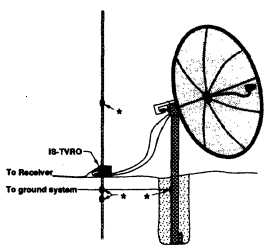
Grounding & Lightning Solutions



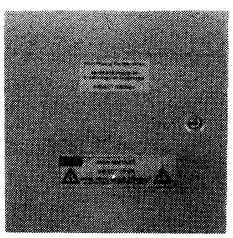
COAX TO 6 GHz



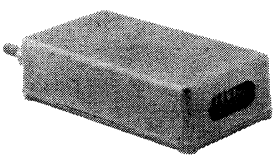
BROADCAST & MILITARY TO 50 KW



TVRO



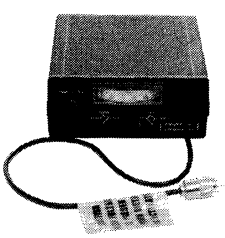
3ø POWER TO 480 VAC



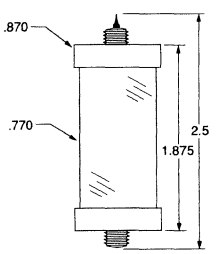
STRIKE COUNTERS TOWER/POWER/PHONE



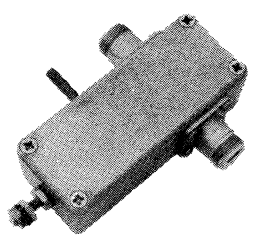
CHEMICAL GROUND SYSTEMS



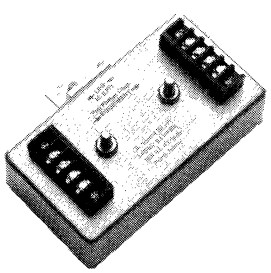
BREAKDOWN TESTERS



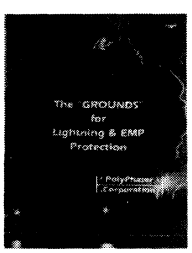
GAS TUBES TO 100 KA



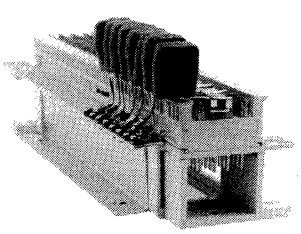
4 TO 23 GHz MICROWAVE DOWNCONVERTERS



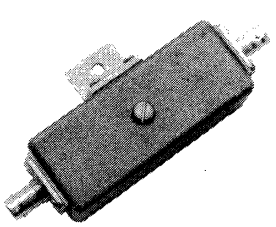
T-1 (TO DS-3 RATES)



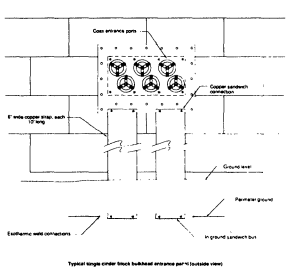
VIDEO & TUTORIAL BOOK



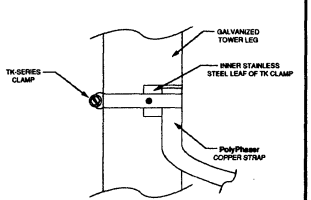
TWISTED PAIR



LAN/VIDEO



ENTRANCE PANELS



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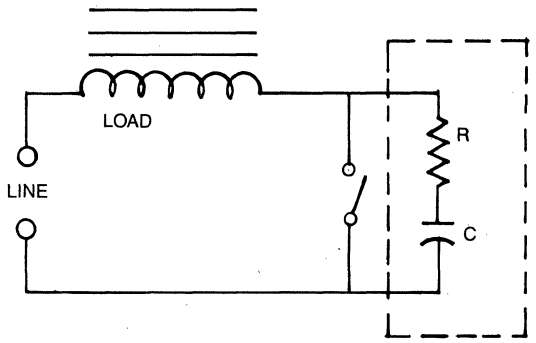
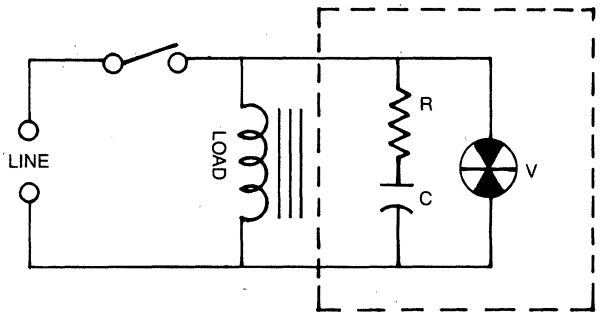
PPD ARC / SURGE suppressor



ARC SUPPRESSION



VOLTAGE SURGE LIMITING

Electrical Ratings

PPD VOLTAGE CODE		12	22	24
V1 No Varistor	Rated Volts	120 vac 250 vdc	220 vac 400 vdc	240 vac 600 vdc
V2 W/Varistor	Allowable Volts	130 vac 170 vac	250 vac 320 vdc	240 vac 350 vdc
V3 Clamp Volts **A** Clamp Amps	Max.	340 v 10A	650 v 10A	710 v 10A
J Watt Seconds (Joules)	Max.	10J	10J	10J

CONSTRUCTION:

A 0.47 MFD Metallized Film Capacitor, in series with a Carbon composition 0.5W Resistor, in the 22-680 Ohm range. This assembly, with or without a VARISTOR, is sealed with Flame Retardant Epoxy resin in a molded plastic box.

Single Phase R-C Networks; R-C networks are used to absorb energy, when disconnecting inductors including contactor operating coils, solenoids, and motors. This prevents damage to mechanical switch contacts, or solid state devices such as Rectifiers, SCRs and TRIACs. PPD R-C NETWORKS USE a 0.47 MFD Metallized Polyester film Capacitor. In series is a 0.5W carbon comp resistor with a value in the range 22-680 Ohm. A Varistor may be included in the assembly, connected across the R-C network terminals.

Voltage designation is:

V1 = Normal operating voltage without the Varistor. Both AC and DC ratings are given.

V2 = Max AC voltage with Varistor, above which heating will occur due to increased Varistor current draw.

V3 = Clamping voltage for Varistor at specified clamping current.

In addition the Varistor energy absorbtion rating is given in: Joules = Watt Seconds. For example, a clamping voltage of 400V at 10A would dissipate 4000W, and Varistor rating of 2.5 Joules would become overloaded beyond

$$\frac{2.5}{4000} = 625 \text{ micro secs.}$$

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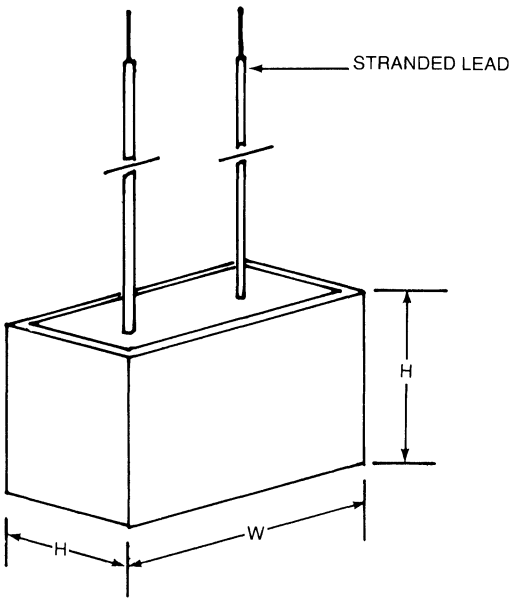
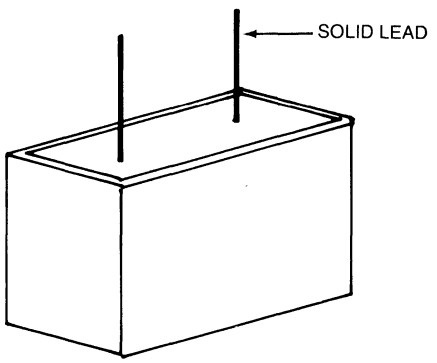
Specifications subject to change without notice.

PPD ARC ⚡ SURGE suppressor





Applications:

Use PPD ARC/SURGE SUPPRESSORS TO PREVENT:

(1) ARCING and VOLTAGE SURGES when disconnecting RELAYS, CONTACTOR COILS, & SOLENOID VALVES.

(2) Breakdown of DIODES, SCRs, and TRIACs.

(3) Transient overvoltages in COMPUTERS, and ELECTRONIC CONTROLLERS.

Dimensions:

Box: H = 0.935" W = 0.6" L = 1.25"
TERMINATIONS: Stranded Copper 18 ga. × 6" INSULATED.
OPTIONAL Solid Copper wire, 20 ga. × 0.75" long
OPERATING TEMPERATURE −35°C to +85°C.

Part Number for Ordering:

EXAMPLE: - 0.47MFD 180 OHM. 120VAC. Varistor. 6" Wire Leads Single Phase.

1 12 47 6 180 V

Phase	Varistor
120 VAC	180 OHMS
0.47 MFD	6" Stranded Wire

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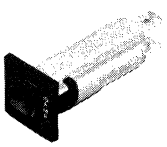
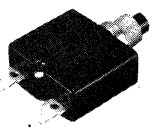
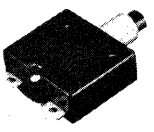
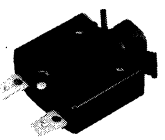
mini circuit breakers

TYPE		HW - 15CP	HW - 35MB			HW - 15MB	
Outline			 M12×1.0	 7/16"-28	 Snap in	 M12×1.0	 7/16"-28
Number of poles		1	1	1	1	1	1
Current rating		5A—15A	5A—35A	5A—35A	5A—35A	10A, 15A	10A, 15A
Maximum operating voltage	AC	250V (125V)	250V (125V)	250V (125V)	250V (125V)	250V (125V)	250V (125V)
	DC	50V	50V	50V	50V	50V	50V
Interrupt capacity	AC 250V	1000A	1000A	1000A	1000A	1000A	1000A
	DC 50V	1000A	2000A	2000A	2000A	2000A	2000A
Actuator		Push-to-reset button	Push-to-reset button	Push-to-reset button	Push-to-reset button	Push-to-reset button	Push-to-reset button
Circuit function		Series trip	Series trip	Series trip	Series trip	Series trip	Series trip
Weight		8.5g	26.5g	24.0g	21.5g	13g	13g
Terminals		.250" quick connect	.250" quick connect	.250" quick connect	.250" quick connect	.250" quick connect	.250" quick connect
Mounting		Snaps into panel cutout from front	M12×1.0 threaded bushing	7/16"-28 threaded bushing	Snaps into panel cutout from back	M12×1.0 threaded bushing	7/16"-28 threaded bushing
Component recognition							

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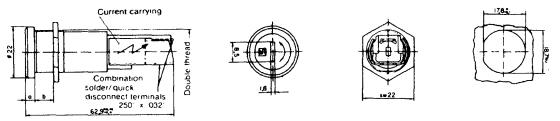
INTERNATIONAL FUSEHOLDERS–IEC 257/VDE 0820, IEC 65/VDE 0860, IEC 529

FUL-High Current



UL, CSA rated 30A/250V, VDE rated 16A/250V
For ¼ x 1¼" or 5 x 20mm fuses, ¼" fast-on terminals
031.2308 Body only
031.2321 Fuse carrier for ¼ x 1¼" fuses
031.2323 Fuse carrier for 5 x 20mm fuses
859.0046 Insulator boot (optional)

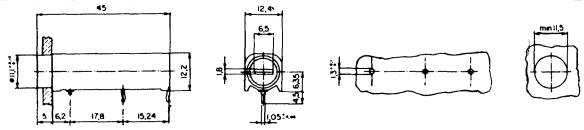


FAU



vert. or horiz.

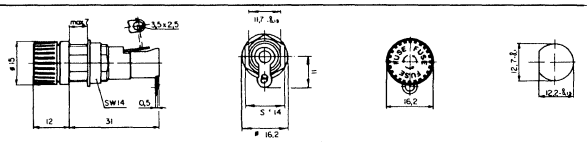
UL, CSA rated 16A/250V, VDE rated 6.3A/250V
031.3577 Body only, horizontal
031.3804 Body only, vertical
031.1666 Fuse carrier for ¼" x 1¼" fuses
031.1663 Fuse carrier, fingergrip, for ¼" x 1¼" fuses
031.1667 Fuse carrier, fingergrip, for ¼" x 1¼" fuses



FEU



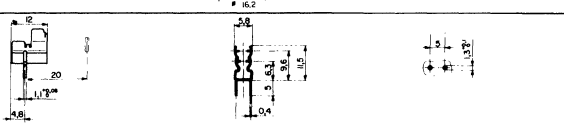
UL, rec. 20A/250V, CSA cert. 16A/250V,
VDE Approved 10A/250V
031.1803 Fuseholder complete with carrier for 5 x 20mm fuse
031.1804 Fuseholder complete with carrier for ¼" x 1¼" fuse



OG



751.0099 Fuse clips for ¼" x 1¼" or 5 x 20mm fuses. Bronze, Tin-plated. UL rec. 16A/500V (Fuses according to 250V standards only.)
751.0100 Fuse clips, Brass, Tin-plated



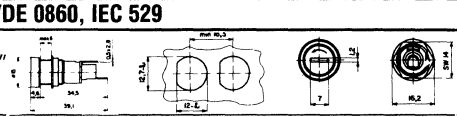
5 x 20mm FUSEHOLDERS–IEC 257/VDE 0820, IEC 65/VDE 0860, IEC 529

FIN

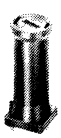


watertight IP 67

UL, CSA, rated 10A/250V, VDE rated 6.3A/250V
Watertight, for 5 x 20mm fuses with solder/fast on terminals .110" x .020"
031.1351 Complete fuseholder with carrier, axial terminals
031.1353 Complete fuseholder with carrier. End terminal 90° off axis.

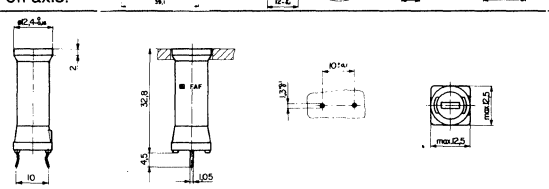


FAF

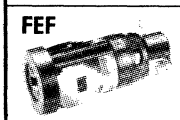


vert. or horiz.

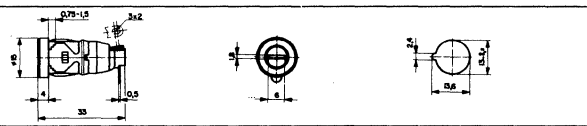
UL rated 12A/250V, CSA 10A/250V, VDE 6.3A/250V
For 5 x 20mm fuses, pcb mount, flux proof. Unsealed or sealed (IP54)
031.3558 Complete fuseholder with fuse carrier, IP40, horizontal
031.3751 Complete fuseholder with fuse carrier, IP40, vertical
031.3753 Complete fuseholder with fuse carrier, IP 54, vertical



FEF



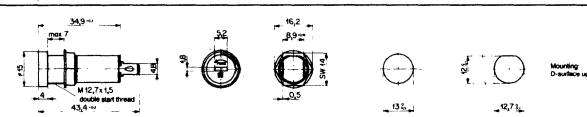
UL, CSA, VDE rated 10A/250V for 5 x 20mm fuses
031.1085 Fuseholder/slotted carrier, screw-on mount, solder terminals.
031.1165 Fuseholder/slotted carrier, push-on mount, solder/fast-on terminals.



FBS



UL, CSA, VDE rated 10A/250V. Fuseholder and carrier complete in one unit. Solder/fast-on terminals
4.8 x 0.5mm. For 5 x 20mm fuses
031.3901 Front panel mount
031.3961 PCB Mount



MICROFUSE HOLDERS

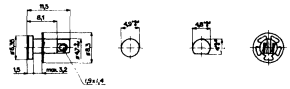


FMS UL, CSA rated 5A/125V
Base material is temperature resistant. Polyphenylensulfide thermoplastic. Contacts are brass, silver plated.
031.7501





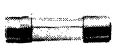
FME UL, CSA rated 5A/125V
031.7503



FUSES–IEC/UL

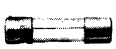
5 x 20mm 250V

FSF Quick-Acting 2mA–10A



UL rec. 32mA–63A VDE Approval for 32mA–6.3A

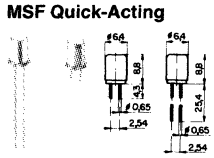
FST Time-Lag 20mA–20A



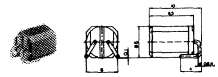
UL rec. 125mA–6.3A VDE Approval for 32mA–6.3A

Microfuses 125V

MSF Quick-Acting

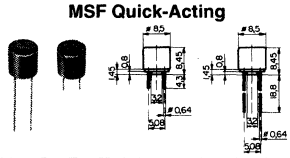


MSO Quick-Acting SMD

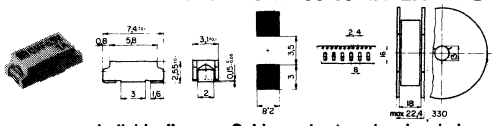


Microfuse 250V

MSF Quick-Acting



Miniature SMD Fuse

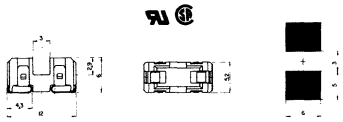


individually Solder pad taped and reeled

OMF 63 63mA–2A

Order Number	Current/Voltage	Packaging
3402.0003.xx	63mA/63V	3402.xxxx.11= Boxes of 100 pieces
3402.0004.xx	100mA/63V	
3402.0005.xx	160mA/63V	
3402.0006.xx	250mA/63V	3402.xxxx.22= 750 pieces taped and reeled
3402.0007.xx	400mA/63V	
3402.0008.xx	630mA/63V	
3402.0009.xx	1 A/63V	3402.xxxx.24= 3000 pieces taped and reeled
3402.0010.xx	1.25 A/63V	
3402.0011.xx	1.6 A/63V	
3402.0012.xx	2 A/63V	

Miniature SMD Fuseholder OMH



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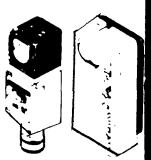
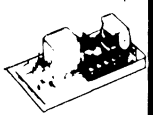
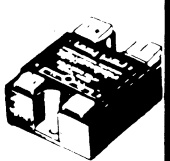

PHOTOELECTRICS


RELAYS


LIQUID LEVEL CONTROLS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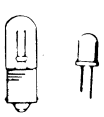
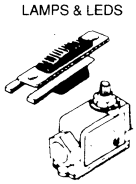
CIRCUIT BREAKERS FUSES & FUSEHOLDERS


KNOBS


LAMPS & LEDS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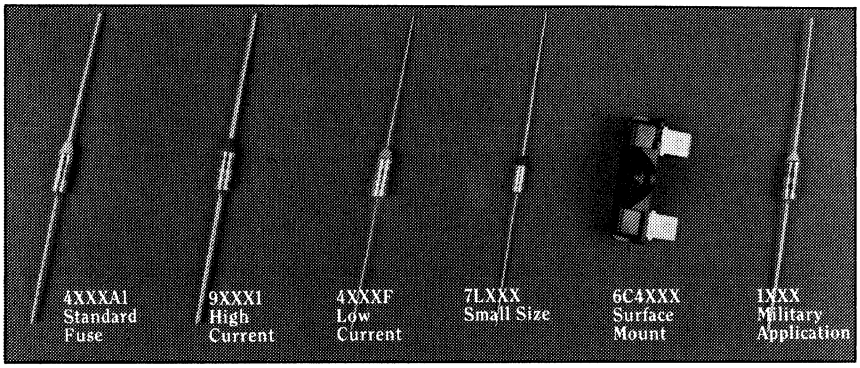
MICROTEMP® Thermal Cutoffs

Microtemp® Thermal Cutoffs provide permanent over-temperature protection for motors, transformers, appliances, HVAC equipment and electronic equipment. Once a Microtemp® Thermal Cutoff opens a circuit, it remains open until the fault is corrected and the thermal cutoff replaced. Custom packages, insulations or special assemblies may be specified to meet your unique application needs.



Thermal Cutoff Series Selection

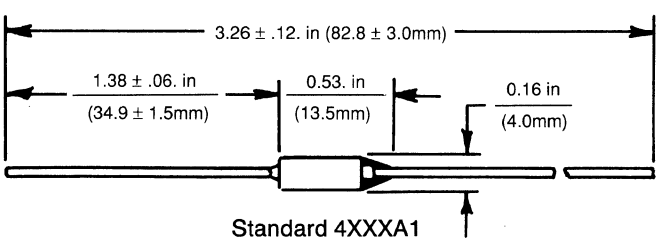
To determine which series is best for your application, remember:

- To consider the normal and abnormal electrical currents and voltages of your product.
- That the current passing through a Microtemp® Thermal Cutoff can generate I^2R, self heating.
- That the outer case of the Microtemp® Thermal Cutoff is electrically live and may require insulation. This insulation can reduce heat transfer, requiring consideration in selecting opening temperature.
- To determine the correct temperature setting a thermocoupled dummy should be installed in the product circuit.
- The ideal placement of the thermal cutoff should allow the greatest difference between operating temperatures and fault conditions.

Thermal Cutoff Types

Type No.	Temp. (°C) Calibration Range	Wire Size AWG	Maximum Recommended Operating Current and Voltge (Resistive)
4XXX	60-240	18	15 Amp/240 VAC
9XXX	60-240	15	25 Amp/240 VAC
4XXXF	60-240	23	5 Amp/240 VAC
7LXXX	72-184	23	6 Amp/240 VAC
6C4XXX	60-184	—	15 Amp/240 VAC
1XXX	60-240	18	15 Amp/240 VAC

Thermal Cutoff Standard Dimensions



Standard 4XXXA1

MICROTEMP® Thermal Cutoff Temperature Ratings

Reading the temperature chart.

All Microtemp® Thermal Cutoffs are identified by their type no. (4XXX, 9XXX, etc.). The "XXX" digits are determined by the opening temperature you specify. For example: A 4136A1 is a Microtemp® Thermal Cutoff with an opening temperature of 60°C.

Model # (XXX)	Max. Opening Temp. °C*
136	60
146	66
158	72
168	77
178	84
191	91
194	93
204	98
208	100
218	104
227	109
239	117
244	121
257	128
283	141
300	152
333	167
358	184
377	192
415	216
438	228
468	240

*Tolerance ±0 −4°C

For further information on your specific design application, contact a Therm-O-Disc sales engineer at 419-525-8500.

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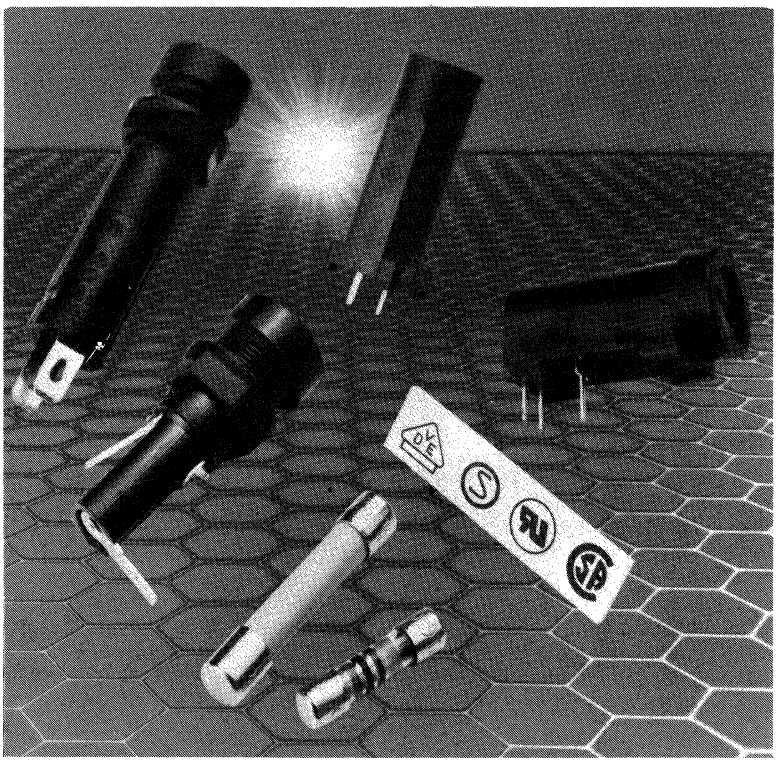
MINIATURE FUSES & FUSE HOLDERS



THE COMPANY

For over 70 years the name Wickmann has stood for the protection of electrical equipment and systems from excess voltage and excess current.

Founded in 1918, the enterprise quickly developed to become a leading manufacturer in the field of fusing technology. In 1930, Wickmann introduced the 5 x 20mm fuse-link marking the beginning of a new era in the manufacture of replaceable fuses.

Further technological advances were made with the addition of Microfuses and Picofuses in 1964, followed by development of the popular TR5 in 1978. Introduction of the surface mount SM3 series in 1988 marks another recent milestone in the company history.

Wickmann USA, Inc. is the North American subsidiary of Wickmann-Werke GmbH devoted to providing local technical and application assistance in the specification of Wickmann components. A comprehensive inventory of circuit protection components is also maintained to meet immediate industry requirements.

STANDARD MINIATURE FUSES

- International 5 x 20mm fuses
- Fast Acting (–F) and Time Lag (–T) characteristics
- High break (ceramic) and Low break (glass) capacity
- VDE, SEMKO, BSI approved
- 5 x 20mm (–F & –T) fuses with UL and CSA
- 5 x 25mm ceramic cartridge fuses with blown fuse indicators

SPECIAL MINIATURE FUSES

- 5 x 30mm glass cartridge fuses rated 500 Volts (50mA - 6.3A)
- 1/4" x 1 1/4" cartridge fuses rated 500 Volts (1.6A-16 Amps)

FUSE HOLDERS

- International Shock-safe fuseholders to accept either 1/4" x 1 1/4" or 5 x20mm fuses
- Panel mount with either high or low profile
- PC board types mounting vertically or horizontally
- Molded construction with sealed contacts
- Full agency approvals

A Mark of Safety

For complete catalog information, engineering support or sample requests, please call or write:

Wickmann USA, Inc.
A subsidiary of Wickmann-Werke GmbH, Germany

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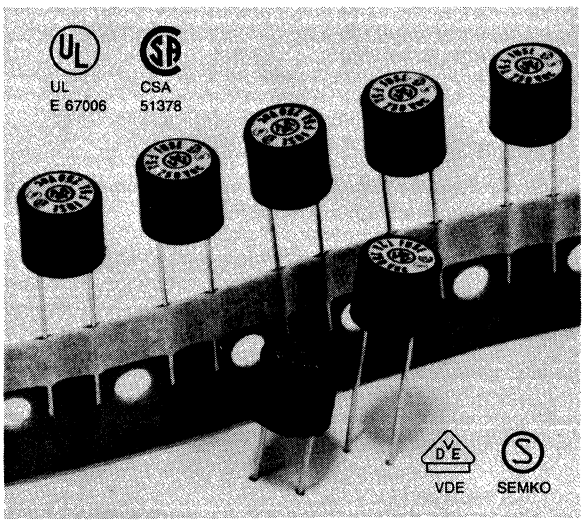
Telephone: (404) 699-7820 • Fax: (404) 691-2843

Wickmann

SUBMINIATURE FUSES

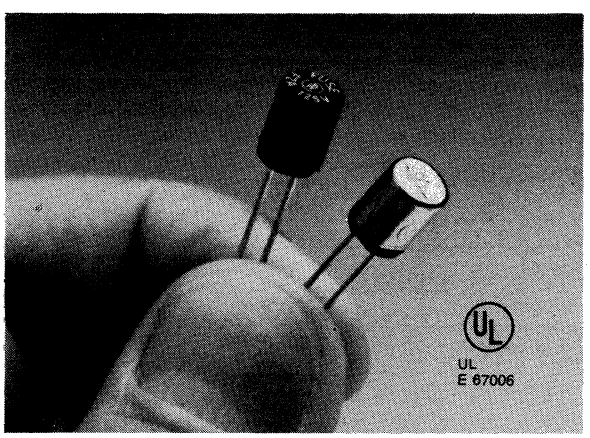
TR5 FUSE - 250 VOLT



- **Rated Voltage:** 250 Volts
- **Rated Current Range:** 50mA - 6.3 Amps
- **Characteristic:** Available either Fast Acting or Time Lag
- **Breaking Capacity:** 50 Amps at 250 VAC
- **Diameter:** 0.335″ (8.5mm); **Height:** 0.315″ (8.0mm) max.
- **Board solderable or Plug-in leads:** 0.2″ (5.08mm) pin spacing
- **Board washable, shock and vibration resistant**
- **Packaging:** Bulk (long or short pins) and Tape & Reel
- **Approvals:** UL Listed/CSA Certified or VDE/SEMKO approved

Catalog #	Description	Range	Approvals
19373	TR5-F (Fast Acting)	50mA-6.3A	UL/CSA
19374	TR5-T (Time Lag)	50mA-6.3A	UL/CSA
19370	TR5-F (Fast Acting)	50mA-4.0A	VDE/SEMKO
19371	TR5-M (Medium Time Lag)	200mA-4A	–
19372	TR5-T (Time Lag)	40mA-4.0A	VDE/SEMKO

TR3 FUSE - 125 VOLT

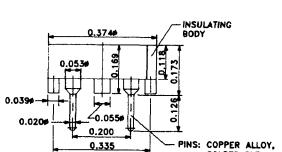


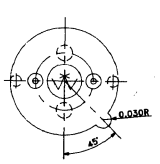
- **Rated Voltage:** 125 Volts
- **Rated Current Range:** 50mA - 5.0 Amps, Fast Acting
- **Breaking Capacity:** 50 Amps at 125 VAC
- **Diameter:** 0.236″ (6.0mm); **Height:** 0.315″ (8.0mm) max.
- **Board solderable or Plug-in leads:** 0.1″ (2.54mm) pin spacing
- **Board washable, shock and vibration resistant**
- **Metal or Thermoplastic cap**
- **Packaging:** Bulk (long or short pins) and Tape & Reel
- **Approvals:** UL Listed/CSA Certified (Metal cap only)

Catalog #	Description	Range	Approvals
19303	TR3-F (Fast Acting)	50mA-5.0A	UL/CSA (metal cap)
19300	TR3-F (Fast Acting)	50mA-5.0A	– (plastic cap)

PC BOARD SUBMINIATURE FUSEHOLDERS

HOLDERS FOR TR5 FUSE

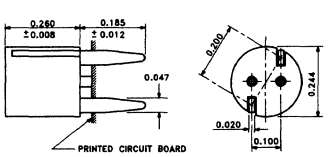




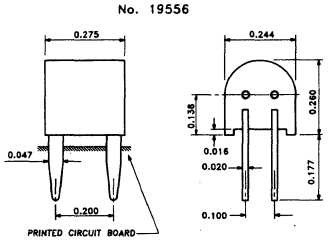
No. 19560

- Rated up to: 250V, 6.3A, 1.6W
- UL94-V0
- Also available in Panel Mount Shock-Safe design

HOLDERS FOR TR3 FUSE



No. 19556



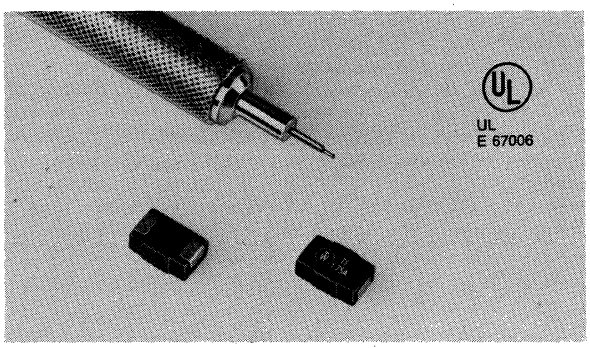
No. 19557

- Rated up to: 125V, 5A
- UL94-V0
- Vertical (No. 19556) or Horizontal (No. 19557) mounting

Wickmann

SUBMINIATURE FUSES

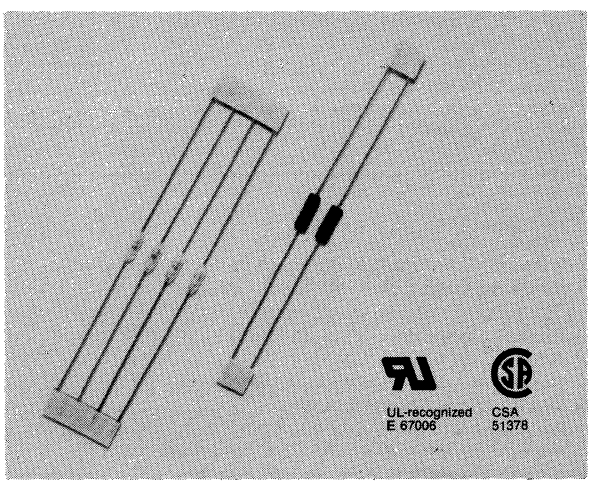
SM-3 SURFACE MOUNT FUSE



- **Rated Voltage:** 125 Volts
- **Rated Current Range:** 500mA - 4.0 Amps, Fast Acting
- **Suitable for all Surface Mount soldering processes**
- **Breaking Capacity:** 50 Amps at 125 VAC
- **Packaging:** Bulk and Blister Tape
- **Approvals:** UL Listed - File No. E67006

Catalog #	Description	Range
19413	SM3-F (Fast Acting)	500mA-4A

PICOFUSE / NANOFUSE

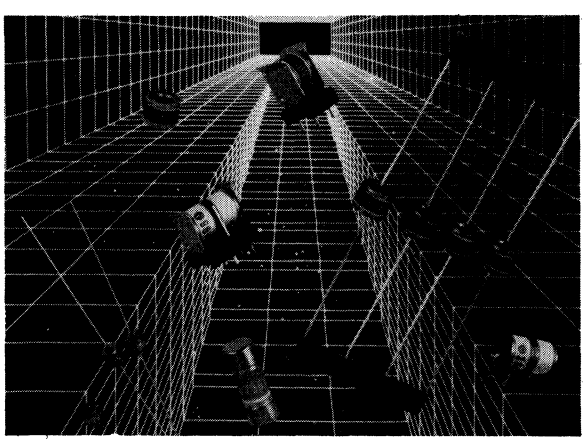


- **Rated Voltage:** 125 Volts
- **Rated Current Range:** 63mA - 10 Amps, Fast Acting (Also 15 Amps at 32 Volts)
- **Material:** Picofuse – Ceramic tube with clear shrink tube cover
  Nanofuse – Ceramic tube with black Thermoplastic molding
- **Board washable, shock and vibration resistant**
- **Packaging:** Taped
- **Approvals:**

	Picofuse	Nanofuse
UL Recognized:	63mA..10A	63mA..7A
CSA Certified:	63mA..5A	63mA..7A

Catalog #	Description	Range
19275	Picofuse	63mA-15A
19274	Nanofuse	63mA-7A

MINIATURE GAS TUBE SURGE ARRESTERS



- Metal Ceramic technology for effective protection against transient overvoltages
- Available in 2 or 3 electrode configurations with nominal DC Sparkover voltages of 90, 230 and 350 Volts
- Nominal AC Discharge Current capacity up to 20 Amps
- Light, Medium or Heavy Duty construction
- Correspond to CCITT K. 12, and VDE 0845 standards
- Button Arresters exhibit self-capacitance below 1pF
- Also available with Tritium doping of fill gas if required
- Please call for a complete catalog of Surge Arrester Specifications and Part Numbers

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MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

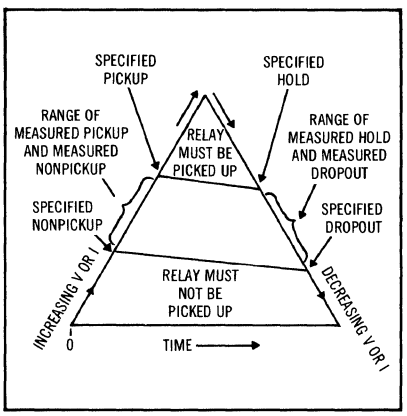
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.



Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

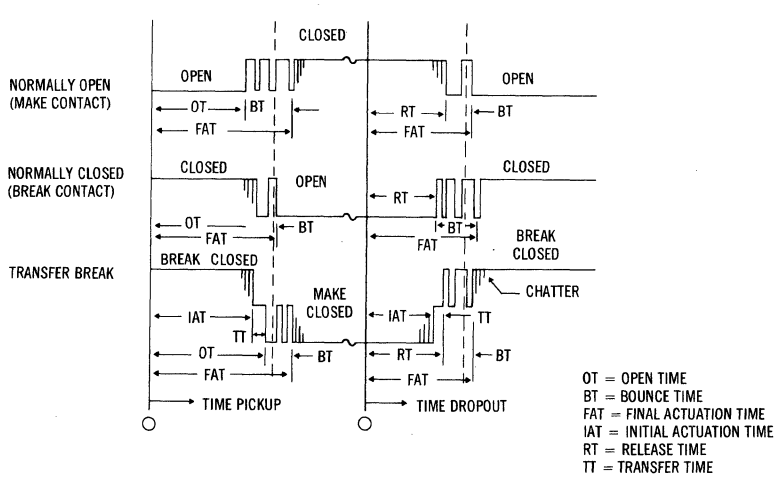


Fig. 2. Typical time vs. current (non-inductive load)

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

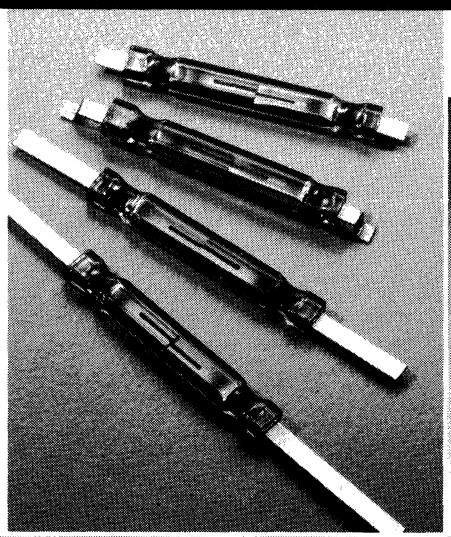
Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

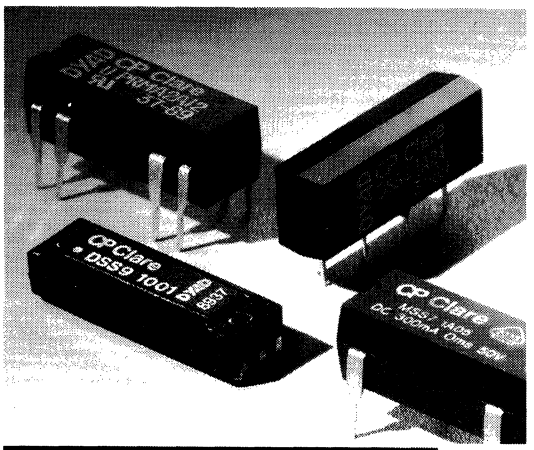
Chatter: See bounce.

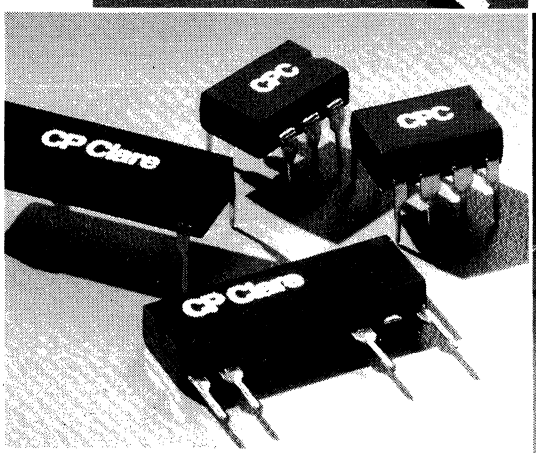
Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

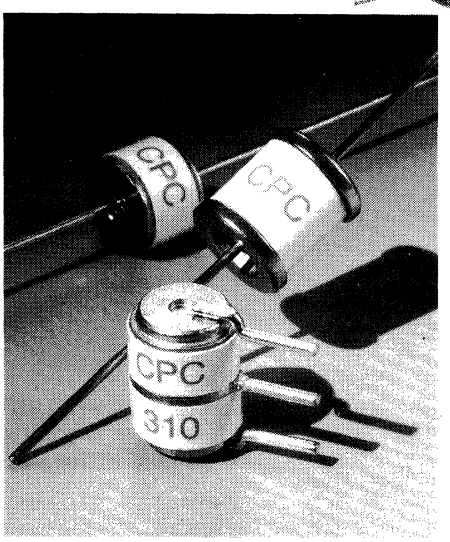
Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.









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A Commitment to Quality

At Clare, quality is integral to our approach of maximizing total value for our customers. We have earned the position of being the world's largest supplier of relays, reed switches and surge arrestor products. The Clare Relay Family covers the spectrum of relay technologies for low-power switching: solid-state relays; dry reed relays; mercury-wetted reed relays; and electro-mechanical relays.

Couple this with high-volume manufacturing capabilities, and you get superior quality products at competitive prices with fast off-the-shelf delivery and full product support.

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RELAYS

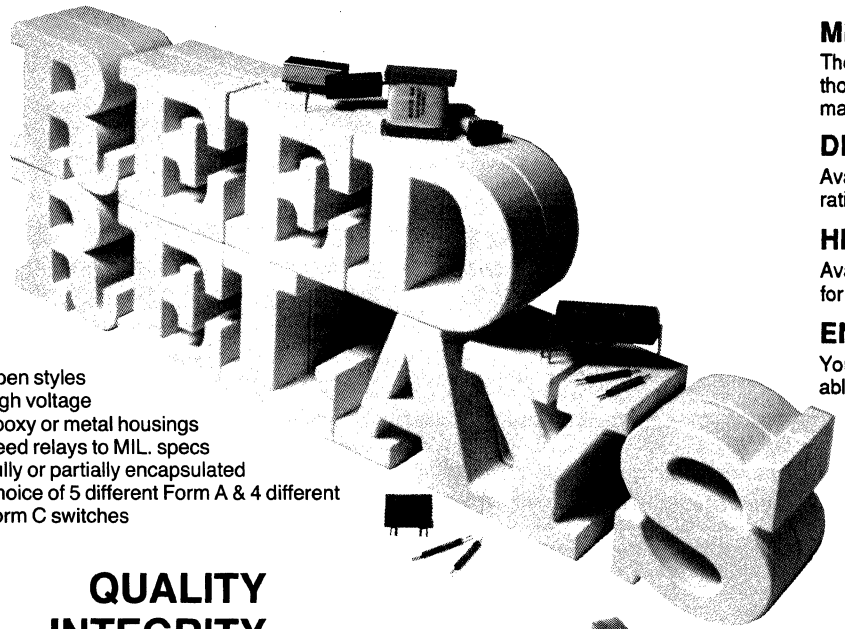
Manufacturer	Starting EEM Page No.	Reed		Solid State	Hybrid	Thermal	Time Delay	I/O Mdl.	General Purpose	Latching	Current Sensing	Sensitive	High Power	High Voltage	RF	Plug-in	PC Mount	DIP/SIP	Low Profile	Approvals/ Ratings
		Mercury Wetted Contacts	Dry Contacts																	
Alllied Control	B•1400			√			√		√	√	√	√				√	√		√	
American Relays Inc.	B•1404	√	√						√	√	√	√	√	√			√	√	√	
American Zettler Inc.	B•1410								√	√	√			√			√		√	UL, CSA, VDE
Amperite	B•1414			√§	√§	√§	√§*				√§*					√§*	√§			UL, CSA
Aromat Corp.	B•1415		√	√§			√		√	√	√	√	√	√		√	√	√	√	UL, CSA,
Robert Bosch Inc.	B•1429								√							√	√			
C.P. Clare Corp.	B•1430	√§	√§	√§	√					√	√	√			√§		√§	√§	√§	
Communications Instruments Inc.	B•1432									√§*		√§*		√§*	√§*	√§*	√§*	√§*	√§*	MIL 5757, 39016, 6106
Cornell Dubilier	B•1439								√	√	√		√			√	√			UL, CSA
Coto Wabash	B•1441	√	√§			√			√			√	√	√	√			√	√	
Crouzet Controls Corp.	B•1446			√			√		√	√	√		√	√		√	√			UL, CSA
Crydom Co.	B•1450			√			√	√					√	√			√	√	√	
Deltrol Controls	B•1456								√				√			√				
Douglas Randall	B•1458	√	√	√			√						√	√		√	√			
EI & S Corp.	B•1462	√	√	√						√	√	√					√	√	√	
Eichhoff Electronics	B•1464								√	√		√	√				√		√	UL, CSA, VDE
Electronic Specialty Corp.	B•1467				√		√		√*	√*	√	√	√		√	√	√			M39016/45, MS27401
Fifth Dimension Inc.	B•1468	√								√					√		√	√		
Fujitsu Microelectronics	B•1470	√§							√§	√§							√§		√§	
Genicom	B•1482								√§*	√§*	√§*	√§*			√§*	√§*	√§*	√§*	√§*	MIL-R-39016
Gordos Corp.	B•1486		√§	√				√					√	√			√	√	√	UL, CSA, VDE
Grayhill Inc.	B•1489			√				√									√			UL, CSA
Gruner (Advanced Comps.)	B•1492						√		√	√			√			√	√			
Hamlin Inc.	B•1493	√§*	√§*							√				√	√		√	√	√	UL, CSA
Hasco Components Inc.	B•1494	√§	√§							√§		√§	√	√			√§	√	√§	
Hold-Heet Products	B•1501					√	√		√		√						√			
IDEC Corp.	B•1502		√§	√§			√		√	√	√		√	√		√	√			
Instrumentation & Control Systems	B•1504			√	√		√									√	√			
International Rectifier	B•1507			√	√				√								√	√	√	

§ Surface Mount * Mil. Spec.

RELAYS (continued)

Manufacturer	Starting EEM Page No.	Reed: Mercury Wetted Contacts	Reed: Dry Contacts	Solid State	Hybrid	Thermal	Time Delay	I/O Mdl.	General Purpose	Latching	Current Sensing	Sensitive	High Power	High Voltage	RF	Plug-in	PC Mount	DIP/SIP	Low Profile	Approvals/ Ratings
ITT Components	B•1508			√					√	√§		√§	√		√	√	√	√	√§	UL, CSA, VDE
Jennings	B•1516									√§	√§*		√§		√§*		√§*			
Kilovac Corp.	B•1520												√*	√*	√*					
Leach Corp.	B•1527			√*	√		√*		√*	√*	√*		√			√*	√*			
Line Electric Products	B•1537						√		√	√		√	√			√	√		√	
Logitek, Inc.	B•1538				√		√					√	√							
Master Elec. Controls	B•1541		√	√			√	√	√	√			√	√		√	√	√	√	
Matrix Systems	B•1545	√	√	√						√					√					
Midtex Relays, Inc.	B•1546		√	√			√		√	√	√	√				√	√	√		UL, CSA
MSD	B•1551	√	√		√		√		√	√	√	√	√			√	√	√		UL, CSA
NEC Electronics	B•1558	√§	√§	√§			√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	UL, CSA
Potter & Brumfield	B•1565	√	√	√§			√	√§	√	√	√	√	√	√		√	√§	√§	√	UL, CSA, VDE, TUV
Ross Engineering Corp.	B•1567									√*			√*	√*						
Schrack North America, Inc.	B•1570								√*			√	√			√				
Scientific Technologies	B•1578				√*	√*	√*			√*										
Sharp Electronics	B•1581			√	√						√			√				√		
Silicon Power Cube Corp.	B•1582			√				√					√	√			√	√	√	
Stancor/White-Rodgers	B•1584								√							√	√			
Struthers-Dunn/Hi-G	B•1588	√*	√*	√*	√*		√*		√*	√*	√*	√*			√*	√*	√*	√*	√*	MIL-Spec
Teledyne Relays	B•1604			√*	√*			√*	√§*	√*	√*				√§		√*	√*		
Triridge	B•1613		√						√		√	√				√	√	√		UL, CSA

§ Surface Mount * Mil. Spec.



- Open styles
- High voltage
- Epoxy or metal housings
- Reed relays to MIL. specs
- Fully or partially encapsulated
- Choice of 5 different Form A & 4 different Form C switches

MERCURY WETTED RELAYS

The largest selection available including all those discontinued by their former manufacturers.

DRY REED RELAYS

Available in all traditional styles and ratings.

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Available in form A, B, or C contact sets for frequencies up to 50 MHZ.

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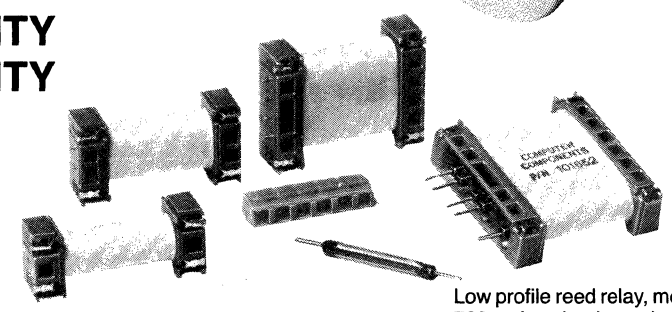
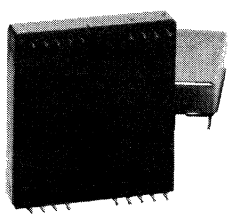


HP (Also 101, 201, 301, & 401 Series)

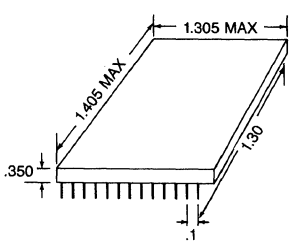
Low profile reed relay, mechanical & electrical replacement for IBM 766 series plug-in, replace reeds, no tools – no soldering

THE MULTI-POLE FLATPACK

The highest density reed relay available – Up to 10 form A or 8 form C or combinations of forms A, B & C



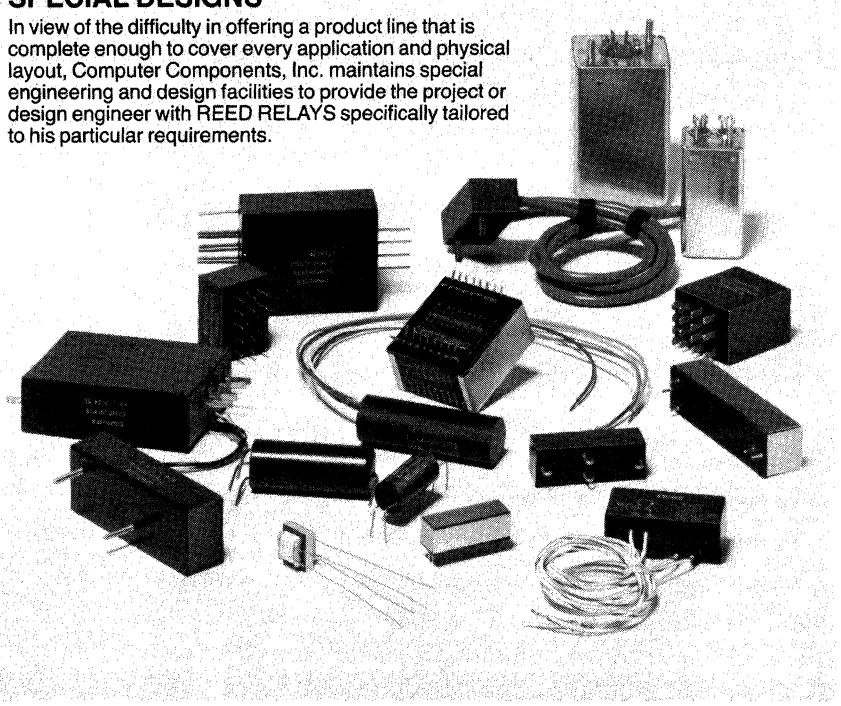
Better Built in the U.S.A.



Why compromise your design using several relays when one compact multi-pole relay can save valuable P.C. board space as well as cost.

SPECIAL DESIGNS

In view of the difficulty in offering a product line that is complete enough to cover every application and physical layout, Computer Components, Inc. maintains special engineering and design facilities to provide the project or design engineer with REED RELAYS specifically tailored to his particular requirements.



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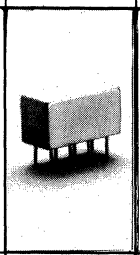
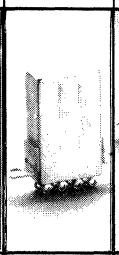
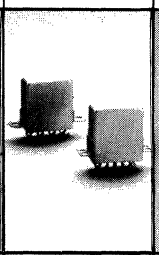
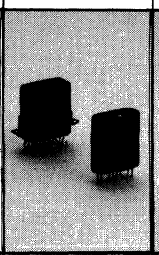
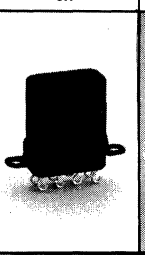
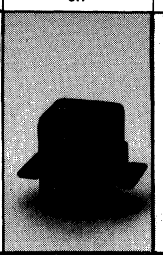
Manufacturer & Distributor
of Relays & Electronic Components
Engineering & Application Services
Assembly Subcontract Services
(Domestic and Offshore)

Allied Control® Relays

MILITARY RELAYS

	RELAY TYPE	1/2 Size Crystal ERS & S	Long Coil Sensitive Crystal WJS	Full Size Crystal WKJ WKY	Full Size Crystal KHJ KHY	Miniature Round Sensitive RSH	Full Size Crystal 2 Pole JH	Full Size Crystal 4 Pole JH	Miniature Round 2 Pole MH-6 MHB-6
									
Contacts	Arrangement	2PDT	1PDT 2PDT	2PDT	2PDT	1PDT 2PDT	2PDT	4PDT	2PDT
	Amps DC	2	3	3	2	2	5	2	5
	Volts DC	28	29	29	29	29	29	29	29
	Amps AC	0.3 or 0.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	Volts AC	115	115	115	115	115	115	115	115
Coil	DC Nominal Volts	6, 12, 26.5 or 48V	—	6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115V	—	6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115
	AC Nominal Volts	—	—	—	—	—	—	—	— 115V
	Operate Sensitivity Milliwatts DC	240	25 40	260	260	22 40	260	480	525 520
Mounting	Plain—No Mtg. Bkts.	X	X	X	X	X	X	X	X
	Flange Mtg.	X	X	X	X	X	X	X	X
	Stud Mtg.	X	X	X	X	—	X	—	X
	Side Bkts.	X	X	X	X	—	X	—	—
Terminals	Printed Ckt.	X	X	X	X	—	X	X	—
	Solder	X	X	X	X	X	X	X	X
	Plug-In	X	X	X	X	X	X	X	X
	Wire Leads	X	X	X	X	—	X	—	—
	Dielectric All Points VRMS	1000	1000	1000	1000	1000	1000	1000	1000
	Across Open Gap VRMS	500	500	500	500	500	500	500	1000
	Coil to Frame	500	500	500	500	500	500	500	1000
	Vibration g's	S ERS 20 30	15	20	20	10	20	20	15
	Hz	2000 3000	2000	2000	2000	500	2000	2000	1000
	Shock g's	50	50	100	100	50	50	50	50
Enclosure	Sealed by Welding	X	X	X	—	—	—	—	—
	Sealed by Solder	—	—	—	X	X	X	X	X
	Metal Dust Cover	—	—	—	—	—	—	—	—
	Plastic Dust Cover	—	—	—	—	—	—	—	—
	Open Frame	—	—	—	—	—	—	—	—
	Temperature Range °C	-65 + 125	-65 + 125	-65 + 125	-65 + 125	-65 + 125	-65 + 125	-65 + 125	-55 + 85 -65 + 125
Dimensions	Length Inches	0.8	0.8	0.8	0.8	1.223	0.8	1.360	1.062
	Width Inches	0.4	0.4	0.4	0.4	0.343	0.4	0.8	0.712
	Height Inches	0.410	1.281	0.875	0.890	1.843	0.890	0.890	1./96
	MIL-Spec.	Mil-R-39016/6	Mil-R-5757/13	Mil-R-5757	Mil-R-5757	Mil-R-5757	Mil-R-5757	Mil-R-5757	Mil-R-5757

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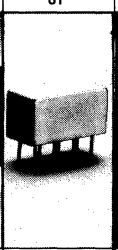
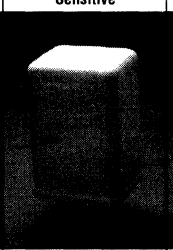
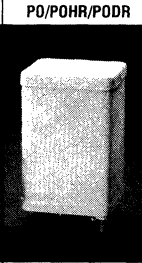
MILITARY & GENERAL PURPOSE RELAYS

		Miniature Round 4 Pole MH-12 MHB-12 MHJ-12	Miniature Round 6 Pole MH-18 MHB-18 MHJ-18	Miniature Round 4 Pole, 10 Amp MHY	Military Type– Comm. Version For Industrial Use 1/2 Size Crystal ST	Miniature Power BOT/BOHR/BODR	Miniature Power BOT/BOHR/BODR Sensitive	Miniature Power PO/POHR/PODR	Sensitive As Low As .003 Watts SWS SWN SWP
									
Contacts	Arrangement	4PDT	6PDT	4PDT	2PDT	1PDT 2PDT	2PDT	2PDT 3PDT/4PDT	1PDT 1PDT/2PDT 1PDT/2PDT
	Amps DC	5	5	10	2	15	10	15	1 2.5 5.0
	Volts DC	29	29	29	28	28	26.5	29	24 24 24
	Amps AC	0.3	0.3	0.5	0.3	15	10	15	1 2.5 5.0
	Volts AC	115	115	115	115	115	110	115	115 115 115
Coil	DC Nominal Volts	6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115V	26.5V	6, 12, 24, 48 or 115V	5.5, 13, 24, 62, 87 or 115V	6, 12, 26.5, 48 or 115V	— — —
	AC Nominal Volts	— — 115V	— — 115V	115V	—	6, 12, 24, 48, 115 or 230V	—	6, 12, 24, 48, 115 or 230V	— — —
	Operate Sensitivity Milliwatts DC	700 675 675	875 845 845	875V	240	4.2VA AC 1.4W DC	360mW	4.2VA AC 1.4W DC	3mW 12mW 50mW
Mounting	Plain—No Mtg. Bkts.	X	X	X	X	—	—	—	—
	Flange Mtg.	X	X	X	—	X	X	X	X
	Stud Mtg.	X	X	X	—	X	X	X	X
	Side Bkts.	—	—	X	—	—	—	—	—
Terminals	Printed Ckt.	—	—	—	X	—	—	—	—
	Solder	X	X	X	—	X	X	X	X
	Plug-In	X	X	X	—	X	X	X	X
	Wire Leads	—	—	—	—	—	—	—	—
	Dielectric All Points VRMS	1000	1000	1000	1000	1250	1250	1250	1000
	Across Open Gap VRMS	1000	1000	1000	500	1250	1250	1250	500
	Coil to Frame	1000	1000	1000	500	1250	1250	1250	500
	Vibration g's	15 15 20	15 15 20	20	20	10	10	10	N/R 10
	Hz	1000 1000 2000	1000 1000 2000	500	2000	55	55	55	N/R 55
	Shock g's	50	50	50	50	25	25	25	N/R 25
Enclosure	Sealed by Welding	—	—	—	X	—	—	—	—
	Sealed by Solder	X	X	X	—	X	X	X	X
	Metal Dust Cover	—	—	—	—	X	X	X	X
	Plastic Dust Cover	—	—	—	—	—	—	—	—
	Open Frame	—	—	—	—	X	X	X	X
	Temperature Range °C	-55+85 -65+125 -65+125	-55+85 -65+125 -65+125	-65+125 -55+85 DC AC	-55 + 125	0 + 71	0 + 71	0 + 71	0 + 71
Dimensions						Open Frame Enclosed	Open Frame Enclosed	2, 3 & 4 Pole Open Frame 2, 3 & 4 Pole Enclosed	
	Length Inches	1.656	1.812	1.812	0.8	1.62 1.796	1.843 1.796	1.906 1.906 1.906 2.281	1.625
	Width Inches	1.125	1.312	1.265	0.4	1.5 1.672	1.5 1.672	1.718 1.906 2.281 2.156	1.141
	Height Inches	1.75	1.75	1.953	0.410	1.937 2.687	1.937 2.687	2.81 3.218 2.281 3.515	1.406
	MIL-Spec.	Mil-R-5757	Mil-R-5757	Mil-R-5757					

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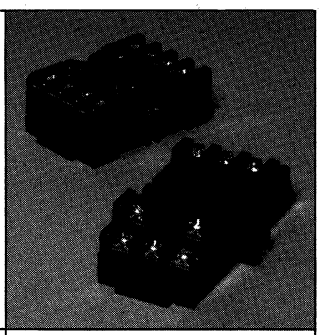
INDUSTRIAL RELAY SOCKETS

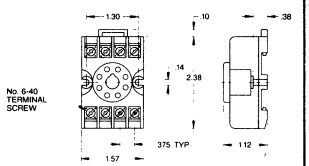
SNAP TRACK MOUNTED

RUNDEL

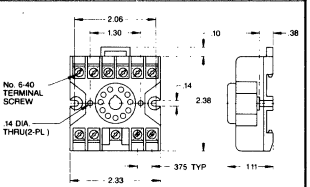


Construction	Self-extinguishing, black polycarbonate body with integral molded barrier.
Terminals	Combination slot/phillips head screws and captive self lifting terminal clamps.

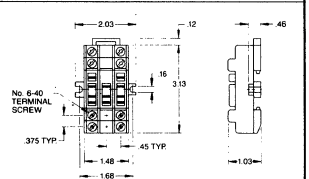
H50SL608S
8-pin octal socket. Rating: U/L and CSA, 10 amperes, 300VAC. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw.



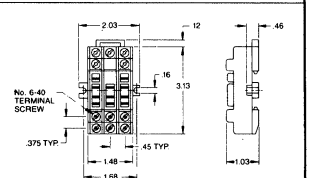
H50SL611S
11-pin magnol socket. Rating: U/L and CSA, 10 amperes, 300VAC. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw.



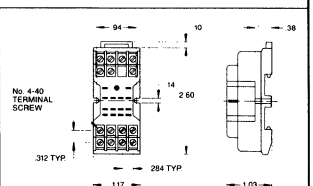
H50SL708S
8-pin blade type socket. Rating: U/L, 15 amperes, 300VAC; CSA, 10 amperes, 300VAC. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw. Cascading mounting center 1.74 ± .010.



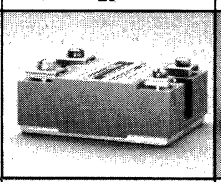
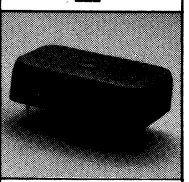
H50SL711S
11-pin blade type socket. Rating: U/L, 15 amperes, 300VAC; CSA, 10 amperes. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw. Cascading mounting center 1.74 ± .010.

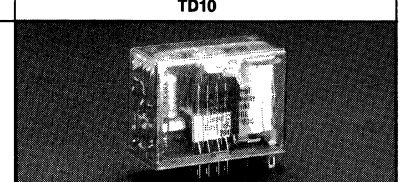


H50SL715S
14-pin blade type socket. Rating: U/L and CSA, 5 amperes, 300VAC. Wire sizes: up to #14 AWG. Terminals: pan head 4-40 slot.



Mounting Track	Standard Track SL601 and SL602 will accept either regular and snap track sockets.
U/L CSA	E48784 LR28098

	RELAY TYPE	**E3**	**E22**
	SOLID STATE RELAYS		
Output	Arrangement	1PST NO 1PST NC	1PST NO
	Amps AC	10, 25 or 40	4
	Volts AC	280	240
	Amps DC		
	Volts DC		
Input	DC Nominal Volts	3-32VDC	5, 12, 24 or 32
	AC Nominal Volts	20-28VAC 100-135VAC	—
Mtg	Panel	X	—
	Printed Ckt.	—	X
	Isolation	2500V	2500V
	Vibration g's	20	20
	Hz	2000	2000
	Shock g's	50	50
	Temperature Range °C	−30 +80	−30 +80
	Length Inches	2.250	1.6
	Width Inches	1.75	1.0
	Height Inches	1.0	.05
	Photo Isolation	X	X
	Zero Crossing	X	X
	U/L	E57093	
	CSA	LR34171	

	TIMER TYPE	**TD10**	
	SOLID STATE TIMER		
	Arrangement	2PDT	4PDT
	Amps	2 or 5	
	Volts	28VDC	115VAC
	Nominal Coil Voltage DC	12, 24 or 48	
	Nominal Coil Voltage AC	24, 115	
	Timer Delay — Operate Delay	0.1 to 300 sec.	
	Timing Adj.	Fixed or Adjustable (Internal or External)	
	Mounting	Printed Circuit Board Mounting Socket Mounting Chassis Mounting	
	Housing	Plastic Dust Cover	
	Vibration g's	10	
	Hz	55	
	Shock g's	25	
	Temperature	0°C to 55°C	
	Dimensions — Length	1.391	1.594
	Width	0.735	0.735
	Height DC	1.187	1.187
	Height AC	1.968	1.968

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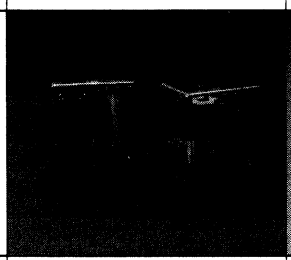
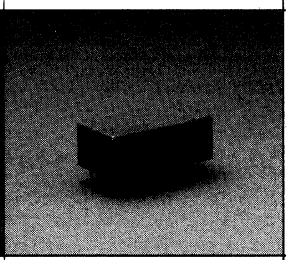
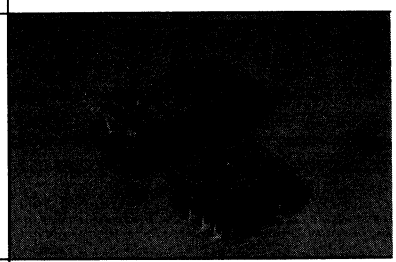
(203) 757-4200
FAX (203) 757-4204
562 Captain Neville Drive • Waterbury, CT 06705

Allied Control® Relays

CRADLE & LOW PROFILE RELAYS

	RELAY TYPE	Miniature General Purpose Cradle Relay T154/T163/T351/T362 Incl. Mag Latch				Flat Pack MPC/MPCL Incl. Mag Latch	
							
Contacts	Arrangement	1PDT up to 8PDT				2PDT	4PDT
	Amps DC	1, 2, 5 or 10				1 or 2	
	Volts DC	29				28	
	Amps AC	1, 2, 5 or 10				0.5 or 1	
	Volts AC	115				120	
Coil	DC Nominal Volts	3 to 115				5, 6, 12, 20, 24 or 48	
	AC Nominal Volts	6 to 220				—	
	Operate Sensitivity Milliwatts	20 to 1000				160 to 550	
Mounting	Plain — No Mtg. Bkts.	X				X	
	Flange Mtg.	—				—	
	Stud Mtg.	X				—	
	Side Bkts.	—				—	
Terminals	Printed Ckt.	X				X	
	Solder	X				—	
	Plug-In	X				—	
	Wire Leads	—				—	
	Dielectric All Points VRMS	1000				1000	
	Across Open Gap VRMS	500				500 (350 btwn. ckts.)	
	Coil to Frame	500				500	
	Vibration g's	10				10	
	Hz	55				55	
	Shock g's	25				30	
Enclosure	Sealed by Welding	—				—	
	Sealed by Solder	X				—	
	Metal Dust Cover	X				—	
	Plastic Dust Cover	X				X	
	Open Frame	X				—	
	Temperature Range °C	−55 +71				−55 +80	
Dimensions		2-P	4-P	6-P	8-P	2-P	4-P/2-P Mag Latch
		Plastic Dust Cover					
	Length Inches	.937	1.172	1.391	1.594	1.10	1.10
	Width Inches	.735	.735	.735	.735	0.6	0.780
	Height Inches	1.187	1.187	1.187	1.187	0.425	0.425
	Mil-Spec.						
	U/L	E20604				E20604	
	CSA	LR34171				LR34171	

Cradle Socket and Accessories



Construction

Body molded of glass filled flame retardant polyester (PBT). Meets UL94VO and is fungus resistant.
One piece contact/terminal construction of berylium copper.
Selectively plated gold over nickel on contact area. 60/40 Brite-Tin on terminal area.

Arrangement

Number of Poles
2 = 2-pole socket
4 = 4-pole socket
6 = 6-pole socket
8 = 8-pole socket

Terminal/Mounting

Type of Terminal
1 = Solder lug/chassis mounted
3 = Standard PC in-line mounting
5 = PC mounting .100″ x .100″ grid throughout
7 = PC mounting .100″ x .100″ grid in contact
.100″ x .150″ grid in coil

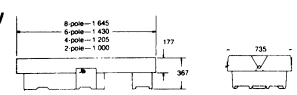
Accessories

Socket Assemblies
10 = Socket only
11 = Socket with ground spring installed
12 = Socket with ground spring installed and retainer
13 = Socket with retainer

Part Name	Part No.	Diagram	Retainer-Part No.	Diagram
Ground Spring for Solder Lug/Chassis	T-00101		T-00102 2-pole T-00104 4-pole T-00106 6-pole	 to be inserted into recesses on narrow sides of sockets
Ground Spring for all P.C. mounted sockets	T-00105		T-00108 8-pole Flat Retainer	

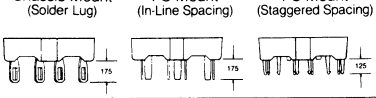
Dimensions

Body



Terminals

Chassis Mount (Solder Lug) | PC Mount (In-Line Spacing) | PC Mount (Staggered Spacing)



U/L	E20604
CSA	LR34171

Allied Controls Incorporated
562 Captain Neville Drive • Waterbury, CT 06705
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REED RELAYS

From American Relays, Inc.

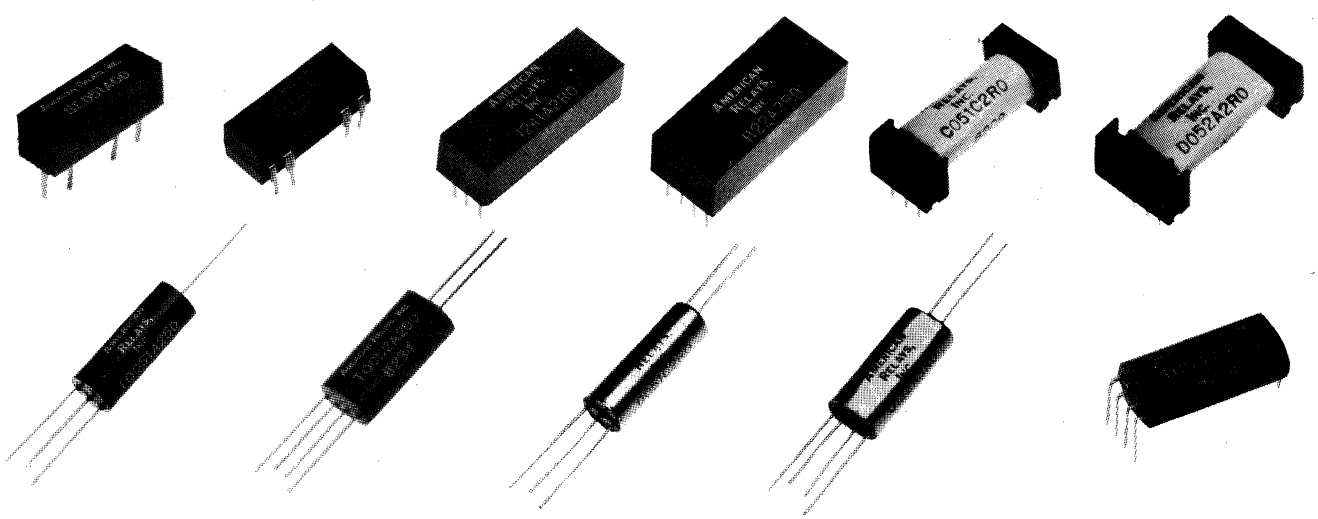
Whether you're looking for a **REED RELAY** that will meet FCC surge requirements, or a sensitive Low-Level **REED RELAY** to switch ATE signal...

AMERICAN RELAYS HAS IT ALL

High Quality — Low Price — On time Delivery

Dry and Mercury Wet contacts
With High Voltage, High Power or Low Level switching

Standard or Specified to YOUR Application,
AMERICAN RELAYS can Build the **REED RELAY** you need.



American Relays, Inc., offers a comprehensive line of super-reliable reed relays. American Relays, Inc., 100% tests all reed switches **AND** 100% final tests all reed relays. We are specialists in **"THE REED RELAY INDUSTRY".**

PACKAGE STYLES

- **Encapsulated**
- **Open Frame**
- **Axial Leeds**
- **DIP**
- **SIP**

SWITCHING TYPE

- **General Purpose Dry Reed**
- **Low Level Switching**
- **High Power**
- **High Voltage**
- **Mercury Wetted Contacts**

- **UL Recognized Relays Available**

10306 Norwalk Blvd., Santa Fe Springs, CA 90670
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American Relays, Inc.

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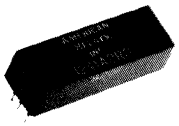
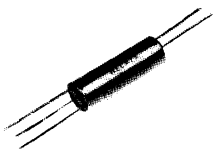
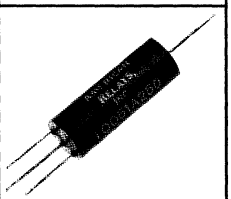
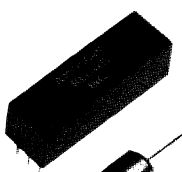
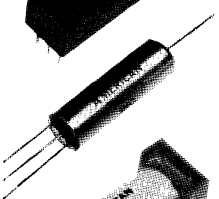
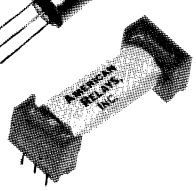
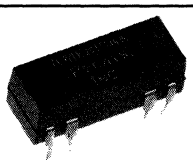
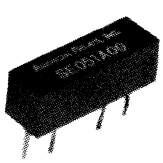
REED RELAY INDEX

RELAY TYPE	DESCRIPTION	TERMINAL GRID	CONTACT FORMS AVAILABLE POLES	PACKAGE
ENCAPSULATED	Epoxy encapsulated. Total Environmental protection. Wide range of contact forms and coil voltages are available.	1.000 × .100 1.000 × .150	Form A (1 to 6) Form B (1 & 2) Form A/B (1 & 2) Form C (1 to 4) Form A Latching (1 & 2)	
OPEN FRAME	Durable glass filled polyester bobbin construction. Switch and coil leads are securely held with epoxy potting. Cost efficient plug-in type reed relay.	1.000 × .100 1.000 × .150	Form A (1 to 4) Form B (1 & 2) Form C (1, 2, 3) Form A Latching (1)	
AXIAL	Rugged axial lead tubular relay. Nickel plated metal jacket provides magnetic shield. 1.000″ center formed leads are available.	Axial 1.000 × .100	Form A (1 & 2) Form B (1) Form C (1 & 2) Form A Latching (1)	
T SERIES	Most economical, high performance tubular relay. Completely sealed in a flame retardant plastic tube. 1.000″ center formed leads are available.	Axial 1.000 × .100	Form A (1 & 2) Form B (1) Form C (1)	
HIGH POWER	50W contact rating. Available with encapsulated, open frame and axial lead packages.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2)	
HIGH VOLTAGE	25W, 1000 VDC switching. 2500 VDC breakdown voltage. Miniature size. Available with encapsulated, open frame and axial lead package.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2)	
MERCURY WETTED	Mercury wetted contact relay. 50W contact rating. Extremely long life expectancy. No contact bounce. Stable low contact resistance.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2) Form C (1 & 2)	
DIP RELAYS	Epoxy molded DIP reed relay. Logic compatible. Stable contact resistance. Fits all standard DIP sockets and is automatic insertion compatible.	DIP .300 × .100	Form A (1 & 2) Form B (1) Form C (1)	
SIP RELAYS	High quality economical Single-In-Line package reed relays. Epoxy encapsulated package. Various contact ratings are available. UL recognized series available.	SIP .2 × .4 × .2 .2 × .2 × .2	Form A (1) Form B (1) Form C (1)	
SPECIAL RELAYS	Let us design reed relays for your specific application. Special relays are cost competitive with standard relays in most cases. Consult the factory or your local representative with your specific requirements.			

American Relays, Inc.

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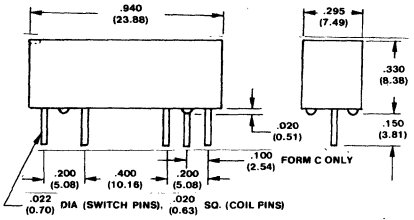
REED RELAYS

SINGLE-IN-LINE SERIES (S SERIES)



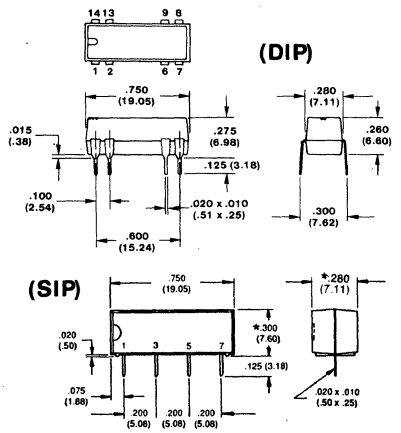
- High Quality Low Cost Single-In-Line
- Sturdy Bobbin and Encapsulated in a Polyester Case
- UL Recognized (File #E104383)

GENERAL SPECIFICATIONS

Contact resistance: .150 ohms max.
Operate time: 0.5 ms typ.
Release time: 0.2 ms typ.
Bounce time: (Form A & B) 0.25 ms typ. (form C, NO/NC) 0.5/1.5 ms typ.
Insulation resistance: 10^{10} ohms min. (form A), 10^{9} ohms min. (form C)
Operating temperature: −40° to +85°C
Vibration: 20G (10 — 2000 Hz)
Shock: 50G @ 11 ms duration

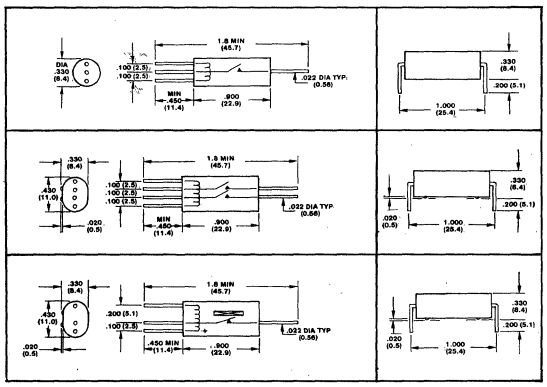
Contact Form	Part Number	Coil VDC	Coil Res. (Ohms)	Must Operate VDC	Must Release VDC	Contact Ratings	Break Down Voltage	Schematic
1A Standard ®ᵁᴸ	SE051A00	5-6	500	3.8	0.5	10 Watts	250	
	SE061A00	5-6	125	3.8	0.5	200 VDC		
	SE121A00	12	500	8.0	1.0	0.5 Amps		
	SE241A00	24	2000	16.0	2.0			
1A High Power ®ᵁᴸ	SE051A10	5-6	300	3.8	0.5	50 Watts	500	
	SE061A10	5-6	125	3.8	0.5	200 VDC		
	SE121A10	12	500	8.0	1.0	1.0 Amps		
	SE241A10	24	2000	16.0	2.0			
1A High Voltage	SE051A20	5-6	300	3.8	0.5	25 Watts	2500	
	SE061A20	5-6	125	3.8	0.5	1000 VDC		
	SE121A20	12	500	8.0	1.0	1.0 Amps		
	SE241A20	24	2000	16.0	2.0			
1A Mercury	SE051A30	5-6	200	4.0	0.5	50 Watts	1500	
	SE061A30	5-6	125	4.0	0.5	500 VDC		
	SE121A30	12	500	9.0	1.0	1.0 Amps		
	SE241A30	24	2000	18.0	2.0			
1A Low Level Ruthenium Contact	SE051A40	5-6	500	3.8	0.5	10 Watts	300	
	SE061A40	5-6	125	3.8	0.5	200 VDC		
	SE121A40	12	500	8.0	1.0	0.5 Amps		
	SE241A40	24	2000	16.0	2.0			
1B ®ᵁᴸ	SE051B00	5-6	300	3.8	0.5	10 Watts	250	
	SE061B00	5-6	125	3.8	0.5	200 VDC		
	SE121B00	12	500	8.0	1.0	0.5 Amps		
	SE241B00	24	2000	16.0	2.0			
1C	SE051C00	5-6	200	3.8	0.5	3 Watts	200	
	SE061C00	5-6	125	3.8	0.5	100 VDC		
	SE121C00	12	500	8.0	1.0	0.25 Amps		
	SE241C00	24	2000	16.0	2.0			

DIP AND SIP REED RELAYS



*MICRO SIP WIDTH .200
*MICRO SIP HEIGHT .225

Contact Form	Part Number: No Diode	Part Number: With Diode	Coil VDC	Coil Res. (Ohms)	Must Operate VDC	Must Release VDC	Contact Ratings	Break Down Voltage	Schematic
1A	AD1A05	AD1A05D	5	500	3.8	0.5	10 Watts	250	
	AD1A12	AD1A12D	12	850	8.0	1.0	150 VDC		
	AD1A24	AD1A24D	24	2200	16.0	2.0	0.5 Amps		
2A	AD2A05	AD2A05D	5	200	3.8	0.5	10 Watts	250	
	AD2A12	AD2A12D	12	500	8.0	1.0	150 VDC		
	AD2A24	AD2A24D	24	1750	16.0	2.0	0.5 Amps		
1B	AD1B05	AD1B05D	5	500	3.8	0.5	10 Watts	250	
	AD1B12	AD1B12D	12	500	8.0	1.0	150 VDC		
	AD1B24	AD1B24D	24	1750	16.0	2.0	0.5 Amps		
1C	AD1C05	AD1C05D	5	200	3.8	0.5	3 Watts	250	
	AD1C12	AD1C12D	12	500	8.0	1.0	100 VDC		
	AD1C24	AD1C24D	24	1750	16.0	2.0	0.25 Amps		
1A Hg Wet	AD1A05HG	AD1A05HGD	5	90	4.0	0.5	50 Watts	1000	
	AD1A12HG	AD1A12HGD	12	360	9.0	1.0	100 VDC		
	AD1A24HG	AD1A24HGD	24	1440	18.0	2.0	2.0 Amps		
1A Mini SIP	SD1A05	SD1A05D	5	500	3.8	0.5	10 Watts	250	
	SD1A12	SD1A12D	12	850	8.0	1.0	150 VDC		
	SD1A24	SD1A24D	24	2200	16.0	2.0	0.5 Amps		
1A Micro SIP	SH1A05	N/A	5	500	3.8	0.5	10 Watts	200	
	SH1A12		12	1800	8.0	1.0	100 VDC		
	SH1A24		24	1800	16.0	2.0	0.5 Amps		



"T" SERIES

- Most Economical High Quality Relay
- Axial Leads for Flexible Mounting
- Formed Leads for P.C. Board Mounting

Contact Form	Part Number: Axial	Part Number: Formed (1.00" Center)	Coil VDC	Coil Res.	Must Operate	Must Release	Contact Ratings	Break Down Voltage
1A	T0051A500	TU051A500	5	500	4.0	0.5	10 Watts	300
	T0121A500	TU121A500	12	500	9.0	1.2	200 VDC	
	T0241A2K0	TU241A2K0	24	2000	18.0	2.4	0.5 Amps	
2A	T0052A250	TU052A250	5	250	4.0	0.5	10 Watts	300
	T0122A1K0	TU122A1K0	12	1000	9.0	1.2	200 VDC	
	T0242A2K0	TU242A2K0	24	2000	18.0	2.4	0.5 Amps	
1B	T0051B250	TU051B250	5	250	4.0	0.5	10 Watts	300
	T0121B1K0	TU121B1K0	12	1000	9.0	1.2	200 VDC	
	T0241B2K0	TU241B2K0	24	2000	18.0	2.4	0.5 Amps	

American Relays, Inc.

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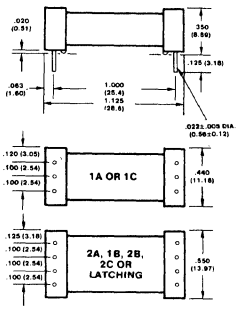
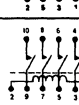
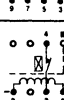
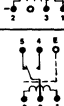
REED RELAYS

OPEN FRAME REED RELAYS (SERIES C AND D)



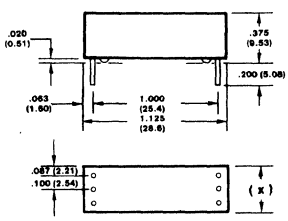
- High Performance, Low Cost Open Frame, PC Mount Dry Reed Relays
- Popular 1.000″ x .100″ or 1.000″ x .150″ Pin Spacing
- Rigid Polyester Relay Body with Epoxy Filled Ends

Specifications	Form A/B	Form C
Power (Resistive Load)	10 Watts	3 Watts
Voltage (Max. Switching)	200 VDC	100 VDC
Voltage (Min. Breakdown)	300 VDC	200 VDC
Current (Max. Switching)	0.5 Amps	0.25 Amps
Current (Max. Carry)	2.0 Amps	1.2 Amps
Capacitance (Typical)	0.2 Pf	0.8 Pf.
Contact Resistance (Max. Initial)	0.2 Ohms	0.2 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms
Release Time (Typical)	0.2/0.5 ms	0.5 ms
Insulation Resistance (Min.)	10^{10} Ohms	10^{9} Ohms
Life (Low Level)	100 x 10^{6} Oper.	50 x 10^{6} Oper.
Life (Rated Load)	10 x 10^{6} Oper.	5 x 10^{6} Oper.
Temperature	−40°C to +85°C	
Vibration	20G to 2000 Hz	
Shock	50G @ 11 MS Duration	

Contact Form	Part Number C End Coil	Part Number D Side Coil	Nom. Coil VDC	Coil Res. (Ohms) ±10%	Max. Pick-up VDC	Min. Drop-out VDC	Width	Schematic Top View C End Coil	Schematic Top View D Side Coil
1A	C051A2R0	D051A2R0	5	500	3.8	0.5	.440		
	C121A2R0	D121A2R0	12	1000	9.0	1.2			
	C241A2R0	D241A2R0	24	2000	18.0	2.4			
2A	C052A2R0	D052A2R0	5	300	3.8	0.5	.550		
	C122A2R0	D122A2R0	12	750	9.0	1.2			
	C242A2R0	D242A2R0	24	1500	18.0	2.4			
4A	C054A2R0	D054A2R0	5	150	3.8	0.5	.640		
	C124A2R0	D124A2R0	12	375	9.0	1.2			
	C244A2R0	D244A2R0	24	1000	18.0	2.4			
1B	C051B2R0	D051B2R0	5	500	3.8	0.5	.550		
	C121B2R0	D121B2R0	12	1000	9.0	1.2			
	C241B2R0	D241B2R0	24	2000	18.0	2.4			
1C	C051C2R0	D051C2R0	5	500	3.8	0.5	.440		
	C121C2R0	D121C2R0	12	1000	9.0	1.2			
	C241C2R0	D241C2R0	24	2000	18.0	2.4			
2C	C052C2R0	D052C2R0	5	300	3.8	0.5	.550		
	C122C2R0	D122C2R0	12	750	9.0	1.2			
	C242C2R0	D242C2R0	24	1500	18.0	2.4			
1A Latching	C051K3R0	D051K3R0	5	375	3.8	0.5	.550		
	C121K2R0	D121K2R0	12	500	9.0	1.2			
	C241K3R0	D241K3R0	24	2000	18.0	2.4			

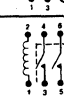
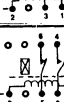
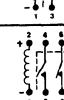
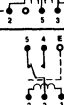
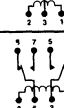
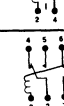
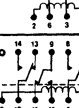
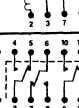
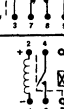
ENCAPSULATED REED RELAYS (SERIES I AND J)

- Total Environmental Protection
- A Wide Variety of Coil and Contact Arrangement Available



Specifications	Form A/B	Form C
Power (Resistive Load)	10 Watts	3 Watts
Voltage (Max. Switching)	200 VDC	100 VDC
Voltage (Min. Breakdown)	300 VDC	200 VDC
Current (Max. Switching)	0.5 Amps	0.25 Amps
Current (Max. Carry)	2.0 Amps	1.2 Amps
Capacitance (Typical)	0.2 Pf	0.8 Pf
Contact Resistance (Max. Initial)	0.2 Ohms	0.2 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms
Release Time (Typical)	0.2/0.5 ms	0.5 ms
Insulation Resistance (Min.)	10^{10} Ohms	10^{9} Ohms
Life (Low Level)	100 x 10^{6} Oper.	50 x 10^{6} Oper.
Life (Rated Load)	10 x 10^{6} Oper.	5 x 10^{6} Oper.
Temperature	−40°C to +85°C	
Vibration	20G to 2000 Hz	
Shock	50G @ 11 MS Duration	

NOTE:
1. Electro-static shielding (E) is optional.
2. On latching relays, (+) indicates set positive.

Contact Form	Part Number I End Coil	Part Number J Side Coil	Nom. Coil VDC	Coil Res. (Ohms) ±10%	Max. Pick-up VDC	Min. Drop-out VDC	Width (X)	Schematic Top View I End Coil	Schematic Top View J Side Coil
1A	I051A2R0	J051A2R0	5	500	3.8	0.5	.375		
	I121A2R0	J121A2R0	12	1000	9.0	1.2			
	I241A2R0	J241A2R0	24	2000	18.0	2.4			
2A	I052A2R0	J052A2R0	5	300	3.8	0.5	.475		
	I122A2R0	J122A2R0	12	750	9.0	1.2			
	I242A2R0	J242A2R0	24	1500	18.0	2.4			
3A	I053A2R0	J053A2R0	5	250	3.8	0.5	.575		
	I123A2R0	J123A2R0	12	500	9.0	1.2			
	I243A3R0	J243A3R0	24	2000	18.0	2.4			
4A	I054A2R0	J054A2R0	5	150	3.8	0.5	.700		
	I124A2R0	J124A2R0	12	375	9.0	1.2			
	I244A2R0	J244A2R0	24	1000	18.0	2.4			
1B	I051B2R0	J051B2R0	5	500	3.8	0.5	.475		
	I121B2R0	J121B2R0	12	1000	9.0	1.2			
	I241B2R0	J241B2R0	24	2000	18.0	2.4			
1A1B	I052F2R0	J052F2R0	5	250	3.8	0.5	.575		
	I122F2R0	J122F2R0	12	500	9.0	1.2			
	I242F3R0	J242F3R0	24	2000	18.0	2.4			
1C	I051C2R0	J051C2R0	5	500	3.8	0.5	.375		
	I121C2R0	J121C2R0	12	1000	9.0	1.2			
	I241C2R0	J241C2R0	24	2000	18.0	2.4			
2C	I052C2R0	J052C2R0	5	300	3.8	0.5	.500		
	I122C2R0	J122C2R0	12	750	9.0	1.2			
	I242C2R0	J242C2R0	24	1500	18.0	2.4			
4C	I054C2R0	J054C2R0	5	50	3.8	0.5	.875		
	I124C2R0	J124C2R0	12	300	9.0	1.2			
	I244C2R0	J244C2R0	24	800	18.0	2.4			
1A Latching	I051K3R0	J051K3R0	5	375	3.8	0.5	.475		
	I121K2R0	J121K2R0	12	500	9.0	1.2			
	I241K3R0	J241K3R0	24	2000	18.0	2.4			

American Relays, Inc.

10306 Norwalk Blvd., Santa Fe Springs, CA 90670 • (213) 944-0447 • FAX (213) 944-0590

REED RELAYS

HIGH POWER SERIES

- Miniature High Power Reed Relays. 50W Contact Rating.
- Capable of Handling High Inrush, Inductive and Capacitive Loads
- Open Frame, Encapsulated and Axial Lead Packages are Available

HIGH VOLTAGE SERIES

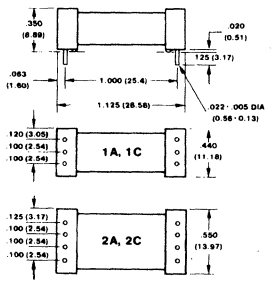
- Miniature High Voltage Reed Relays
- Meets FCC Part 68 Voltage Breakdown Requirement
- Open Frame, Encapsulated and Axial Lead Packages are Available

MERCURY WETTED SERIES

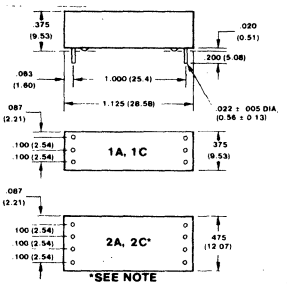
- Miniature Reed Relay with Mercury Wetted Contacts
- No Contact Bounce
- 50 Watts Contact Rating
- Open Frame, Encapsulated and Axial Lead Packages are Available

Specifications	High Power	High Voltage	Mercury Wetted	
			Form A	Form C
Power (Resistive Load)	50 Watts	25 Watts	50 Watts	50 Watts
Voltage (Max. Switching)	200 VDC	1000 VDC	500 VDC	500 VDC
Voltage (Min. Breakdown)	300 VDC	2500 VDC	1500 VDC	1500 VDC
Current (Max. Switching)	1 Amp	1 Amp	2 Amps	1 Amp
Current (Max. Carry)	2 Amps	2 Amps	3 Amps	2 Amps
Capacitance (Typical)	0.2 Pf	0.2 Pf	0.3 Pf	0.7 Pf
Contact Resistance (Max. Initial Typ.)	0.5 Ohms	0.2 Ohms	0.07 Ohms	0.07 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms	1.5 ms	2.0 ms
Release Time (Typical)	0.5 ms	0.2 ms	1.0 ms	2.0 ms
Insulation Resistance (Min. Typ)	10^{10} Ohms	10^{10} Ohms	10^{10} Ohms	10^{9} Ohms
Life (Medium Load)	10 x 10^{6} Oper	100 x 10^{6} Oper.	10^{9} Oper.	10^{9} Oper.
Life (Rated Load)	1 x 10^{6} Oper	10 x 10^{6} Oper	5 x 10^{7} Oper.	5 x 10^{7} Oper.

OPEN FRAME

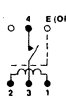
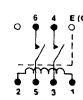
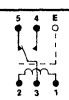
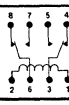


ENCAPSULATED



Note: Dimension for 2 Form C Mercury Encapsulated Relays. Length: 1.175, Width: .600, Height: .375.

PART NUMBERS AND OPERATING CHARACTERISTICS (@ 25°C)

Contact Form	Nom. Coil VDC	Max. Pick-up VDC	Min. Drop-out VDC	High Power			High Voltage			Mercury Wetted*			Schematic Top View
				Coil Res. (Ohms) ±10%	Part Number		Coil Res. (Ohms) ±10%	Part Number		Coil Res. (Ohms) ±10%	Part Number		
					Open Frame	Encapsulated		Open Frame	Encapsulated		Open Frame	Encapsulated	
1A	5	3.8	0.5	500	C051A2TO	I051A2TO	500	C051A2HO	I051A2HO	125	C051A1MO	I051A1MO	
	6	4.5	0.6	125	C061A1TO	I061A1TO	125	C061A1HO	I061A1HO	125	C061A1MO	I061A1MO	
	12	9.0	1.2	750	C121A1TO	I121A1TO	1000	C121A2HO	I121A2HO	750	C121A1MO	I121A1MO	
	24	18.0	2.4	2000	C241A2TO	I241A2TO	2000	C241A2HO	I241A2HO	2000	C241A2MO	I241A2MO	
2A	5	3.8	0.5	100	C052A1TO	I052A1TO	100	C052A1HO	I052A1HO	100	C052A1MO	I052A1MO	
	6	4.5	0.6	100	C062A1TO	I062A1TO	100	C062A1HO	I062A1HO	100	C062A1MO	I062A1MO	
	12	9.0	1.2	300	C122A1TO	I122A1TO	750	C122A2HO	I122A2HO	300	C122A1MO	I122A1MO	
	24	18.0	2.4	1500	C242A2TO	I242A2TO	1500	C242A2HO	I242A2HO	1500	C242A2MO	I242A2MO	
1C	5	4.0	0.5	—	NA	—	—	—	—	100	C051C1MO	I051C1MO	
	12	9.0	1.2	—	NA	—	—	—	—	350	C121C1MO	I121C1MO	
	24	18.0	2.4	—	NA	—	—	—	—	1500	C241C1MO	I241C1MO	
2C	5	4.0	0.5	—	NA	—	—	—	—	75	C052C1MO	I052C1MO	
	12	9.0	1.2	—	NA	—	—	—	—	300	C122C1MO	I122C1MO	
	24	18.0	2.4	—	NA	—	—	—	—	1200	C242C1MO	I242C1MO	

* Mercury wetted relays should be mounted within ±30° from vertical position.

AXIAL LEAD SERIES

- Encapsulated Axial Lead Reed Relays
- Axial Leads Allows Various Mounting Configurations.
- Total Environmental Protection
- Nickel Plated Metal Tube Provides Magnetic Shielding
- Formed Leads are Also Available
- 1 Form A, 2 Form A, 1 Form B, 1 Form C and 2 Form C Types are Available
- Various Contact Ratings Available
- Contact American Relays, Inc. for Specific Part Numbers and Additional Options

SPECIAL RELAY DESIGN

American Relays, Inc. is a custom relay specialist. Our major objective is to design and build parts that fulfill special requirements for the reed relay user.

Our facility is designed and equipped for prompt, systematic processing of samples, prototype and production orders.

MINIGLOSSARY TIMERS

Accuracy
The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

Adjustability
The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

Contact Rating
The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

Delayed Interval Timing Function
Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

Also called: single shot.

Delay-On-Operate Timing Function
Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

Also called: Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

Delay-On-Release Timing Function
Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

Also called: Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

Frequency Sensor
A device that monitors a predetermined overfrequency and/or underfrequecy condition, and changes output state when these conditions exist.

Hysteresis
The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

Interval Timer Timing Function
Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

Also called: Delay Interval, One Shot.

Output Control
The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

Phase Sensor
A device that monitors for proper phase rotation in 3-phase systems.

Programmability
Ability to modify function, time delay or input voltage of a timer.

Recovery Timer

(Delay-On-Operate/Interval Timer)
The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

(Delay-On-Release)
The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

Recycle Time

(Delay-On-Operate or Interval Timer)
The minimum time that input voltage must be interrupted after the timing cycle is completed to assure a successive timing cycle within the repeatability specified.

(Delay-On-Release)
The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

Repeat Cycle Timer Timing Function
Application of power automatically initiates continuous off-on cycling of the output relay.
Also called: flasher, intervalometer

Reset Time
The time required for the contacts to return to normal position when power is removed.

Reverse Polarity Protection
Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

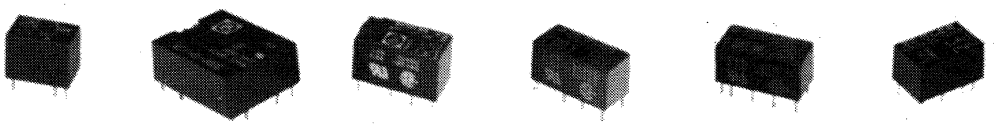
Tolerance
The difference between specified and actual timing or sense point (factory setup tolerance).

Transient Protection
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

Trip Point
The predetermined point at which a sensing device is set to change the output state.

Voltage Sensor
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.

AZ...SIMPLY THE BEST RELAYS



Low Profile Relays

SERIES		AZ 5	AZ 7	AZ 820	AZ 830	AZ 830P	AZ 835
FEATURES		• High Sensitivity • Subminiature Size • Low Cost • Meets FCC Part 68.302 and 68.304	• Meets FCC 1500V Surge Requirement • Low Profile • High Sensitivity • Pd-Ag Contacts Available	• Meets FCC Part 68.302 and 68.304 • Bifurcated Pd-Ag Contacts • Low Profile • Dip Package	• Meets FCC Part 68.302 and 68.304 • Polarized Coil • Dip Package • Bifurcated Contacts • Pd-Ag Contacts Available	• Polarized Magnetic Bistable (Latching) Relay • Meets FCC Part 68.302 and 68.304 • Dip Package • Bifurcated Contacts • Pd-Ag Contacts Available	• Low Profile, 0.32" High • High Sensitivity • Meets FCC Part 68.302 • Latching Versions Available
EPOXY SEALED		Yes	Yes	Yes	Yes	Yes	Yes
CONTACTS	Form	1 Form C	2 and 4 Form C Form D Available	2 Form C	2 and 4 Form C	2 and 4 Form C	2 Form C
CONTACTS	Rating (Resistive)	Standard Duty: 1A @ 30 VDC 0.5A @ 120 VAC Heavy Duty: 2A @ 30 VDC 1A @ 120 VAC	2A @ 30 VDC or 50 VAC 0.5A @ 125 VAC	2A @ 15 VDC or 30 VAC 1A @ 30 VDC or 60 VAC 0.5A @ 60 VDC or 125 VAC	2 Pole: 2A @ 30 VDC or 60 VAC 1A @ 60 VDC or 125 VAC 0.5A @ 120 VDC or 240 VAC 4 Pole: 2A @ 30 VDC or 30 VAC	2 Pole: 2A @ 30 VDC or 60 VAC 1A @ 60 VDC or 120 VAC 0.5A @ 120 VDC or 240 VAC 4 Pole: 2A @ 30 VDC or 30 VAC	1A @ 30 VDC or 40 VAC
COIL VOLTAGE		5, 6, 9, 12, 24V (DC)	5, 6, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24V (DC)
OPERATING POWER AT PICK UP VOLTAGE		Standard Coils: 220 mW Sensitive Coils: 100 mW	2 Pole: 190 mW 4 Pole: 310 mW	250 mW	Standard Coils: 200 mW Sensitive Coils: 100 mW	Standard Coils Monostable: 200 mW Bistable (Latching) Two: 180 mW Sensitive Coils Monostable: 100 mW Bistable (Latching) Two: 90 mW	Monostable Coil: 100 mW Bistable (Latching) Single Coil: 100 mW Bistable (Latching) Two Coil: 130 mW
DIELECTRIC STRENGTH		Coil to Contact: 1000 Vrms Between Open Contacts: 500 Vrms	Between All Points: 1500 Vrms Between Open Contacts: 750 Vrms	Between All Points: 1500 Vrms Between Open Contacts: 1000 Vrms	Between Open Contacts: 1000 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1500 Vrms	Between Open Contacts: 1000 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1500 Vrms	Between Open Contacts: 500 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1000 Vrms
TYPICAL LIFE OPERATIONS	Electrical	(Std. Duty) 5×10^5 – 1A/30 VDC or 4×10^5 – 0.5A/120 VAC (Hvy Duty) 2×10^5 – 2A/30 VDC or 2×10^5 – 1A/120 VAC	5×10^6 – 1A/26 VDC 10^6 – 2A/30 VDC	5×10^5 – 1A/30 VDC	5×10^5 – 2A/30 VDC or 1A/125 VAC 2×10^6 – 1A/30 VDC or 0.5A/125 VAC	5×10^5 – 2A/30 VDC or 1A/125 VAC 2×10^6 – 1A/30 VDC or 0.5A/125 VAC	10^5 – 1A/30 VDC or 0.3A/125 VAC
TYPICAL LIFE OPERATIONS	Mechanical	10^7	10^8	10^7	10^8	10^8	12×10^6
MAXIMUM SIZE INCHES L x W x H		0.610 x 0.420 x 0.450	2 Pole: 1.200 x 0.826 x 0.458 4 Pole: 1.200 x 0.965 x 0.458	0.795 x 0.394 x 0.453	2 Pole: 0.788 x 0.390 x 0.371 4 Pole: 1.09 x 0.390 x 0.390	2 Pole: 0.788 x 0.390 x 0.366 4 Pole: 1.39 x 0.390 x 0.390	0.630 x 0.390 x 0.315
Terminals	PC	X	X	X	X	X	X
	Solder/Plug-in	—	—	—	—	–	—
UL/CSA/VDE		UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA

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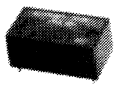
AZ...SIMPLY THE BEST RELAYS




Low Profile (Cont.)

AZ 845	AZ 2530/2531
• Micro Miniature Size • High Sensitivity • Meets FCC Part 68.302 • Bistable (Latching) Versions Available	• Low Profile • High Insulation Resistance • High Sensitivity • Long Life
Yes	Yes
2 Form C	1 and 2 Form C
1A @ 30 VDC or 60 VAC 0.5A @ 125 VAC	2A @ 26 VDC 1A @ 120 VAC
3, 5, 6, 9, 12, 24V (DC)	5, 6, 12, 24, 48V (DC)
Monostable Coil: 79 mW (3-12 VDC) 113 mW (24 VDC) Bistable (Latching) Two Coil: 113 mW (3-12 VDC) 169 mW (24 VDC)	Standard 1 Form C: 125 mW Sensitive 1 Form C: 80 mW Standard 2 Form C: 250 mW
Between Open Contacts: 750 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1000 Vrms	Contact to Contact: 500 Vrms Contact to coil: 500 Vrms
2×10^5 – 1A/30 VDC 10^5 – 0.5A/125 VAC	10^6 – 1A/26 VDC or 0.5A/115 VAC 2×10^5 – 2A/26 VDC or 1A/115 VAC
5×10^7	10^7
0.551 x 0.354 x 0.158	1 Pole: 1.090 x 0.593 x 0.445 2 Pole: 1.090 x 0.888 x 0.445
X	X
—	—
UL/CSA	UL/CSA

General Purpose Relays

SERIES		AZ 4	AZ 8	AZ 420
FEATURES		• Subminiature Size • Low Cost • Rugged Construction • Meets FCC Part 68.302 and 68.304 • Wide Switching Range	• High Sensitivity • Subminiature Size • Low Cost • Wide Switching Range • Class F (155°C) Version Available	• Versatile Contact Configurations • Wide Switching Range • High Sensitivity • Long Life
EPOXY SEALED		Yes	Yes	Yes
	Form	1 Form C	1 Form A and C	1-6 Form C Forms A, B, D Avail.
CONTACTS	Rating (Resistive)	3A @ 30 VDC or 125 VAC 5A @ 30 VDC or 125 VAC 10A @ 125 VAC	Form A: 10A @ 30 VDC or 120 VAC Form C: 3A @ 30 VDC or 200 VAC 6A @ 30 VDC or 300 VAC	2A @ 28 VDC or 115 VAC 3A @ 30 VDC or 115 VAC 7.5A @ 30 VDC or 115 VAC
COIL VOLTAGE		5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	3 thru 115V (DC)
OPERATING POWER AT PICK UP VOLTAGE		230 mW	110 to 210 mW Standard Coil: 210 mW Sensitive Coil: 110 mW to 140 mW	Standard Coils: 450 to 850 mW Sensitive Coils: 40 mW per pole, 25 mW per pole Available
DIELECTRIC STRENGTH		Contact to Contact: 1000 Vrms Contact to Coil: 1500 Vrms	Contact to Contact: 750 Vrms Contact to Coil: 2000 Vrms	Between All Points: 1000 Vrms 1500 Vrms Versions Available
TYPICAL LIFE OPERATIONS	Electrical	10^5 (at rated load)	(LD) 3×10^5 – 3A/120 VAC (MD) 1.8×10^5 – 6A/120 VAC (HD) 10^5 – 10A/120 VAC	1×10^8 – 10 mA/6 VDC 1.5×10^6 – 2A/28 VDC or 115 VAC 2×10^5 – 5A/28 VDC or 115 VAC 1×10^5 – 7.5A/28 VDC or 115 VAC
	Mechanical	10^7	10^8	5×10^8
MAXIMUM SIZE INCHES L x W x H		0.866 x 0.635 x 0.745	0.830 x 0.630 x 0.560	2 Pole: 0.940 x 0.735 x 1.230 6 Pole: 1.395 x 0.735 x 1.230
Terminals	PC	X	X	X
	Solder/Plug-in	—	—	X
UL/CSA/VDE		UL/CSA	UL/CSA	UL/CSA

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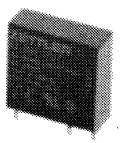
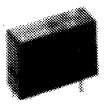
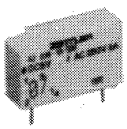
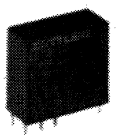
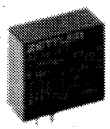
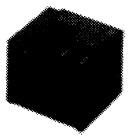

Power Relays

SERIES	AZ 690	AZ 695	AZ 696	AZ 730	AZ 735	AZ 2100
FEATURES	• High Dielectric Strength, 4000 Vrms • Complete List of International Approvals • 10 Amp Switching Capability in Compact Size	• Utilizes only 0.18 Sq. In. of PCB Area • 5 Amp Switching in Miniature Size • High Dielectric Strength, 3000 Vrms • High Sensitivity	• Subminiature Size • 10 Amp, Low Profile • High Sensitivity • Complete List of Approvals • Dielectric Strength 4000 Vrms	• High Dielectric Strength, 4000 Vrms • Complete List of International Approvals • 8 Amp Switching Capability in Compact Size	• High Dielectric Strength, 5000 Vrms • Complete List of International Approvals • 16 Amp Switching Capability in Compact Size	• Oversize Contact Switching Up to 30 Amps • Versatility of Both PC & .250" Fast-On Tabs for Contacts • Complete UL and CSA Approvals • Class F (155°C) Version Available
EPOXY SEALED	Yes	Yes	Yes	Yes	Yes	Yes
CONTACTS — Form	1 Form A, B, or C	1 Form A	1 Form A	2 Form A, B, or C	1 Form A or C	1 Form A, B, or C
CONTACTS — Rating (Resistive)	10A @ 30 VDC or 200 VAC 1/4 HP 120 VAC Motor Load	5A @ 30 VDC or 250 VAC	10A @ 30 VDC or 250 VAC	8A @ 30 VDC or 120 VAC 1/8 HP 120 VAC Motor Load	16A @ 30 VDC or 200 VAC 1/2 HP 120 VAC Motor Load A300 Pilot Duty TV5 Rating	Form A: 30A @ 30 VDC or 240 VAC Form B: 15A @ 30 VDC or 300 VAC Form C (NO): 20A @ 30 VDC or 300 VAC
COIL VOLTAGE	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 18, 24V (DC)	5, 6, 12, 24, 48V (DC)	5, 6, 12, 24, 48V (DC)	6, 12, 24, 48V (DC)	5, 6, 9, 12, 15, 18, 24, 48, 70, 110V (DC)
OPERATING POWER AT PICK UP VOLTAGE	Standard Coils: 350 mW Sensitive Coils: 250 mW	100 mW	100 mW	Standard Coils: 350 mW Sensitive Coils: 250 mW	350 mW	500 mW
DIELECTRIC STRENGTH	Coil to Contact: 4000 Vrms Between Open Contact: 1000 Vrms	Contact to Contact: 750 Vrms Coil to Contact: 3000 Vrms	Coil to Contact: 4000 Vrms	Coil to Contact: 4000 Vrms Contact to Contact: 2500 Vrms Between Open Contacts: 1000 Vrms	Coil to Contact: 5000 Vrms Between Open Contacts: 1000 Vrms 10,000 V Surge, Max, 40 Micro Seconds, Contact to Coil	Coil to Contact: 2500 Vrms Between Open Contacts: 1500 Vrms
TYPICAL LIFE OPERATIONS — Electrical	5×10^4 – 10A/30 VDC or 115 VAC 2×10^5 – 8A/250 VAC	10^5 – 5A/30 VDC or 250 VAC	10^5 (at rated load)	10^5 – 8A/30 VDC 2×10^5 – 8A/115 VAC or 6A/250 VAC	10^5 – 16A/30 VDC 2×10^5 – 16A/120 VAC 10^5 – 14A/250 VAC	10^5 (at rated load)
TYPICAL LIFE OPERATIONS — Mechanical	3×10^7	2×10^7	10^7	3×10^7	10^7	10^7
MAXIMUM SIZE INCHES L x W x H	SLIMPAK – 1.110 x 0.467 x 1.030 THINPAK – 1.110 x 1.030 x 0.441	0.690 x 0.256 x 0.492	1.180 x 0.394 x .638	1.110 x 0.496 x 1.030	1.110 x 0.469 x 1.040	OPEN 1.20 x 0.970 x 0.618 ENCASED 1.270 x 1.080 x 1.100
Terminals — PC	X	X	X	X	X	X
Terminals — Solder/Plug-in	—	—	—	—	—	Quick Connect
UL/CSA/VDE	UL/CSA/VDE	UL/CSA	UL/CSA/VDE	UL/CSA/VDE	UL/CSA/VDE	UL/CSA

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RELAY PRODUCT SHOWCASE

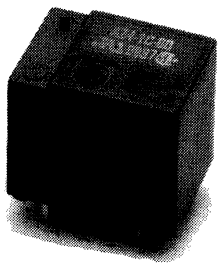
BORN IN THE USA

To maintain its high quality standards and increase customer responsiveness, American Zettler manufactures many of its relay lines right at its headquarter facilities in Orange County, California. Utilizing state-of-the-art production equipment and advanced quality assurance techniques, American Zettler can support your program with competitively priced standard relays, or can design application-specific relays ideally suited to your requirements.

AZ 4

UL-Approved PC Board Relay Sets the Standard in Price Performance

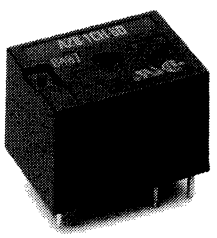
- Subminiature Size
- DC Coils to 48 VDC
- 3, 5,10 Amp Contacts
- Epoxy Sealed
- Suitable for Class B Applications
- UL & CSA Approvals



AZ 8

High Sensitivity Relay Delivers High Reliability in Subminiature Package

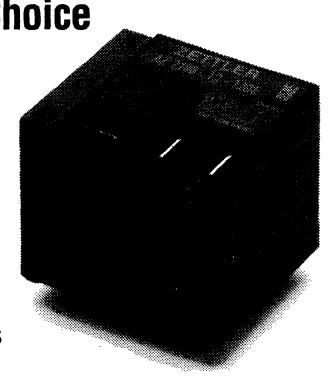
- High Sensitivity, 110 mW Pick-up
- Epoxy Sealed
- DC Coils to 48 VDC
- 3, 6,10 Amp Contacts
- Epoxy Sealed
- Suitable for Class B & F Applications
- UL, VDE, and CSA Approvals



AZ 2100

The Industry Leading 30 Amp Relay Gives You the Power of Choice

- Up to 30 Amp Switching in Compact Size
- Three Different Versions
- Complete UL Approvals
- Both PC and "Trace-Saver" Quick Connect Terminals
- Class B & F Applications
- 1 Form A, B, and C Contacts Available



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AMPERITE
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Union City, New Jersey 07087
•
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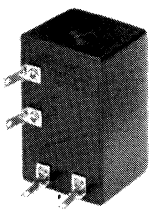
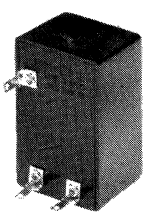
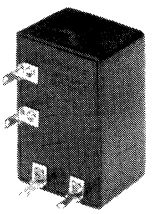
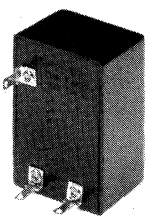
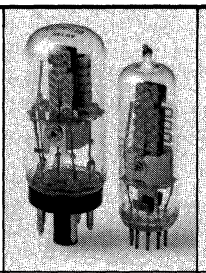
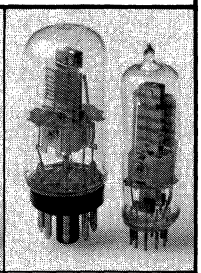
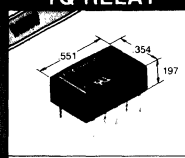
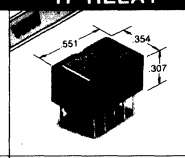
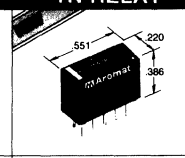
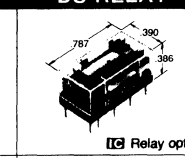
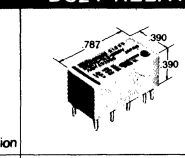
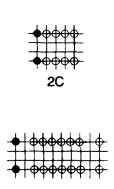
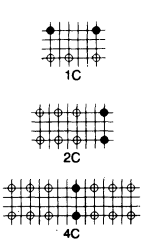
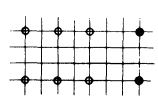
Time Delay Relays & Flashers

	 Optional Panel Mount						
Series	B Series Time Delay Relay	B Series Flasher	C Series Time Delay Relay	D Series Flasher	Glass Tube Time Delay Relay	Glass Tube Flasher
Features	• Thermal • Economical • Small Size	• Thermal • Economical • Small Size	• Solid State Timing Circuitry • Relay Output • Compact Size • Instant Reset	• 100% Solid State Timing Circuitry • Flash Resistive & Inductive Loads • Economical • Compact Size	• Thermal • Hermetically Sealed • Extremely Wide Temperature Operating Range • Recommended For Explosive Atmospheres	• Thermal • Hermetically Sealed • Extremely Wide Temperature Operating Range • Recommended For Explosive Atmospheres
Dimensions (in)	$1^{23}/_{32}$ x $1^{1}/_{8}$ x $^{7}/_{8}$	$1^{23}/_{32}$ x $1^{1}/_{8}$ x $^{7}/_{8}$	$1^{23}/_{32}$ x $1^{1}/_{8}$ x $^{7}/_{8}$	$1^{23}/_{32}$ x $1^{1}/_{8}$ x $^{7}/_{8}$	Octal: $2^{3}/_{4}$ x $1^{1}/_{8}$ 9-Pin: $2^{1}/_{2}$ x $^{7}/_{8}$	Octal: $2^{3}/_{4}$ x $1^{1}/_{8}$ 9-Pin: $2^{1}/_{2}$ x $^{7}/_{8}$
Contact Arrangement	• Single Pole Single Throw	• Single Pole Single Throw	• Single Pole Single Throw • Single Pole Double Throw	• Single Pole Single Throw	• Single Pole Single Throw	• Single Pole Single Throw
Input Voltage	1-240V AC/DC	1-240V AC/DC	**5-240V AC/DC**	5-240V AC/6-30V DC	1-240V AC/DC	1-240V AC/DC
Contact Rating	3A @ 115V AC uses 2.3 watts	2A @ 115V AC Requires min. current of 60ma. Wire load across heater.	½A @ 115V AC 1.0A @ 32V DC	2A@115V AC inter. 1½A@115V AC cont. Draw: 12-24V@30ma 5-6V@60ma	3A @ 115V AC uses 2.3 watts	½A non-inductive @ 115V AC uses 2.3 watts
Mode Of Operation	• Delay on make (normally open) • Delay on break (normally closed) • Off time delay	• Delay on break (normally closed) Flasher	• Delay on make (normally open) • Delay on break (normally closed) ★ Off time delay	• RC Analog Solid State Timing Circuitry With Solid State Switching	• Delay on make (normally open) • Delay on break (normally closed) • Off time delay	• Delay on break (normally closed) Flasher
Delay Time	Fixed 2 - 300 sec.	Fixed 1 - 45 F.P.M. Duty Cycle ⅓ on & ⅔ off	Fixed: .10-300 sec. Adj.: .10-300 sec. ★Fixed: .10-600 sec. ★Adj.: 4-600 sec.	Fixed: 1-120 F.P.M. Duty: 50%	Fixed Octal: 2-300 sec. 9-Pin: 2-120 sec.	Fixed 10-90 F.P.M. Duty ⅓ on ⅔ off
Type Of Control	Bimetallic Heater Operated Contact Blades	Bimetallic Heater Operated Contact Blades	Fixed or Screw Driver Potentiometer Adjustable	Solid State Switching: AC units have Triacs, DC units have NPN Transistors	Bimetallic Heater Operated Contact Blades	Bimetallic Heater Operated Contact Blades
Repeatability	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%
Tolerance	± 20%	± 20%	± 5%	± 5%	± 20%	± 20%
Temp. Range	− 30 °F to + 175 °F	− 30 °F to + 175 °F	− 10 °F to + 140 °F	− 10 °F to + 140 °F	− 176 °F to + 275 °F	− 176 °F to + 275 °F
Mounting & Terminiation	(4) 110, 250 or Screw Terminals Panel or PC mount	(3) 110, 250 or Screw Terminals Panel or PC mount	(4, 5 or 6) 110, 250 or Screw Terminals Panel or PC mount	(3) 110, 250 or Screw Terminals Panel or PC mount	Plug in: Octal or 9-Pin Base	Plug In: Octal or 9-Pin Base
Life Expectancy	500,000 operations	500,000 operations	500,000 operations	500,000 operations	500,000 operations	500,000 operations

Aromat Relay Selector Chart

	TQ-RELAY	TF-RELAY	TN-RELAY	DS-RELAY	DS2Y-RELAY
				 IC Relay option	
[illegible]	• Ultra-small size • High sensitivity • 1,500V FCC • 4 pole model available	• Highest sensitivity • Ultra-small size • 1,500V FCC • Surface-mount type available	• Ultra-slim size • High sensitivity • 1,500V FCC	• 1,500V FCC surge satisfied • High sensitivity • High switching power	• High sensitivity • 2 Form C contact • 1,500V FCC • Sealed construction
[illegible]	●	●	●	●	●
[illegible]	●	●	●	●	●
[illegible]	Gold-clad silver	Gold-clad silver	Gold-clad silver	Gold-clad silver (Silver palladium)	Gold-clad silver
• [illegible]	1 A 30 V DC	1 A 30 V DC	1 A 30 V DC	2 A 30 V DC	1 A 30 V DC
Minimum	10 μA 10 mV DC	10 μA 10 mV DC	10 μA 10 mV DC	10 μA 10 mV DC	10 μA 10 mV DC
• Contact arrangement	2C, 4C	2C	2C	1C, 2C, 2D, 4C	2C
• Life (Min. operation) Electrical	2×10^5	2×10^5	2×10^5	5×10^5	5×10^5
• Life (Min. operation) Mechanical	10^8	10^8	10^8	10^8	10^8
• Breakdown voltage [illegible]	750Vrms	750Vrms	750Vrms	1,000Vrms (500 Vrms for DS1-S)	750Vrms
• Breakdown voltage [illegible]	1,000Vrms	1,000Vrms	1,000Vrms	1,000Vrms	1,000Vrms
• Breakdown voltage [illegible]	1,000Vrms	1,000Vrms	1,000Vrms	1,500Vrms (1,000 Vrms for DS1-S)	1,000Vrms
• Breakdown voltage [illegible]	—	—	—	—	—
• Surge withstand voltage	1,500V FCC	1,500V FCC	1,500V FCC	1,500V FCC	1,500V FCC
• Coil voltage	(DC) 3, 4.5, 5, 6, 9, 12, 24 V	(DC) 3, 4.5, 5, 6, 9, 12, 24, 48V	(DC) 3, 4.5, 5, 6, 9, 12, 24V	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V
• Nominal operating power	(Single) (2C) 140mW (4C) 280mW (−L2) 200mW	80mW (DC 3 to 12V) 140mW (DC 24V) 260mW (DC48V)	(Single) 140mW (Up to 12VDC) 200mW (24VDC)	M type (Single) 400mW (−L2) 360mW S type (Single) 200mW (−SL2) 180 mW	(Single) 200mW (300mW: 48V) (−L2) 180mW (360mW: 48V)
• Terminal layout (Bottom View) • coil terminal (.100 inch grid)	 2C 4C			 1C 2C 4C	
• Standards	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)
• Mounting method					

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

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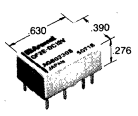
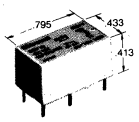
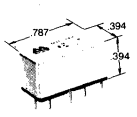
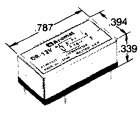
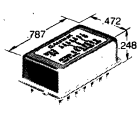
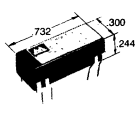
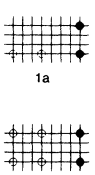
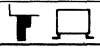
High sensitive DIL Miniature	Miniature DIL Power	Half-Size	Highly Reliable DIL	Hermetically Sealed	Economical Reed
DF-RELAY	**DSP-RELAY**	**R-RELAY**	**DR-RELAY**	**DX-RELAY**	**DA-RELAY**
		 [C] Relay option	 [C] Relay option		
• Smaller than most 2 form C relays • High sensitivity • DIL	• High switching capacity • High sensitivity • High contact welding resistance • High breakdown voltage	• Magnetically shielded • High sensitivity • High speed operation	• High sensitivity • High contact force • High breakdown voltage • High speed operation	• DX2-HT types with 200°C resistance available • High radio frequency characteristics • High shock and vibration resistance	• DIL terminal • Glass encapsulated reed switch
●	●	●	●	●	●
●	●	●	●	●	
Gold-clad silver	Gold-flush cover silver alloy	Gold cobalt	Gold cobalt	Gold-clad silver alloy	Rh-plated nickel-iron alloy
1 A 30 V DC 1 mA 1 V DC	8 A 250 V AC 5 A 30 V DC 1a 5 A 250 V AC 5 A 30 V DC 1a1b, 2a	1 A 20 V DC 10 µA 100 mV DC	1 A 20 V DC 10 µA 100 mV DC	1 A 30 V DC 10 µA 30 mV DC	0.2 A 48 V DC 1 mA 100 mV DC
2C	1a, 1a1b, 2a	1C	1C	2C	1a, 2a
10^5	10^5	10^6	10^6	2×10^5	10^6
(Single) 5×10^6 (Latching) 10^6	5×10^7	10^9	10^9	3×10^7	10^8
500Vrms	1,000Vrms	350Vrms or 500VDC	750Vrms	500Vrms	200VDC (1 min.)
500Vrms	2,000Vrms	—	—	500Vrms	—
1,000Vrms	3,000Vrms	1,000Vrms	1,500Vrms	500Vrms	500VDC (1 min.)
—	—	1,000Vrms	1,000Vrms	500Vrms	—
1,500V FCC	5,000V surge		1,500V FCC		
(DC) 1.5, 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24V	(DC) 5, 6, 12, 24V
(Single) 200mW (−L) 100mW (−L2) 200mW	(Single) 300mW (−L) 150mW (−L2) 300mW	(Single) 150 to 280mW (−L) 70 to 100mW (−L2) 150 to 230mW	(Single) 96 to 209mW (−L) 56 to 109mW (−L2) 111 to 290mW	(Single) 125 to 144mW (−L) 125 to 144mW (−L2) 250 to 288mW	(1a) 230mW (2a) 325mW
	 1a 1a1b, 2a				
UL (E57521), CSA (LR26550)	UL (E57520), TÜV, CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)	—	—
					

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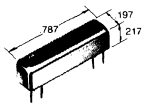
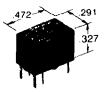
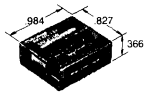
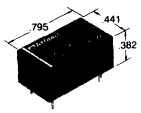
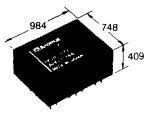
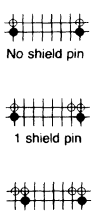
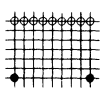
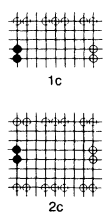
Aromat Relay Selector Chart

	High Quality DB-RELAY	Ultra-Miniature Sealed Type HD-RELAY	High Frequency RF-RELAY	High Frequency RK-RELAY	1C and 2C High Frequency RG-RELAY
• Type of relay					
• Features	• High insulation resistance • High sensitivity • High speed operation	• Ultra-small type • High sensitivity • Sealed construction	• Excellent high frequency • High reliability and long life • Flux-resistant molded construction	• Excellent high frequency characteristics • High sensitivity in small size	• Excellent high frequency • Wide selection • 1A 24VDC
• Surface mount terminal	●	●	●	●	●
• Latching types available				●	●
• Contact material (Optional material)	Rhodium	Gold-clad silver	(Stationary contact) Gold-plated nickel silver (Movable contact) Gold-clad phosphorus bronze	Gold-clad silver	Gold-clad silver
• Contact rating chart Maximum (cos φ = 1) 15 A 10 A 8 A 5 A 3 A 2 A 1 A	0.4 A 24 V DC	1 A 30 V DC	0.01 A 24 V DC	0.01A 24VDC	1 A 24 V DC
Minimum 1 mA 100 μA 10 μA	100 μA 5 V DC	1 mA 1 V DC	30 μA 3 mA DC		
• Contact arrangement	1a	1C	1C	1C	1C, 2C
• Life (Min. operations) Electrical	10^6	10^5	10^5	3×10^5	10^5
• Life (Min. operations) Mechanical	2×10^8 (2 shield pin)	5×10^6	5×10^6	5×10^6	5×10^6
• Breakdown voltage Between open contacts	200VDC (1 min.)	500Vrms	1,000Vrms	500Vrms	1,000Vrms
• Breakdown voltage Between contact sets	—	—	—	—	—
• Breakdown voltage Between contacts and coil	500VDC (1 min.)	500Vrms	2,000Vrms	1,000Vrms	2,000Vrms
• Breakdown voltage Between live parts and ground	500VDC (1 min.)	—	Between contacts and ground: 500Vrms; Between ground and coil: 2,000Vrms	500Vrms	500Vrms
• Surge withstand voltage			—	—	—
• Coil voltage	(DC)1.5, 3, 5, 6, 9, 12, 15, 18, 24V	(DC) 1.5, 3, 5, 6, 9, 12, 24V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 9, 12, 24, 48V
• Nominal operating power	(Standard) 130mW (High sensitivity for 5V type) 80mW	280 to 300mW	450mW	(Single) 200mW (−L) 200mW (−L2) 400mW	(Single) 350 to 400mW (−L) 180 to 200mW (−L2) 350 to 400mW
• Terminal layout (Bottom View) • coil terminal (.100 inch grid)					
• Standards	—	UL (E57521), CSA (LR26550)	—	—	—
• Mounting method					

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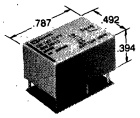
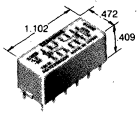
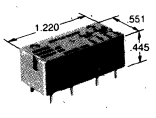
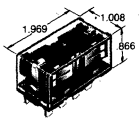
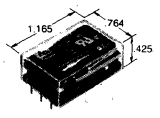
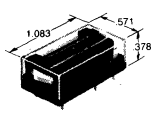
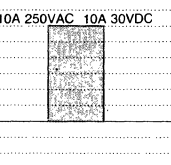
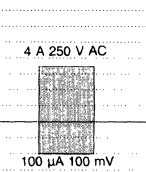
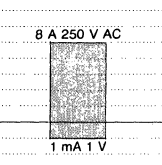
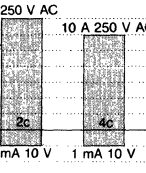
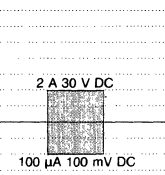
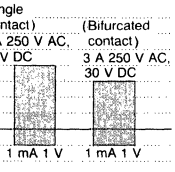
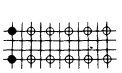
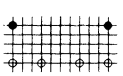
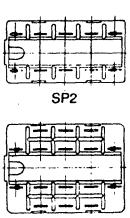
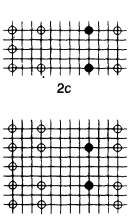
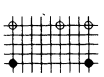
Miniature Power	High Density	Field Switching Power	Compact Power Sensitive	Flatpack	Thin 1 Form C
DK-RELAY	**SEB-RELAY**	**STE-RELAY**	**SP-RELAY**	**NF-RELAY**	**NB-RELAY**
					
	[C] Relay option	[C] Relay option	[C] Relay option		
• Large capacity in small size • High sensitivity • High breakdown voltage	• High sensitivity • High vibration and shock resistance • Low thermal electromotive force	• Large capacity in small size • High inrush capability	• High sensitivity • High vibration and shock resistance • Wide switching range	• 1,500V FCC surge satisfied • Low profile • High sensitivity • MBB contact available	• 1500V FCC surge staisfied • Low profile • 5A contact rating • Low profile
●	●	●		●	●
●	●	●	●		●
Gold-flush cover silver alloy	Gold-clad silver alloy	Gold-flush cover silver alloy	Silver alloy/gold-plated silver alloy	Gold-clad silver (Silver palladium)	(Single) Silver nickel (Bifurcated) Gold-clad silver nickel
					
1a	2a2b, 4a	1a1b, 2a	2C, 4C	2C, 4C, 2D, 4D	1C
10^5	10^5	10^5	10^5	10^6	2×10^5
5×10^7	10^8	10^7	5×10^7	(2C) 3×10^8 (4C) 10^8	10^7
1,000Vrms	750Vrms	1,200Vrms	1,500Vrms	750Vrms	1,000Vrms
4,000Vrms	1,000Vrms	2,000Vrms	3,000Vrms	1,000Vrms	—
4,000Vrms	1,500Vrms	3,750Vrms	3,000Vrms	1,000Vrms	2,000Vrms
—	—	—	—	1,000Vrms	—
—	—	6,000V surge		1,500V FCC	1,500V FCC
(DC) 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V
200mW	192 to 355mW	240mW	300mW	(2C) 300mW (4C) 480mW	400mW
					
UL (E57520), CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57521), VDE, CSA (LR40868, LR58006)	UL (E57520), CSA (LR26550)
					

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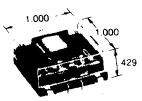
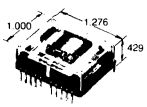
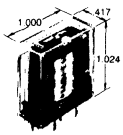
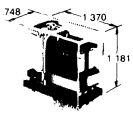
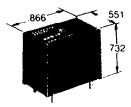
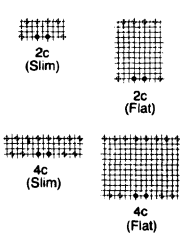
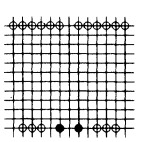
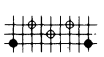
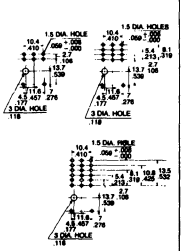
Aromat Relay Selector Chart

	Flatpack/Vertical type & DIL	6PDT Flatpack DIL	Vertical type	High sensitivity Cradle	Compact Economical Power
	NC-RELAY	NL-RELAY	NT-RELAY	K-RELAY	JE-X-RELAY
• Type of relay (inch)					
• Features	• Flatpack and vertical type • DIL terminal • Bifurcated contacts	• 6PDT Flat-pack • Low operating power • MBB contact available	• Large capacity 8A • Compact size • AC coils	• Sealed types available • Long life • Bifurcated contact	• Compact size • High contact capacity • Safety-oriented between coil and contact • Flux-resistant type available
• Sealed types availability	●	●		●	●
• Latching types availability	●	●			
• Contact material (Optional material)	Gold-clad Silver nickel	Gold-clad silver	Gold-clad silver nickel	Gold-clad silver/ silver	Silver alloy
• Contact rating chart (15 A, 10 A, 8 A, 5 A, 3 A, 2 A, 1 A) Maximum (cos φ = 1)	5 A max. 250 V AC	2 A 30 V DC	8 A 250 V AC	5 A 125 V AC (K2F) 1 A 50 V AC, 2 A 250 V DC	3 A 277 V AC 5 A 125 V AC 5 A 30 V DC
Minimum (1 mA, 100 μA, 10 μA)	100 μA 1 V	100 μA 100 mV DC	1 mA 1 V	100 μA 100 mV	
• Contact arrangement	2C, 4C	6C, 6D	1C	2C, 4C, 6C	1a, 1C
• Life (Min. operation) Electrical	(2C) 10^5 (4C) 10^5	5×10^5	10^5	10^6	10^5
• Life (Min. operation) Mechanical	2×10^7	5×10^7	10^7	10^8	5×10^6
• Breakdown voltage Between open contacts	1,000Vrms	1,000Vrms	1,000Vrms	750Vrms	750Vrms
• Breakdown voltage Between contact sets	1,000Vrms	1,000Vrms	—	750Vrms	—
• Breakdown voltage Between contacts and coil	2,000Vrms	2,000Vrms	2,000Vrms	1,500Vrms	1,500Vrms
• Breakdown voltage Between live parts and ground	—	—	—	1,250Vrms	—
• Surge withstand voltage					5,000V surge
• Coil voltage	(DC) 5, 6, 12, 24, 48, 110V	(DC) 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48V (AC) 6, 12, 24, 48, 115V	(DC) 3, 6, 12, 24, 42, 48, 60, 110V (AC) 6, 12, 24, 28, 42, 48, 60, 110, 220V	(DC) 5, 6, 9, 12, 24, 48V
• Nominal operating power	(Single) (2C) 360mW (4C) 720mW (−L2) (2C) 800mW (4C) 1,600mW	(single) 720mW (−L2) 1,600mW	(DC) 290mW (AC) 0.75VA	(2C) 200 to 400mW (4C) 500 to 700mW (6C) 1,300mW	400mW
• Terminal layout (Bottom View) •: coil terminal (.100 inch grid) mm inch					
• Standards	UL (E57520), VDE, CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57521), VDE, CSA (LR26550)	UL (E57521), VDE, CSA (LR26550)	UL (E57520), TÜV, CSA (LR48525)
• Mounting method					

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

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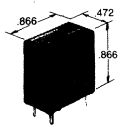
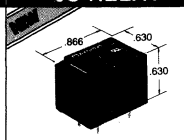
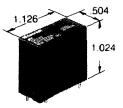
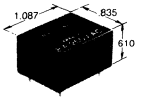
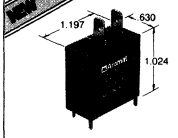
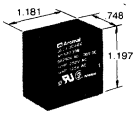
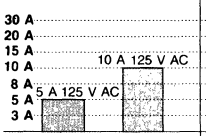
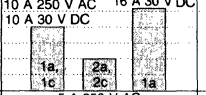
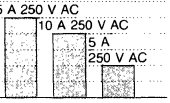
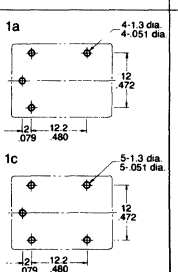
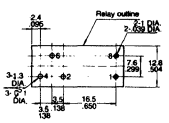
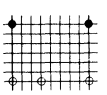
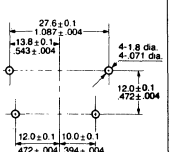
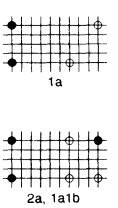
Compact Power	Ultra-Miniature PC Board Type Power Relay	Slim Type Power	Compact Power	Compact Power Relay for Inductive Load	Compact High Power
JY-RELAY	**JS-RELAY**	**JR-RELAY**	**JB-RELAY**	**JM-RELAY**	**JC-RELAY**
					
• 5A, 10A types • Class B coil type available • High dielectric withstanding: 5,000V surge	• Ultra-miniature size with universal terminal footprint • High switching capacity 10A	• 16A type available • Wide insulation distance • High inrush current capability	• High dielectric withstanding: 10,000V surge • Large capacity 8A in compact size	• Super welding resistance • High surge resistance • Compact high capacity relay for inductive load	• Class B coil type available • TV-rated type available • High dielectric withstanding: 10,000V surge
●	●				
				●	
Silver alloy	Gold-clad silver	Silver alloy	Silver alloy	Silver alloy	Silver alloy
					
1C	1a, 1C	1a / 1C | 2a / 2C | 1a	1C	1a	1a | 2a | 1a1b
10^5	10^5	10^5	10^5	10^5	10^5
5×10^6	10^7	5×10^6	10^7	10^6	5×10^6
800Vrms	750Vrms	1,000Vrms	1,000Vrms	1,000Vrms	2,000Vrms
—	—	3,000Vrms	—	—	2,000Vrms
2,000Vrms	1,500Vrms	5,000Vrms	2,500Vrms	5,000Vrms	4,000Vrms
—	—	—	—	—	—
5,000V surge	—	10,000V surge	10,000V surge	—	10,000V surge
(DC) 5, 6, 9, 12, 24, 48 V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 6, 12, 24, 48 V (AC) 115V	(DC) 5, 6, 12, 24, 48V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 6, 12, 24, 48V
400mW	360mW	530mW	(Up to 24 V DC) 480mW (48V DC) 560mW	0.9W	(1a) 0.9W (2a, 1a1b) 1W
					
UL (E57520), TÜV, CSA (LR26550)	UL (E57520), TÜV, CSA (LR26550), TV rating	UL (E57520), TÜV, CSA (LR26550), TV rating	UL (E57520), CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57520), VDE, CSA (LR26550), TV rating

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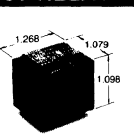
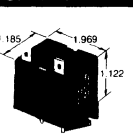
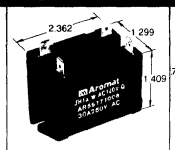
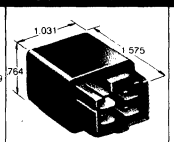
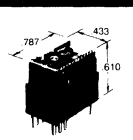
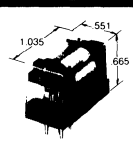
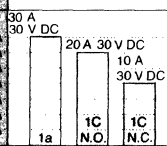
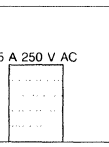
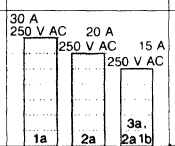
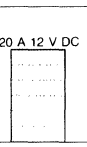
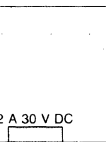
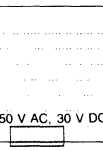
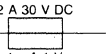
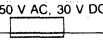
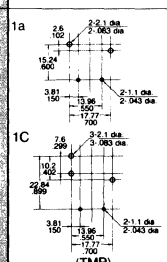
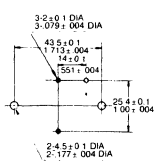
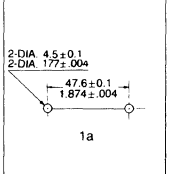
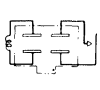
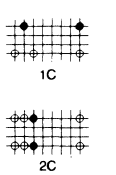
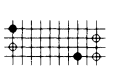
Aromat Relay Selector Chart

	JT-RELAY	JA-RELAY	JH-RELAY	CA-RELAY	HB-RELAY	HA-RELAY
• Type of relay						
• Features	• High switching capacity • Open, Dust cover, Sealed types available • Class B coil type available	• High switching capacity 55A inrush, 15A steady • TV-rated type available	• High dielectric withstanding: 10,000V surge • High inrush resistance	• Small size • Light weight • Completely water tight • Automotive direct plug-in	• DIP terminal • Flux-resistant • Ag-Pd contacts type available	• Compact size • AC coils
• Sealed types availability	●			●	●	●
• Latching types availability			●			
• Contact material	Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver nickel (Silver palladium)	Silver nickel
• Contact rating chart Maximum (cos φ = 1)						
Minimum						
• Contact arrangement	1a, 1C	1a, 1b, 1C	1a | 2a | 3a, 2a 1b	1a, 1b	1C, 2C	1C
• Life (Min. operation) Electrical	10^5	10^5	10^5	10^5	2×10^5	10^5
• Life (Min. operation) Mechanical	10^7	5×10^6	5×10^6	2×10^5	10^7	10^7
• Breakdown voltage Between open contacts	1,500Vrms	1,000Vrms	2,000Vrms	500Vrms	500Vrms	750Vrms
• Breakdown voltage Between contact sets	—	—	2,000Vrms	—	500Vrms	—
• Breakdown voltage Between contacts and coil	1,500Vrms	2,000Vrms	5,000Vrms	500Vrms	1,000Vrms	1,500Vrms
• Breakdown voltage Between live parts and ground	—	—	—	—	—	—
• Surge withstand voltage	—	5,000V surge	10,000V surge			
• Coil voltage	(DC) 5, 6, 9, 12, 15, 18, 24V	(DC) 6, 12, 24V (AC) 6, 12, 24, 115V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 220, 240V	(DC) 5, 9, 12, 24V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 9, 12, 24, 48V (AC) 6, 12, 24, 48, 115V
• Nominal operating power	890mW	(DC) 1.2W (AC) 1.3VA	(DC) 1.9W (AC) 3.2VA	1.8W	(1C) 360mW (2C) 576mW	(DC) 360mW (AC) 0.9VA
• Terminal layout (Bottom View) • coil terminal (.100 inch grid) mm inch	 (TMP)	 (TMP)	 1a	 (Terminal layout)	 1C 2C	
• Standards	UL (E57520), CSA (LR42758)	UL (E57520), TÜV, CSA (LR26550), TV rating	UL (E57520), VDE, TÜV, CSA (LR26550), TV rating	—	UL (E57520), CSA (LR26550)	UL (E57520), CSA (LR26550)
• Mounting method						

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

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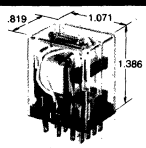
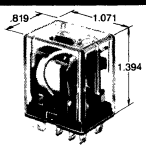
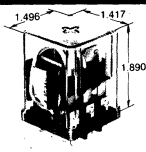
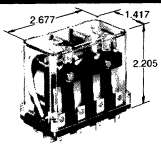
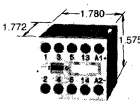
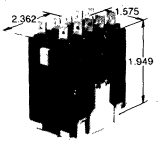
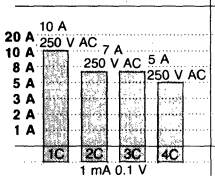
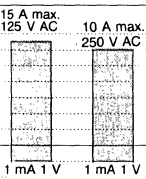
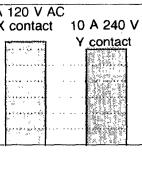
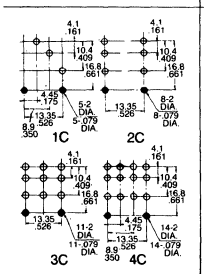
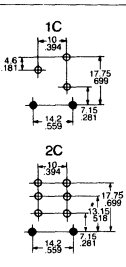
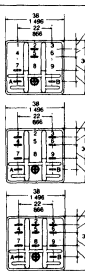
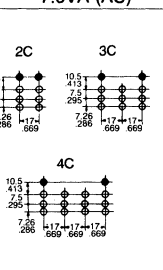
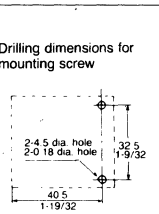
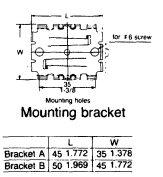
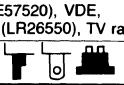
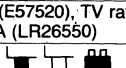
Miniature Power	Compact Power	10 Amp Power	20 Amp Power	Polarized High Power Relay	Heavy Duty Power
HC-RELAY	**HL-RELAY**	**HP-RELAY**	**HG-RELAY**	**PC-5 RELAY**	**VC-RELAY**
					
• Wide applications • Versatile range • Foot print compatible with competitive types	• Large capacity • Compact size • Foot print compatible with competitive types	• Long life • Foot print compatible with competitive types	• Large capacity 20A	• Direct motor drive by IC output • Surge suppression circuit incorporated • Screw terminals	• Large capacity with Form X contacts • Screw terminals available
●					
Gold-flushed silver alloy	Silver alloy	Silver alloy	Silver-cadmium-oxide	Silver alloy	Silver-cadmium-oxide
					
1C | 2C | 3C | 4C	1C | 2C	1C, 2C, 3C	2C, 3C, 4C	4X, 3X1Y, 2X2Y	1X, 2X, 3X, 4X, 1X1Y, 2X1Y, 2X2Y, 3X1Y
2×10^5	5×10^5	2×10^5	2×10^5	25×10^4	2.5×10^5
(DC) 10^8 (AC) 5×10^7	(DC) 10^8 (AC) 5×10^7	10^7	(DC) 10^6 (AC) 10^7	10^7	10^6
700Vrms	1,000Vrms	(HP31, 32) 1,000Vrms (HP33) 2,000Vrms	2,000Vrms	2,500Vrms	2,500Vrms
700Vrms	1,500Vrms	2,000Vrms	2,000Vrms	—	2,500Vrms
2,000Vrms	2,000Vrms	2,000Vrms	2,000Vrms	—	2,500Vrms
—	—	—	—	—	—
(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 220/240 V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 220/240 V		(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V	(DC) 12, 24V	(AC) 24, 48, 110, 120, 220, 240V (DC) 12, 24, 48V
(DC) 0.9W (AC) 1.2VA	(DC) 0.9 to 1.0W (AC) 1.2 to 1.3VA	(DC) 1.5W (AC) 2.0VA	(2C) 1.4W (DC) 3.6VA (AC) (3C) 1.6W (DC) 5.2VA (AC) (4C) 2.0W (DC) 7.6VA (AC)	500mW	5.0 to 6.6VA
					 L W Bracket A 45 1.772 35 1.378 Bracket B 50 1.969 45 1.772
UL (E57520), VDE, CSA (LR26550), TV rating	UL (E57520), TV rating CSA (LR26550)	UL (E57520), VDE, CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57520), CSA (LR52199-6)	UL (E57520), VDE, CSA (LR26550), TÜV
				—	—

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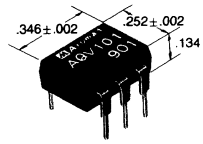
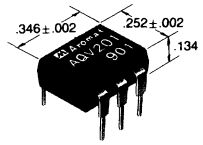
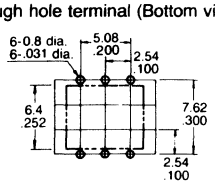
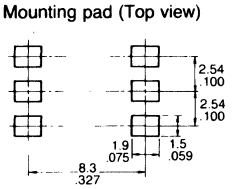
			PhotoMOS Relay							
			AQV10 Type				AQV20 Type			
			DC Type				AC/DC Type			
• Type of relay										
• Packing style			• Low on-resistance • Control with an input current of 10 mA							
• Output	Load voltage*	Peak AC	—	—	—	—	40 V	60 V	250 V	400 V
		DC	40 V	60 V	250 V	400 V	40 V	60 V	250 V	400 V
	Continuous load current	1 A								
		0.5 A	0.6 A	0.5 A	0.2 A	0.15 A	0.4 A	0.35 A	0.15 A	0.1 A
	Peak load current		1.8 A	1.5 A	0.6 A	0.5 A	1.8 A	1.5 A	0.6 A	0.5 A
	Power dissipation*		180 mW				180 mW			
	ON resistance	Typical	0.3 Ω	0.37 Ω	2.7 Ω	6.3 Ω	0.6 Ω	0.74 Ω	5.5 Ω	12.4 Ω
		Maximum	0.5 Ω	0.7 Ω	4 Ω	8 Ω	1 Ω	1.4 Ω	8 Ω	16 Ω
	Off state leakage current		Max. 1 μA				Max. 1 μA			
• Input	LED forward current*		50 mA				50 mA			
	LED reverse voltage*		6 V				6 V			
	Peak forward current		1 A				1 A			
	Power dissipation*		150 mW				150 mW			
	LED operate current	Typical	2.3 mA				2.4 mA			
		Maximum	5 mA				5 mA			
	LED turn off current	Minimum	0.8 mA				0.8 mA			
		Typical	2.2 mA				2.2 mA			
	LED dropout voltage	Typical	2.3 V				2.3 V			
		Maximum	3 V				3 V			
• Switching speed	Turn on time	Typical	0.23 msec.	0.22 msec.	0.13 msec.	0.09 msec.	0.38 msec.	0.41 msec.	0.21 msec.	0.18 msec.
		Maximum	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.
	Turn off time	Typical	0.07 msec.	0.07 msec.	0.07 msec.	0.08 msec.	0.08 msec.	0.08 msec.	0.07 msec.	0.07 msec.
		Maximum	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.
• Total power dissipation*			210 mW				210 mW			
• I/O isolation voltage*			1,500 V AC				1,500 V AC			
• Temperature limits	Operating*		−20°C to +80°C −4°F to +176°F				−20°C to +80°C −4°F to +176°F			
	Storage*		−40°C to +100°C −40°F to +212°F				−40°C to +100°C −40°F to +212°F			
• I/O capacitance	Typical		1.3 pF				1.3 pF			
	Maximum		3 pF				3 pF			
• Initial I/O isolation resistance			1,000 MΩ (min.)				1,000 MΩ (min.)			
• Terminal layout (.100, inch grid)			Through hole terminal (Bottom view)  Tolerance: ±0.1 ±.004				Surface mount terminal Mounting pad (Top view)  			
• Standards			UL (E57521), CSA (LR26550)							
• Mounting method										

*The values are absolute maximum ratings (25°C 77°F).

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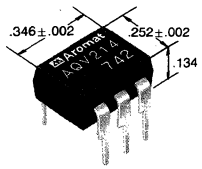
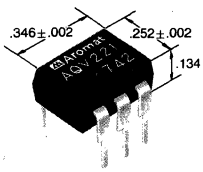
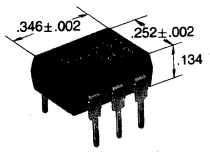
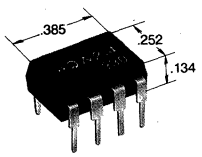
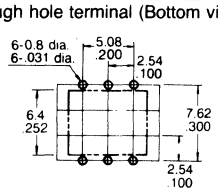
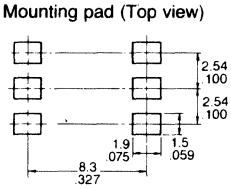
AC/DC Type

AQV21 Types	AQV22 Types		AQV23 Types	AQW21 Types
				
• High sensitivity (input current of 5 mA)	• For high frequency applications • Low "off state" leakage current		• Highest sensitivity LED operate current: typical 0.31 mA	• Approx. 1/2 smaller compared with proximity mounting of two 1 Form A units • Applicable to 2 Form A uses
400 V	40 V	80 V	400 V	400 V
400 V	40 V	80 V	400 V	400 V
0.1 A	0.08 A	0.05 A	0.12 A	0.1 A
0.3 A	0.18 A	0.15 A	0.3 A	0.3 A
500 mW	230 mW		500 mW	800 mW
30 Ω 50 Ω	22 Ω 35 Ω	36 Ω 50 Ω	30 Ω 50 Ω	30 Ω 50 Ω
Max. 1 μA	Max. 10 nA		Max. 1 μA	Max. 1 μA
50 mA	50 mA		50 mA	50 mA
3 V	3 V		3 V	3 V
1 A	1 A		1 A	1 A
75 mW	75 mW		75 mW	75 mW
1 mA 3 mA	0.9 mA 3 mA		0.31 mA 0.5 mA	1 mA 3 mA
0.4 mA 0.79 mA	0.4 mA 0.85 mA		0.1 mA 0.29 mA	0.4 mA 0.79 mA
1.25 V 1.5 V	1.25 V 1.5 V		1.1 V 1.5 V	1.14 V 1.5 V
0.21 msec. 0.5 msec.	0.10 msec. 0.3 msec.		0.89 msec. 0.5 msec.	0.21 msec. 0.5 msec.
0.05 msec. 0.2 msec.	0.03 msec. 0.1 msec.		0.22 msec. 1 msec.	0.05 msec. 0.2 msec.
550 mW	280 mW		550 mW	850 mW
1,500 V AC	1,500 V AC		1,500 V AC	1,500 V AC
−20°C to +80°C −4°F to +176°F	−20°C to +80°C −4°F to +176°F		−20°C to +80°C −4°F to +176°F	−20°C to +80°C −4°F to +176°F
−40°C to +100°C −40°F to +212°F	−40°C to +100°C −40°F to +212°F		−40°C to +100°C −40°F to +212°F	−40°C to +100°C −40°F to +212°F
0.8 pF 1.5 pF	0.8 pF 1.5 pF		0.8 pF 1.5 pF	0.8 pF 1.5 pF
1,000 MΩ (min.)	1,000 MΩ (min.)		1,000 MΩ (min.)	1,000 MΩ

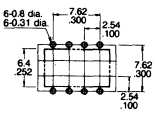
Through hole terminal (Bottom view)



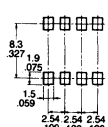
Surface mount terminal
Mounting pad (Top view)



PC board pattern (Bottom view)



Mounting pad (Top view)



UL (E57521), CSA (LR26550)

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

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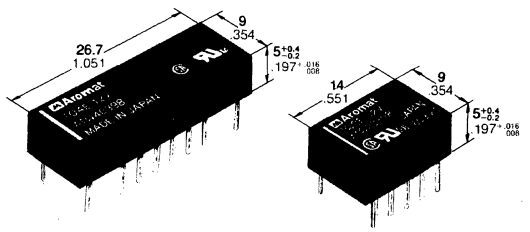


mm inch

FEATURES

- **Ultra-small size**
- **High sensitivity:**
  2 Form C; 140mW power consumption (single side stable type)
  4 Form C; 280mW power consumption (single side stable type)
- **Surge voltage withstand: 1500V FCC Part 68**
- **Sealed construction allows automatic washing.**
- **Self-clinching terminal also available.**
- **UL/CSA recognized.**

SPECIFICATIONS

Contact

Arrangement			2 Form C, 4 Form C
Initial contact resistance, max. (By voltage drop 6V DC 1A)			50mΩ
Contact material			Gold-clad silver
Rating	Max. switching power		30W, 62.5VA (resistive load)
	Max. switching voltage		110V DC, 125V AC
	Max. switching current		1A
	Min. switching capability		10μA, 10mV DC
UL/CSA rating			1A 30V DC 0.3A 110V DC 0.5A 125V AC
Expected life (min. operations)	Mechanical (at 180cpm)		10^8
	Electrical (at 20cpm)	1A 30V DC resistive	2×10^5
		0.5A 125V AC resistive	10^5

Characteristics (at 20°C 68°F)

Max. operating speed (at rated load)		20cpm
Operate time (at nominal voltage)		Approx. 2msec.
Release time (at nominal voltage)		Approx. 1msec.
Set time (latching) (at nominal voltage)		Approx. 2msec.
Reset time (latching) (at nominal voltage)		Approx. 2msec.
Initial breakdown voltage	Between open contacts	750Vrms for 1 min.
	Between contact sets	1,000Vrms for 1 min.
	Between contact and coil	1,000Vrms for 1 min.
FCC surge voltage between open contacts		1,500V
Initial insulation resistance		Min. 1,000MΩ (at 500V DC)
Temperature rise (at nominal voltage)		Max. 50 deg.
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance	Functional	50G
	Destructive	100G
Vibration resistance	Functional	18G, 10 to 55Hz at double amplitude of 3mm
	Destructive	30G, 10 to 55Hz at double amplitude of 5mm
Unit weight		2 Form C: Approx. 1.5g .053oz. 4 Form C: Approx. 3g .106oz.

TYPES AND COIL DATA (at 20°C 68°F)

1. 2 Form C type

Operating function	Part number	Nominal voltage, V DC	Pick-up/set voltage, V DC (max.)	Coil resistance, Ω (±10%)		Nominal operating power, mW	
				Set coil	Reset coil	Set coil	Reset coil
Single side stable	TQ2E-3V	3	2.25	64.3		140	
	TQ2E-4.5V	4.5	3.38	144.6		140	
	TQ2E-5V	5	3.75	178		140	
	TQ2E-6V	6	4.5	257		140	
	TQ2E-9V	9	6.75	579		140	
	TQ2E-12V	12	9	1,028		140	
	TQ2E-24V	24	18	2,880		200	
1 coil latching	TQ2E-L-3V	3	2.25	90		100	
	TQ2E-L-4.5V	4.5	3.38	202.5		100	
	TQ2E-L-5V	5	3.75	250		100	
	TQ2E-L-6V	6	4.5	360		100	
	TQ2E-L-9V	9	6.75	810		100	
	TQ2E-L-12V	12	9	1,440		100	
	TQ2E-L-24V	24	18	3,840		150	
2 coil latching	TQ2E-L2-3V	3	2.25	45	45	200	200
	TQ2E-L2-4.5V	4.5	3.38	101.2	101.2	200	200
	TQ2E-L2-5V	5	3.75	125	125	200	200
	TQ2E-L2-6V	6	4.5	180	180	200	200
	TQ2E-L2-9V	9	6.75	405	405	200	200
	TQ2E-L2-12V	12	9	720	720	200	200
	TQ2E-L2-24V	24	18	1,920	1,920	300	300

2. 4 Form C type

Operating function	Part number	Nominal voltage, V DC	Pick-up/set voltage, V DC (max.)	Coil resistance, Ω (±10%)		Nominal operating power, mW	
				Set coil	Reset coil	Set coil	Reset coil
Single side stable	TQ4E-3V	3	2.25	32		280	
	TQ4E-4.5V	4.5	3.38	72.3		280	
	TQ4E-5V	5	3.75	89		280	
	TQ4E-6V	6	4.5	129		280	
	TQ4E-9V	9	6.75	289		280	
	TQ4E-12V	12	9	514		280	
	TQ4E-24V	24	18	2,056		280	
1 coil latching	TQ4E-L-3V	3	2.25	45		200	
	TQ4E-L-4.5V	4.5	3.38	101.2		200	
	TQ4E-L-5V	5	3.75	125		200	
	TQ4E-L-6V	6	4.5	180		200	
	TQ4E-L-9V	9	6.75	405		200	
	TQ4E-L-12V	12	9	720		200	
	TQ4E-L-24V	24	18	2,880		200	
2 coil latching	TQ4E-L2-3V	3	2.25	22.5	22.5	400	400
	TQ4E-L2-4.5V	4.5	3.38	50.6	50.6	400	400
	TQ4E-L2-5V	5	3.75	62.5	62.5	400	400
	TQ4E-L2-6V	6	4.5	90	90	400	400
	TQ4E-L2-9V	9	6.75	202.5	202.5	400	400
	TQ4E-L2-12V	12	9	360	360	400	400
	TQ4E-L2-24V	24	18	1,440	1,440	400	400

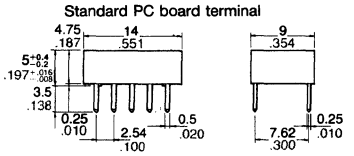
Notes: 1. Please add "H" for self-clinching terminal types as TQ4EH-L-3V, TQ2EH-L-24V.
2. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
3. Please note the following: the drop-out voltage; min. 10% of nominal voltage, the reset voltage; max. 75% of nominal voltage.
4. Standard packing: Tube:50pcs Case:1,000pcs

DIMENSIONS

mm inch

2 Form C

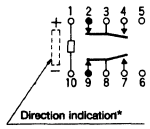
Standard PC board terminal



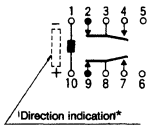
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

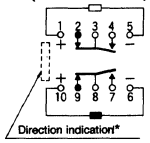
- Single side stable (Deenergized condition)



- 1-coil latching (Reset condition)

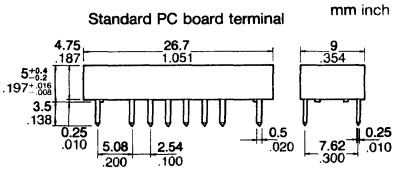


- 2-coil latching (Reset condition)



4 Form C

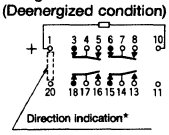
Standard PC board terminal



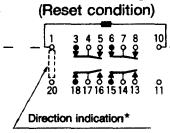
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

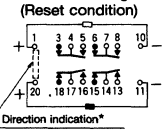
- Single side stable (Deenergized condition)



- 1-coil latching (Reset condition)



- 2-coil latching (Reset condition)



*Orientation stripe located on top of relay

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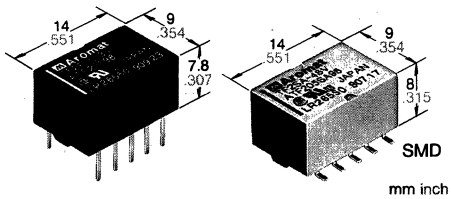
TF-RELAYS



FEATURES

- **High sensitivity:**
  Nominal operating power; 80mW (Single side stable 3-12V type)
- **Surge voltage withstand: 1500V FCC Part 68**
- **Minimal magnetic interference allows high density mounting.**
- **Sealed construction allows automatic washing.**
- **Self-clinching terminal also available.**
- **UL/CSA recognized.**

SPECIFICATIONS

Contact

			Standard PC board terminal type, Self-clinching terminal type	Surface-mount terminal type
Arrangement			2 Form C	
Initial contact resistance, max. (By voltage drop 6V DC 1A)			50mΩ	60mΩ
Contact material			Gold-clad silver	Gold-clad silver palladium
Rating	Max. switching power		30W, 62.5VA	
	Max. switching voltage		110V DC, 125V AC	
	Max. switching current		1A	
	Min. switching capacity		10μA, 10mV DC	
UL rating			1A 30V DC, 0.3A 110V DC	
CSA rating			1A 30V DC, 0.5A 125V AC	
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8	5×10^7 (Single side stable type 3-24V DC) 10^7 (Single side stable type 48V DC, Laching type)
	Electrical (at 20cpm)	1A 30V DC resistive	2×10^5	
		0.5A 125V AC resistive	10^5	

Characteristics

Max. operating speed (at rated load)		20cpm
Operate time (at nominal voltage)		Approx. 2msec.
Release time (at nominal voltage)		Approx. 1msec.
Set time (latching) (at nominal voltage)		Approx. 2msec.
Reset time (latching) (at nominal voltage)		Approx. 2msec.
Initial breakdown voltage	Between open contacts	750Vrms for 1 min.
	Between contact sets	1,000Vrms for 1 min.
	Between contact and coil	1,000Vrms for 1 min.
FCC surge voltage between open contacts		1,500V
Initial insulation resistance		Min. 1,000MΩ (at 500V DC)
Temperature rise (at nominal voltage)		Max. 50 deg.
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance	Functional	Min. 50G
	Destructive	Min. 100G
Vibration resistance	Functional	18G, 10 to 55Hz at double amplitude of 3mm
	Destructive	30G, 10 to 55Hz at double amplitude of 5mm
Unit weight		Approx. 2g .071oz.

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard PC board terminal type

Operating function	Part number	Nominal voltage, V DC	Pick-up/set voltage V DC (max.)	Coil resistance, Ω (±10%)	Nominal operating power, mW
Single side stable	TF2E-3V	3	2.25	112.5	80
	TF2E-4.5V	4.5	3.38	253	80
	TF2E-5V	5	3.75	312.5	80
	TF2E-6V	6	4.5	450	80
	TF2E-9V	9	6.75	1,012.5	80
	TF2E-12V	12	9	1,800	80
	TF2E-24V	24	18	4,100	140
	TF2E-48V	48	36	8,860	260
1 coil latching	TF2E-L-3V	3	2.25	163.6	55
	TF2E-L-4.5V	4.5	3.38	368.2	55
	TF2E-L-5V	5	3.75	454.5	55
	TF2E-L-6V	6	4.5	654.5	55
	TF2E-L-9V	9	6.75	1,472	55
	TF2E-L-12V	12	9	2,618	55
	TF2E-L-24V	24	18	5,760	100
2 coil latching	TF2E-L2-3V	3	2.25	81.8	110
	TF2E-L2-4.5V	4.5	3.38	184.1	110
	TF2E-L2-5V	5	3.75	227.3	110
	TF2E-L2-6V	6	4.5	327.3	110
	TF2E-L2-9V	9	6.75	736.4	110
	TF2E-L2-12V	12	9	1,309	110
	TF2E-L2-24V	24	18	2,880	200

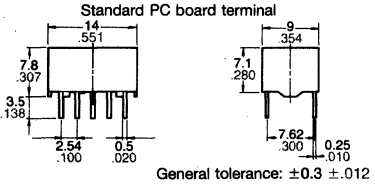
2. Surface-mount terminal type

Operating function	Part number	Nominal voltage, V DC	Pick-up/set voltage V DC (max.)	Coil resistance, Ω (±10%)	Nominal operating power, mW
Single side stable	TF2SA-3V	3	2.25	64.2	140
	TF2SA-4.5V	4.5	3.38	144.6	140
	TF2SA-5V	5	3.75	178.5	140
	TF2SA-6V	6	4.5	257.1	140
	TF2SA-9V	9	6.75	578.5	140
	TF2SA-12V	12	9	1,028	140
	TF2SA-24V	24	18	4,100	140
	TF2SA-48V	48	36	8,860	260
1 coil latching	TF2SA-L-3V	3	2.25	112.5	80
	TF2SA-L-4.5V	4.5	3.38	253	80
	TF2SA-L-5V	5	3.75	312.5	80
	TF2SA-L-6V	6	4.5	450	80
	TF2SA-L-9V	9	6.75	1,012	80
	TF2SA-L-12V	12	9	1,800	80
	TF2SA-L-24V	24	18	5,760	100
2 coil latching	TF2SA-L2-3V	3	2.25	56	160
	TF2SA-L2-4.5V	4.5	3.38	126	160
	TF2SA-L2-5V	5	3.75	156	160
	TF2SA-L2-6V	6	4.5	225	160
	TF2SA-L2-9V	9	6.75	506	160
	TF2SA-L2-12V	12	9	900	160
	TF2SA-L2-24V	24	18	2,870	200

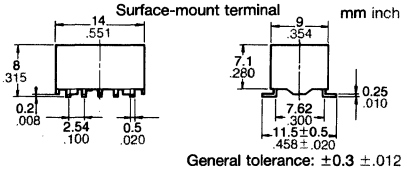
Notes: 1. Please add "H" for self-clinching terminal types as TF2E-H-3V, TF2E-L2-H-5V.
2. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
3. Please note the following: the drop-out voltage; min. 10% of nominal voltage, the reset voltage; max. 75% of nominal voltage.
4. Standard packing: Tube:50pcs Case:1,000pcs

DIMENSIONS

Standard PC board terminal

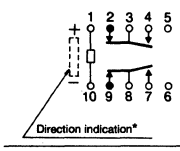


Surface-mount terminal mm inch

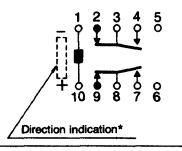


Schematic (Bottom view) General tolerance: ±0.3 ±.012

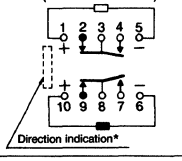
Single side stable (Deenergized condition)



1-coil latching (Reset condition)

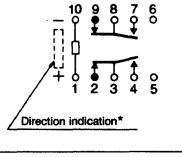


2-coil latching (Reset condition)

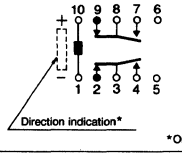


Schematic (Top view) General tolerance: ±0.3 ±.012

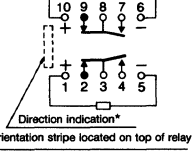
Single side stable (Deenergized condition)



1-coil latching (Reset condition)



2-coil latching (Reset condition)



*Orientation stripe located on top of relay

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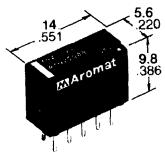


mm inch

FEATURES

- **Ultra-slim size for minimal PC board mounting requirements.**
- **Small header area makes higher density packaging possible.**
- **High sensitivity: 140mW nominal operating power**
- **Surge voltage withstand: 1500V FCC Part 68**
- **Sealed construction allows automatic cleaning.**
- **Self-clinching terminal also available**
- **UL/CSA recognized.**

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6V 1A)			60mΩ
Contact material			Gold-clad silver
Rating (resistive load)	Max. switching power		30W, 62.5VA
	Max. switching voltage		110V DC, 125V AC
	Max. switching current		1A
	Min. switching capability		10μA, 10mV DC
UL/CSA rating			1A 30V DC 0.5A 125V AC 0.3A 110V DC
Expected life (min. operations)	Mechanical (at 180cpm)		10^8
	Electrical (at 20cpm)	1A 30V DC resistive	2×10^5
		0.5A 125V AC resistive	10^5

Characteristics

Max. operating speed (at rated load)		20cpm
Operate time (at nominal voltage)		Approx. 2msec.
Release time (at nominal voltage)		Approx. 1msec.
Set time (latching) (at nominal voltage)		Approx. 2msec.
Reset time (latching) (at nominal voltage)		Approx. 2msec.
Initial breakdown voltage	Between open contacts	750Vrms for 1 min.
	Between contact sets	1,000Vrms for 1 min.
	Between contact and coil	1,000Vrms for 1 min.
FCC surge voltage between open contacts		1,500V
Initial insulation resistance		Min. 1,000MΩ (at 500V DC)
Temperature rise (at nominal voltage)		Max. 50 deg.
Ambient temperature		−40°C to +70°C −40°F to +158°F
Shock resistance	Functional	50G
	Destructive	100G
Vibration resistance	Functional	18G, 10 to 55Hz at double amplitude of 3mm
	Destructive	30G, 10 to 55Hz at double amplitude of 5mm
Unit weight		Approx. 1.5g .053oz.

TYPES AND COIL DATA (at 20°C 68°F)

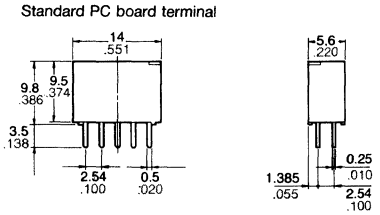
Operating function	Part number	Nominal voltage, V DC	Pick-up/set voltage, V DC (max.)	Coil resistance, Ω (±10%)	Nominal operating power, mW
Single side stable	TN2E-3V	3	2.25	64.3	140
	TN2E-4.5V	4.5	3.38	145	140
	TN2E-5V	5	3.75	178	140
	TN2E-6V	6	4.5	257	140
	TN2E-9V	9	6.75	579	140
	TN2E-12V	12	9	1,028	140
	TN2E-24V	24	18	2,880	200
1 coil latching	TN2E-L-3V	3	2.25	90	100
	TN2E-L-4.5V	4.5	3.38	203	100
	TN2E-L-5V	5	3.75	250	100
	TN2E-L-6V	6	4.5	360	100
	TN2E-L-9V	9	6.75	810	100
	TN2E-L-12V	12	9	1,440	100
	TN2E-L-24V	24	18	3,840	150
2 coil latching	TN2E-L2-3V	3	2.25	45	200
	TN2E-L2-4.5V	4.5	3.38	101	200
	TN2E-L2-5V	5	3.75	125	200
	TN2E-L2-6V	6	4.5	180	200
	TN2E-L2-9V	9	6.75	405	200
	TN2E-L2-12V	12	9	720	200
	TN2E-L2-24V	24	18	1,920	300

Notes: 1. Please add "H" for self-clinching terminal types as TN2E-L-H-12V.
2. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
3. Please note the following: the drop-out voltage; min. 10% of nominal voltage, the reset voltage; max. 75% of nominal voltage.
4. Standard packing: Tube:50pcs Case:1,000pcs

DIMENSIONS

mm inch

Standard PC board terminal



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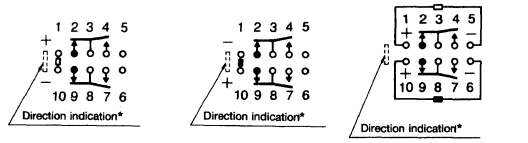
- 1-coil latching (Reset condition)
- 2-coil latching (Reset condition)



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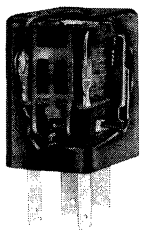
Quabbin

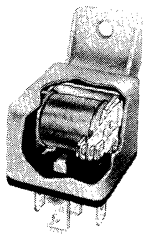
P&B POTTER & BRUMFIELD

BOSCH Relays

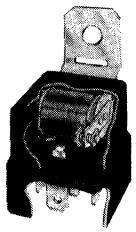
The Mini-Giants®



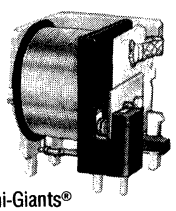
The Mini-Giants®
Micro Relays



The Mini-Giants®
Electrical Relays



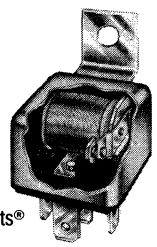
The Skirted
Mini-Giants®
Electrical Relays



The Mini-Giants®
Printed Circuit Board Relays



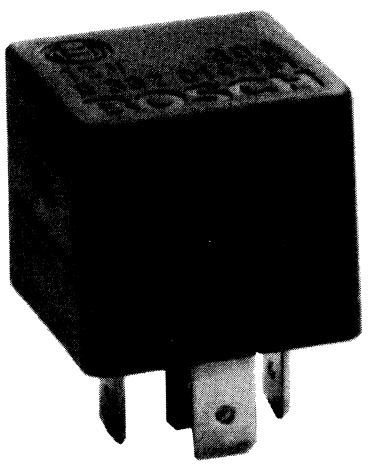
The Sealed Skirted
Mini-Giants® Electrical
Relays



The Mini-Giants®
Metal Cap
Electrical Relays

PART NUMBER	VOLT-AGE	DESCRIPTION	N.O. Contact		N.C. Contact		Switching Cycles			
			Resistive Load	Motor Load	Resistive Load	Motor Load	Resistive Load N.O.	Resistive Load N.C.	Motor Load N.O.	Motor Load N.C.
0 332 017 102	12V	SPST W/BRACKET	20A	20A	—	—	100,000	—	50,000	—
0 332 207 101	12V	SPST W/BRACKET	20A	20A	10A	10A	100,000	100,000	50,000	50,000
0 332 207 105	12V	SPDT PCS MOUNT	20A	20A	10A	10A	100,000	100,000	50,000	50,000
0 332 204 184	12V	SPDT W/RESISTOR W/BRACKET	30A	15A	20A	15A	100,000	50,000	100,000	50,000
0 332 014 150	12V	SPST W/BRACKET	30A	15A	—	—	50,000	—	50,000	—
0 332 204 150	12V	SPDT W/BRACKET	30A	15A	20A	15A	50,000	50,000	50,000	50,000
0 332 204 159	12V	SPDT W/RESISTOR (GMC)	30A	15A	20A	15A	100,000	50,000	100,000	50,000
0 332 204 171	12V	SPDT W/RESISTOR 65 OHM COIL W/BRACKET (GMC)	30A	15A	20A	15A	100,000	50,000	50,000	50,000
0 332 016 102	12V	SPST	15A	12A	—	—	250,000	—	100,000	—
0 332 206 101	12V	SPDT	15A	12A	10A	8A	250,000	100,000	250,000	100,000
0 332 206 106	12V	SPDT	30A	24A	10A	8A	50,000	50,000	250,000	50,000
0 332 204 164	12V	SPDT PCB MOUNT	30A	15A	20A	15A	100,000	50,000	100,000	100,000
0 332 014 125	12V	SPST W/BRACKET	30A	24A	—	—	250,000	—	100,000	—
0 332 204 101	12V	SPDT	30A	24A	20A	16A	250,000	250,000	100,000	100,000

Bosch, The Right Relay 99.999% Of The Time



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CP CLARE Corporation

Clare-ification Chart Electromagnetic Relays & Reed Switches

RELAYS FORM A, B

Product Name	Contact Form	Contact Material	Maxiumum Switching Power (VA)	Voltage (VDC)	Current (A)	Nominal Input Power (mW) Reference 5V Version	Operate Time (ms) (Typical)	Life @ Signal (10 VDC, 10 mA) Level Loads (No. Operations)	FCC 68	Approvals (UL, CSA, BSI, Etc.)	Packaged Type
MRBS	1A	RUTHENIUM	5	75	0.15	10	1.30	200×10^6	NO	BSI	METAL
PRMA	1A, 2A, 1B	RUTHENIUM	10	100	0.50	50	0.25	200×10^6	YES	UL, VDE	MOLDED
DSS3	1A	RUTHENIUM	10	100	0.50	63	0.30	200×10^6	NO		PLASTIC
DSS4	1A	RUTHENIUM	10	100	0.50	50	0.25	200×10^6	YES	UL	MOLDED
CUP V	1A, 2A, 1B, 1A1B, 2A2B	RUTHENIUM	10	200	0.75	175	0.45	300×10^6	NO	BSI, PTB	PLASTIC
CUP 1	1A THRU 5A, 1B, 2B	RUTHENIUM	10	200	0.75	73	0.70	300×10^6	NO		PLASTIC
DSS7	1A	RUTHENIUM	10	100	0.50	50	0.25	200×10^6	NO	BSI,VDE	MOLDED
DSS9	1A	RUTHENIUM	10	100	0.50	167	0.40	200×10^6	NO		PLASTIC
PRME	1A	RUTHENIUM	10	100	0.50	50	0.25	200×10^6	NO		MOLDED
MRB	1A, THRU 6A, 1B, 2B	RUTHENIUM	10	200	0.50	111	1.00	200×10^6	NO	UL	METAL
951	1A THRU 5A	RUTHENIUM	10	150	0.75	132	0.50	200×10^6	NO		MOLDED
MSS2	1A	MERCURY	30	350	0.75	178	1.20	200×10^6	YES	VDE	MOLDED
MSS4	1A	MERCURY	30	350	0.75	178	1.20	200×10^6	YES		MOLDED
MSS6	2A	MERCURY	30	350	0.75	312	1.20	200×10^6	YES		PLASTIC
MSS7	1A	MERCURY	30	350	0.75	178	1.20	20×10^6	YES	BSI,VDE	MOLDED
CUP 6	1A THRU 5A, 1B	MERCURY	30	350	0.75	179	2.00	200×10^6	YES		PLASTIC
CUP 5	1A THRU 5A, 1B	MERCURY	30	350	1.00	179	1.60	100×10^6	YES		PLASTIC
MMRB	1A THRU 5A	MERCURY	30	350	0.75	125	1.60	200×10^6	YES		METAL
MRBV	1A, 1B	RUTHENIUM	40	200	1.00	125	2.00	100×10^6	NO		METAL
HRM	1A, 2A	MERCURY	50	350	1.00	75	1.60	1000×10^6	YES		METAL
HRB	1A THRU 6A	MERCURY	50	350	1.00	125	2.00	1000×10^6	YES		METAL
851	1A THRU 5A	MERCURY	50	350	1.00	208	2.00	1000×10^6	YES		MOLDED

RELAYS FORM C

PRMA	1C	RHODIUM	3	100	0.25	125	1.50	20×10^6	NO		MOLDED
922	1C THRU 4C	RHODIUM	3	28	0.25	125	2.00	20×10^6	NO		METAL
HGZM	1C, 2C	MERCURY	50	350	1.00	568	2.50	100×10^6	YES		PLASTIC
LX	2C	SILVER-PD, GOLD	60	220	2.00	200	2.00	100×10^6	YES	UL, CSA	PLASTIC
LM44	2C	SILVER-PD, GOLD	30	125	2.00	400	3.00	10×10^6	YES	UL, CSA	PLASTIC
LA	4C	SILVER-PD, GOLD	30	100	1.00	1100	15.00	100×10^6	YES		PLASTIC
LB/LBP	6C	SILVER-PD, GOLD	30	100	1.00	1100	15.00	100×10^6	YES		PLASTIC
LC	12A, 6B6C	SILVER-PD, GOLD	30	100	1.00	1100	15.00	100×10^6	YES		PLASTIC
MHC	1C, 2C	MERCURY	50	350	1.00	161	2.00	1000×10^6	YES		PLASTIC
HGJM	1C, 2C	MERCURY	100	500	2.00	200	1.00	2000×10^6	YES	UL	METAL
HGWM	1C, 2C, 1D, 2D	MERCURY	100	500	2.00	213	1.00	2000×10^6	YES		METAL
HGRM	1C, 2C, 1D, 2D	MERCURY	100	500	2.00	357	1.75	2000×10^6	YES	UL	METAL
HGSM	1C, 2C, 1D, 2D	MERCURY	100	500	2.00	290	1.75	2000×10^6	YES		METAL
HGSR	1C, 1D	MERCURY	100	500	2.00	357	1.75	2000×10^6	YES		METAL
HGM	1D, 2D	MERCURY	250	500	5.00	2100	3.00	2000×10^6	YES		METAL
HG	1D, 2D	MERCURY	250	500	5.00	625	3.00	2000×10^6	YES		METAL

REED SWITCHES

Product Name	Contact Form	Contact Material	Maxiumum Switching Power (VA)	Voltage (VDC)	Current (A)	Nominal Input Power (mW) Reference 5V Version	Operate Time (ms) (Typical)	Life @ Signal (10 VDC, 10 mA) Level Loads (No. Operations)	FCC 68	Approvals (UL, CSA, BSI, Etc.)	Packaged Type
FR 2	1A	RUTHENIUM	10	200	0.50	10-40 OP NI	0.50	200×10^6			GLASS
MA 1	1A	MERCURY	30	350	0.75	30-70 OP NI	1.00	200×10^6			GLASS
MH 2	1A	MERCURY	50	350	1.00	30-65 OP NI	1.00	1000×10^6			GLASS
HGZ	1C	MERCURY	50	350	1.00	35-70 OP NI	2.50	1000×10^6			GLASS
HG W	1C	MERCURY	100	500	2.00	60 NI MAX	1.00	2000×10^6			GLASS
HG 1	1D	MERCURY	250	500	5.00	120-180 OP NI	3.00	2000×10^6			GLASS

SALES OFFICES

CP CLARE CORPORATION
Theta J Solid State Division
Wakefield, MA.
TEL: 617-246-4000
FAX: 617-246-1356

CP CLARE CORPORATION
El Toro, CA.
TEL: 714-586-0650
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CP CLARE CORPORATION
Chicago, IL.
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CP CLARE CORPORATION
Hicksville, L.I., N.Y.
TEL: 516-933-3645
FAX: 516-433-4412

CP CLARE Of Canada, Ltd
Toronto, Ontario, Canada
TEL: 416-336-1644
FAX: 416-336-8854

CP CLARE Corporation

Theta J. Solid State Division

Clare·ification Chart Solid State Relays

Product Name	Contact Form	Output Switch Device	Typical Output Characteristics			Typical Control Characteristics (mA)	Typical Operate Time (mS)	I/O Isolation Type (Vrms)	FCC 68	Approvals (UL, CSA, BSI, Etc.)	Package Type
			Blocking Voltage	Load Current (A)	On-Resistance (Ohms)						
AC/DC SWITCHES											
LCA	1A, 2A	MOS FET	400	.170	20	2	1	2500	YES	UL, BABT	6 PIN, 8 PIN
XCA	1A, 2A	MOS FET	300	.100	25	5	1	2500	YES	UL, BABT	6 PIN, 8 PIN
OMA	1A, 2A	MOS FET	300	.100	25	10	2	1500	YES	UL, BABT	6 PIN, 8 PIN
LCB	1B, 2B	MOS FET	350	.120	20	2	1	2500	YES	UL, BABT	6 PIN, 8 PIN
LAA	2A	MOS FET	350	.170	20	2	1	2500	YES	UL, BABT	8 PIN
LBB	2B	MOS FET	350	.170	20	2	1	2500	YES	UL, BABT	8 PIN
LCC	1C	MOS FET	350	.170	20	5	1	2500	YES	UL, BABT	8 PIN
LBA	1A, 1B	MOS FET	350	.170	20	2	1	2500	YES	UL, BABT	8 PIN DIP
AC POWER SWITCHES											
PM	1A	SCR	600	.500	N/A	2	8.3	2500	N/A	UL, VDE	6 PIN DIP
PD	1A	SCR	600	1	N/A	2	8.3	2500	N/A	UL, VDE	16 PIN DIP
PS	1A	SCR	600	1	N/A	2	8.3	2500	N/A	UL, VDE	8 PIN SIP
OF'02	1A	SCR	600	1.5	N/A	10	8.3	4000	N/A	UL	PLASTIC
OF'05D	1A	TRIAC	600	3	N/A	10	8.3	4000	N/A	UL	PLASTIC
MX	1A	TRIAC	600	1	N/A	10	32	2500	N/A	UL, CSA	PLASTIC
JT	1A	TRIAC	600	10	N/A	10	32	2500	N/A	UL, CSA	PLASTIC
OF'05	1A	TRIAC	600	5	N/A	10	8.3	4000	N/A	UL, CSA	PLASTIC
OF'10	1A	TRIAC	600	10	N/A	10	8.3	4000	N/A	UL, CSA	PLASTIC
SPECIALTY PRODUCTS											
LDA1XX	N/A	TRANSISTOR	50	.100	N/A	6	N/A	2500	YES	UL, BABT	6 PIN DIP
LDA2XX	N/A	TRANSISTOR	50	.100	N/A	6	N/A	2500	YES	UL, BABT	8 PIN DIP
TS	1A, 1B	MOS FET/ TRANSISTOR	350/50	.170/.100	20	2	1	2500	YES	UL, BABT	8 PIN DIP
FDA	N/A	IC	N/A	N/A	N/A	2	1	2500	N/A		8 PIN DIP

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CP CLARE Of Canada, Ltd
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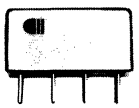
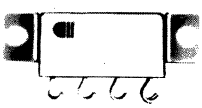
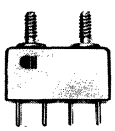
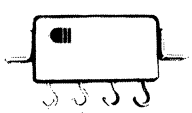
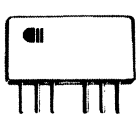
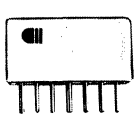
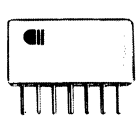
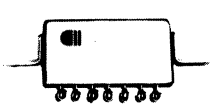
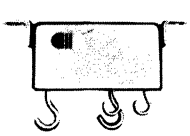
Military Grade/Half Size Relays

RELAY	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
 **HFW** (Standard Sensitivity)	• Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Sensitive version available • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/6 level L, M & P (Request Brochure Half Size 1-91)
 **HFW4A** (4 Amp Rating)	• Low Level to 4.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-39016 (Request Brochure Half Size 1-91)
 **HMS** (Sensitive Series)	• Low Level to 2.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 36.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Energy-saving 100/125 milliwatt sensitivity • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/44 level L, M & P (Request Brochure Half Size 1-91)
 **HMB** (Bifilar Coil)	• Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Bifilar transient suppression • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/22 level L, M & P (Request Brochure Half Size 1-91)
 **LS** (2 Pole Latching)	• Low Level to 2.0 Amps • 2 Form C, (DPDT)	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Single or dual latch version • Excellent RF switching • Qualified to MIL-R-39016/45 level L, M (Request Brochure Half Size 1-91)
 **LR** (4 Pole Latching)	• Low Level to 2.0 Amps • 4 Form C (4PDT)	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Four pole design • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-39016 (Request Brochure Half Size 1-91)
 **SR** (4 Pole Version)	• Low Level to 2.0 Amps • 4 Form C (4PDT)	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Four pole design • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/40 level L, M (Request Brochure Half Size 1-91)
 **SS** (6 Pole Version)	• Low Level to 2.0 Amps • 6 Form C, (6PDT)	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Six pole hi-density design • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-39016 (Request Brochure Half Size 1-91)
 **C-10 AMP** (10 Amp Series)	• Low Level to 10 Amps • 1 Form C, (SPDT)	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Unique hi-current design package • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-39016 (Request Brochure Half Size 1-91)

SIZE (Case Size): H-.410 (10.41) D-.410 (10.41) & W-.810 (20.57)

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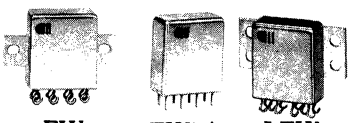
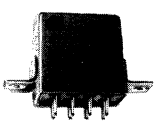
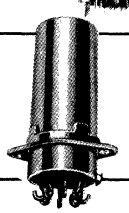
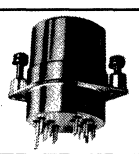
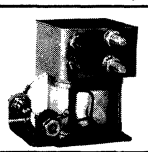
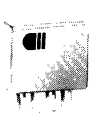
Military Grade/Full Size Relays

RELAY	SIZE (Case Size)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
 **FW** (3 Amp Series) **FW5A** (5 Amp Version) **LFW** (Latching Series)	H- .875 (22.23) * D- .400 (10.16) W- .800 (20.32)	FW & LFW • Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A FW5A • Low Level to 5.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6.3 to 110.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Sensitive version available (FW only) • Excellent RF switching • Ambient temp rating -65° to +125°C • One and two coil operation (LFW only) • Qualified to 5757/10 (FW only) (Request Data Sheet FW6-89)

Military Grade/Other Relays

PF 10 Amp Power Relay 	H- 1.300 (33.02) D- .515 (13.08) W- 1.075 (27.31)	• Low Level to 10.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6.0 to 115.0 VDC	• Welded, hermetically sealed enclosures • Very low contact resistance • Package volume .72 cubic inch • Excellent RF switching • Ambient temp rating -65°C to + 125°C • Designed to MIL-R-5757/23 & 28 (Request Data Sheet PF-85)
 **07**	H- 1.000 (25.40) D- .515 (13.08) W- 1.015 (25.78)	• Low Level to 10.0 Amps • 2 Form C	6.0 to 120.0 VDC or 115.0 VAC 60/400 Hz	• Qualified to MIL-R-5757/23 & MIL-R-6106 (MS27245 & MS27247) • 10 Amp contact rating • DC & AC coils
RD 4&6 Pole Relays 	H- 1.34 (34.04) D- 1.14 (28.96) W- 1.06 (26.92)	• Low Level to 2.0 Amps • 4 Form C, 6 Form C	26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Welded construction • 100 G Shock. • Ambient temp rating -65°C to + 125°C • Qualified to MIL-R-5757/1 & 7 (Request Data Sheet RD-83)
 **02**	H- 1.575 (40.01) D- .718 (18.24) W- 1.062 (26.97)	• Low Level to 2.0 Amps • 2 Form C	6.0 to 50.0 VDC	• Compact 2 pole design • Military construction • Hermetically sealed
03 	H- 1.407 (35.74) D- 1.320 (33.53) W- 1.843 (46.81)	• Low Level to 2.0 Amps • 6 Form C	6.0 to 48.0 VDC	• Efficient 6 pole design • Military construction • Hermetically sealed
82 	H- 3.093 (78.56) D- 4.375 (111.13) W- 4.250 (107.95)	• 150.0 Amps • 1 Form X to 4 Form X	6.0 to 120.0 VDC	• 150 Amp contact rating • High power switching • Up to 4 pole contacts • Optional hermetic sealing
SF 40 MW Sensitive Relay 	H- 1.281 (32.54) D- .400 (10.16) W- .800 (20.32)	• Low Level to 2.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	1.8 to 40.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • 40 milliwatt sensitivity • Excellent RF switching • Ambient temp rating -65°C to + 125°C • Designed to MIL-R-5757/13 (Request Data Sheet SF-85)
MFW 1/6th Size Relay 	H- .410 (10.41) D- .230 (5.84) W- .500 (12.70) *mm	• Low Level to 1.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	3.5 to 53.0 VDC	• Hermetically sealed enclosures • Low contact resistance • Total volume only .046 cubic inch • Excellent RF switching • Ambient temp rating -65°C to + 125°C • Qualified to MIL-R-39016/34, L & M level (Request Data Sheet MFW6-88)

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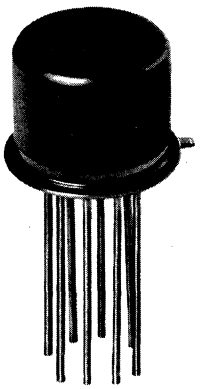
TO-5 Relays



TM Military Relay	TMD Military Relay	HM Commercial Relay	HMD Commercial Relay
• Built in accordance with MIL-R-39016/9	• Built in accordance with MIL-R-39016/15 • QPL Version Pending • Diode Coil Suppression		• Diode Coil Suppression
• 130mW Sensitivity	• 130mW Sensitivity	• 180mW Sensitivity	• 180mW Sensitivity
• -65°C to +125°C	• -65°C to +125°C	• -65°C to +85°C	• -65°C to +85°C
• 30G Vibration	• 30G Vibration	• 10G Vibration	• 10G Vibration
• 75G Shock	• 75G Shock	• 30G Shock	• 30G Shock

CONTACTS

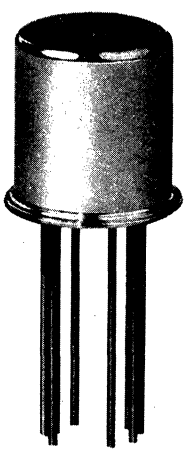
- DC Rating:
  - Resistive — low level to 1 amp / 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

COILS

Nominal Voltage	Coil Resistance
5.0 VDC	50 Ω
6.0 VDC	98 Ω
9.0 VDC	220 Ω
12.0 VDC	390 Ω
18.0 VDC	880 Ω
26.5 VDC	1560 Ω
30.0 VDC	2500 Ω

SIZE

- Diameter:
  - Enclosure (max) — .335 inches (8.51)
  - Base (max) — .370 inches (9.40)
- Height (max): .280 (7.11)
- All welded construction, hermetically sealed



TS Military Relay	TSD Military Relay	HS Commercial Relay	HSD Commercial Relay
• Built in accordance with MIL-R-39016/11 • QPL Version Pending	• Built in accordance with MIL-R-39016/16 • QPL Version Pending • Diode Coil Suppression		• Diode Coil Suppression
• -65°C to +125°C	• -65°C to +125°C	• -65°C to +85°C	• -65°C to +85°C
• 60mW Sensitivity	• 60mW Sensitivity	• 90mW Sensitivity	• 90mW Sensitivity
• 30G Vibration	• 30G Vibration	• 10G Vibration	• 10G Vibration
• 75G Shock	• 75G Shock	• 30G Shock	• 30G Shock

CONTACTS

- DC Rating:
  - Resistive — low level to 1 amp / 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

COILS

Nominal Voltage	Coil Resistance
5.0 VDC	100 Ω
6.0 VDC	200 Ω
9.0 VDC	400 Ω
12.0 VDC	850 Ω
18.0 VDC	1600 Ω
26.5 VDC	3300 Ω
36.0 VDC	6500 Ω
48.0 VDC	11000 Ω

SIZE

- Diameter:
  - Enclosure (max) — .335 inches (8.51)
  - Base (max) — .370 inches (9.40)
- Height (max): .375 (9.53)
- All welded construction, hermetically sealed

Options for all TO-5 Relays

- Terminal Lengths
- Special Coils
- Ground Pins
- Spreader Pads

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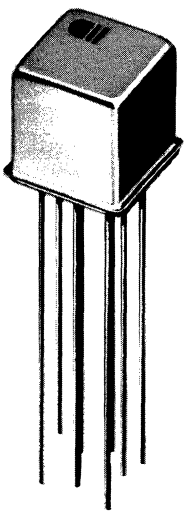
.100 Grid Relays



TC Military Relay	TCD Military Relay	HC Commercial Relay	HCD Commercial Relay
• Built in accordance with MIL-R-39016/17	• Built in accordance with MIL-R-39016/18		
• QPL Version Pending	• QPL Version Pending		
	• Diode Coil Suppression		• Diode Coil Suppression
• -65°C to +125°C	• -65°C to +125°C	• -65°C to +85°C	• -65°C to +85°C
• 130mW Sensitivity	• 130mW Sensitivity	• 180mW Sensitivity	• 180mW Sensitivity
• 30G Vibration	• 30G Vibration	• 10G Vibration	• 10G Vibration
• 75G Shock	• 75G Shock	• 30G Shock	• 30G Shock

CONTACTS

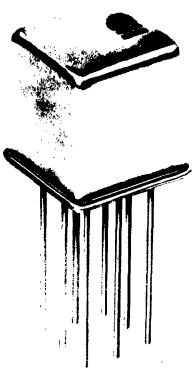
- DC Rating:
  - Resistive — low level to 1 amp / 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

COILS

Nominal Voltage	Coil Resistance TC,TCD	Coil Resistance HC,HCD
5.0 VDC	50 Ω	64 Ω
6.0 VDC	98 Ω	98 Ω
9.0 VDC	220 Ω	220 Ω
12.0 VDC	390 Ω	400 Ω
18.0 VDC	880 Ω	880 Ω
26.5 VDC	1560 Ω	1600 Ω

SIZE

- Width & Depth:
  - Enclosure (sq. max) — .335 inches (8.51)
  - Base (sq. max) — .370 inches (9.40)
- Height (max): .280 (7.11)
- All welded construction, hermetically sealed



TCS Military Relay	TCSD Military Relay	HCS Commercial Relay	HCSD Commercial Relay
• Built in accordance with MIL-R-39016/41	• Built in accordance with MIL-R-39016/42		
• QPL Version Pending	• QPL Version Pending		
	• Diode Coil Suppression		• Diode Coil Suppression
• -65°C to +125°C	• -65°C to +125°C	• -65°C to +85°C	• -65°C to +85°C
• 60mW Sensitivity	• 60mW Sensitivity	• 90mW Sensitivity	• 90mW Sensitivity
• 30G Vibration	• 30G Vibration	• 10G Vibration	• 10G Vibration
• 75G Shock	• 75G Shock	• 30G Shock	• 30G Shock

CONTACTS

- DC Rating:
  - Resistive — low level to 1 amp / 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

COILS

Nominal Voltage	Coil Resistance
5.0 VDC	100 Ω
6.0 VDC	200 Ω
9.0 VDC	400 Ω
12.0 VDC	800 Ω
18.0 VDC	1600 Ω
26.5 VDC	3200 Ω
36.0 VDC	6500 Ω
48.0 VDC	11000 Ω

SIZE

- Width & Depth:
  - Enclosure (sq. max) — .335 inches (8.51)
  - Base (sq. max) — .370 inches (9.40)
- Height (max): .375 (9.53)
- All welded construction, hermetically sealed

Options for all .100 Grid Relays

- Terminal Lengths
- Special Coils
- Ground Pins
- Spreader Pads

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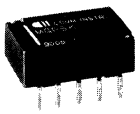
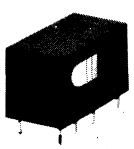
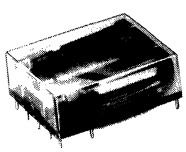
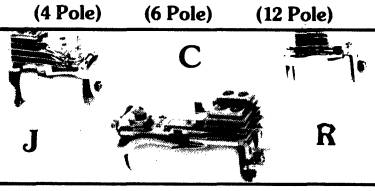
Commercial/Telecommunication Relays

RELAY	SIZE (Case Size)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
 MQ	H- .197 (5.0)* D- .354 (9.0) W- .551 (14.0)	• 2 Form C (DPDT) • Low Level up to 1 Amp 30 VDC Resistive	3 VDC 5 VDC 6 VDC 9 VDC 12 VDC 24 VDC	• Bifurcated contacts gold clad silver-palladium. • Rated low level to 1 Amp switching. • Long Life—Mechanical 100 million ops. • High sensitivity. • Completely sealed. • UL & CSA Approval pending. • Meets FCC Part 68, 1000VAC & 1500V peak. (Request Brochure MQ-90)
 MM	H- .428 (10.87) D- .410 (10.41) W- .410 (10.41)	• Low Level (microwatts) up to 2.0 Amps 24 VDC • 2 Form C (DPDT) 1 Form C (SPDT) 1 Form A (SPST-NO) 2 Form A (DPST-NO)	3 VDC 4 VDC 5 VDC 6 VDC 12 VDC 24 VDC 48 VDC	• Bifurcated contacts gold clad silver-palladium. • Rated for low level to 2.0 Amp switching. • Long Life—Mechanical 100 million ops. • .1 inch (2.54 mm) footprint. • Low contact resistance. • UL recognized file #E90612. • Completely sealed. • Meets FCC Part 68, 1000VAC & 1500V peak. **(Request Data Sheet MM 5-89)**
 MD	H- .472 (12.0) D- .394 (10.0) W- .795 (20.2)	• Low Level (microwatts) up to 2.0 Amps 24 VDC • 2 Form C (DPDT)	5 VDC 6 VDC 9 VDC 12 VDC 24 VDC 48 VDC	• Two form C bifurcated contacts gold clad silver-palladium. • Completely sealed. • Contact rating from low level to 2.0 Amps switching—3.0 Amps carry. • Low contact resistance. • UL recognized File #E90612. • Conforms to FCC Part 68, 1000VAC & 1500V peak. • CSA approved #LR65354-1. **(Request Data Sheet MD 4-90)**
 MP4	H- .45 (11.5) D- 1.20 (30.5) W- .96 (24.5) *mm	• Low Level (microwatts) up to 2.0 Amps 24 VDC •4 Form C(4PDT) 4 Form D(4PDT)** 2 Form C(DPDT) 2 Form D(DPDT)** **make before break	5 VDC 6 VDC 9 VDC 12 VDC 24 VDC 48 VDC	• Long life: 100,000,000 mechanical operations. 1,000,000 operations at 1.0 Amps. • Environment sealed. • Low contact resistance. • Contact rating. From low level to 2.0 Amps switching—3.0 Amps carry. • UL recognized File #E90612. • Conforms to FCC Part 68, 1500V peak. • CSA approved #LR65354-1. (Request Data Sheet MP-4-86)

Telephone Relays

 MA (4 Pole) MB (6 Pole) MC (12 Pole)	Variable	• Low Level (microwatts) to 2.0 Amps 28 VDC • MA-4 pole MB-6 pole MC-12 pole	6 VDC 12 VDC 24 VDC 48 VDC 60 VDC	• 4, 6, & 12 poles available • Bifurcated contacts • Low cost • PCB or plug in mounting (Request Date Sheet MA/MB 85)
 J C R	Variable	• Low Level to 10.0 Amps • Contact Arrangements: Long Frame: up to 8 Form C Medium Frame: up to 8 Form C Short Frame: up to 4 Form C	6 to 250.0 VDC	• Optional hermetic sealing • AC or DC operation • Fast operate and fast release times • Variety of accessories • Ambient temp rating -55°C to +85°C • Custom designs available (Request Catalog 502)
 20/26 210/211	Variable	• Point Variations: 10 to 52 point operation • Contact rating: 0.1 Amp @ 115 VAC or 30 VDC resistive Carry: 3.0 Amps	6 to 110.0 VDC	• Optional sealing • Insulation resistance $10^9\Omega$ at 500 VDC • Fast operate and fast release times • Variety of switch mounting acccessories • Operating temperature +0°C to +85°C • Custom designs available (Request Catalog 601)

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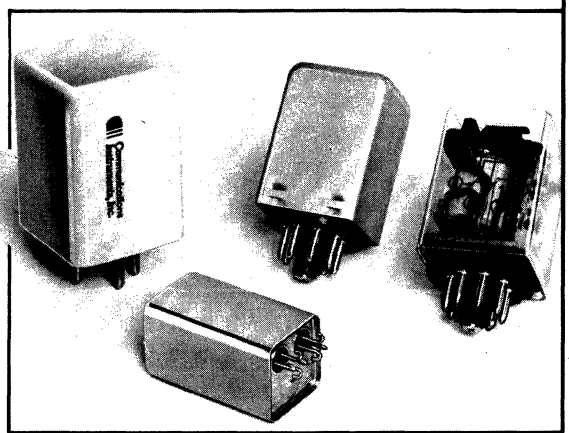
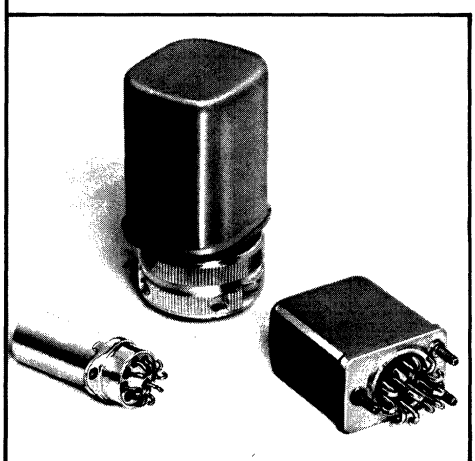
New Relays from CII

CII's new line of highly sensitive relays includes a broad range of types for low level to 10 Amp switching capability. These relays are proven performers with a solid history of reliable performance in aerospace, defense, telecommunications, commercial and industrial applications.

- Series 4 — SPDT, DC sensitive relay
- Series 5 — SPDT, AC/DC sensitive relay
- Series 6 — Multipole, polarized 3-position relay
- Series 22 — SPDT & DPDT sensitive, high performance relay
- Series 26 — SPDT DC miniature relay
- Series 32 — DPDT, Polarized, magnetic latching relay
- Series 33 — DPDT, Polarized, magnetically biased relay
- Series 34 — DPDT, Magnetic latching polar relay
- Series 35 — DPDT, DC Sensitive polar relay
- Series 36 — DPDT, DC Half-size sensitive relay
- Series 41 — SPDT, AC/DC High sensitivity relay
- Series 42 — DPDT, AC/DC High sensitivity relay
- Series 48 — SPDT, DC Rugged, sensitive relay
- Series 72 — SPDT, Pulse & telegraph polar relay



*These relays were formerly manufactured by Sigma Instruments, Division of Pacific Scientific.



CII's new line of commercial and military grade relays offer a range from low level to 150 Amp switching capacity. These relays are highly reliable components that have been used for years in a wide variety of applications.

- 02 Series — DPDT, Military grade relay
- 03 Series — 6PDT, Multiple switching military relay
- 07 Series — DPDT, 10 Amp Aerospace relay
- 21 Series — SP, 3P, 4P, 6PDT, AC/DC Relay
- 54 Series — DPDT, 4PDT Open or sealed general purpose relay
- 57 Series — DPDT, 4PDT Bifurcated miniature, general purpose relay
- 62 Series — High voltage, 25KV relay
- 82 Series — 150 Amp Power relay

*These relays were formerly manufactured by AIRPAX, Division of North American Philips.

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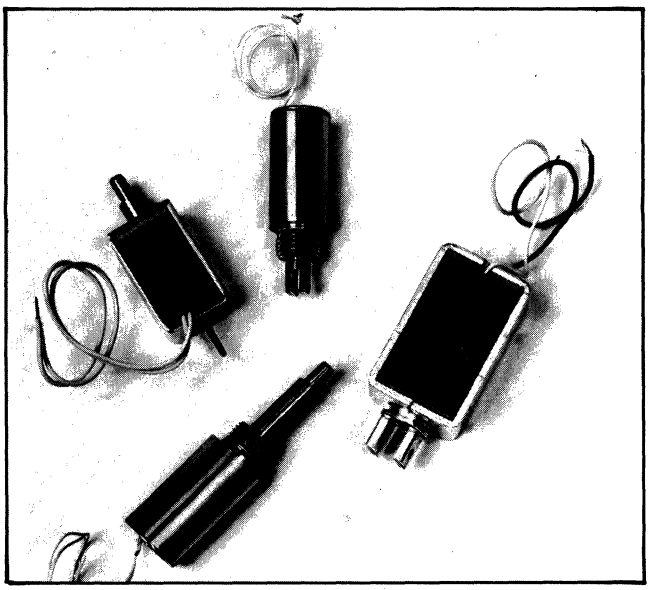
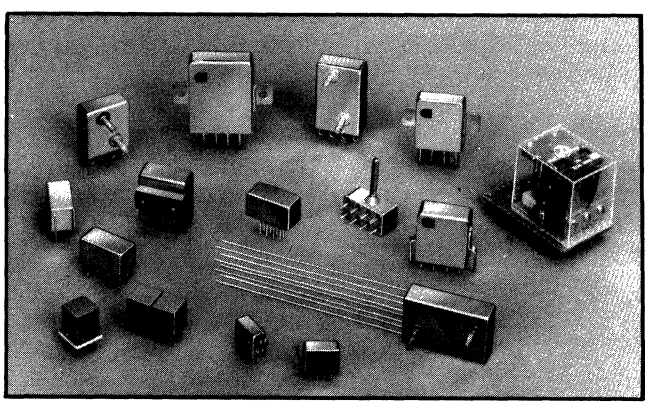
New Solenoids from CII

Custom Solenoids
CII offers a complete capability for manufacturing solenoids to satisfy low, medium or maximum pull force applications. Whether you require a TUBULAR, "C" FRAME or a BOX FRAME unit (in AC or DC) CII can custom-design and build the solenoid you need at especially competitive prices. For more information, contact Communications Instruments Inc.



Custom Relays



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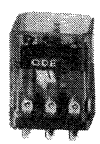
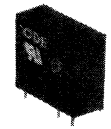
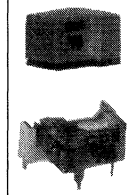
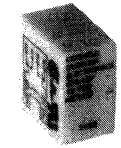
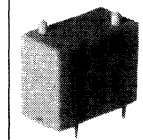
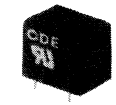
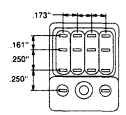
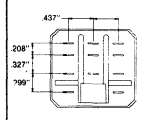
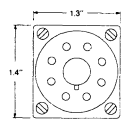
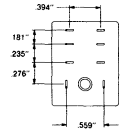
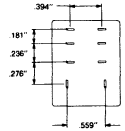
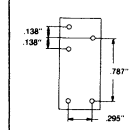
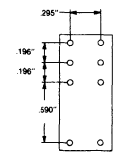
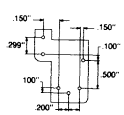
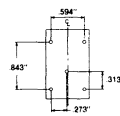
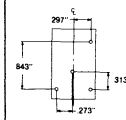
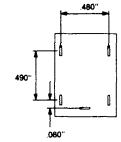
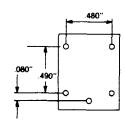
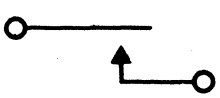
Relay Selector Chart

STYLE	GENERAL PURPOSE				MINIATURE						SUB-MINIATURE	
												
TYPE	**CDR10**	**CDR20**	**CDR30**	**CDR40**	**CDR50**	**CDR63**	**CDR64**	**CDR80**	**600**	**692**	**CDR70**	**CDR90**
VOLTAGE	6-120VDC 12-240VAC	6-120VDC 12-240VAC	6-125VDC 6-240VAC	6-120VDC 12-240VAC	6-120VDC 12-240VAC	5-48VDC	5-48VDC	5-48VDC	3-48VDC 12-115VAC	3-48VDC	3-48VDC	3-48VDC
SAFETY APPROVAL	UL/CSA*	UL/CSA*	UL/CSA*	UL/CSA*	UL/CSA*	UL/CSA*	UL/CSA*	UL/CSA*	UL/CSA	UL/CSA	UL/CSA*	UL/CSA*
CONTACT RATING	5A, 28 VDC 5A, 250VAC	10A, 28 VDC 10A, 240VAC	10A, 28 VDC 10A, 120VAC	10A, 28 VDC 10A, 240VAC	15A, 28 VDC 15A, 240VAC	10A, 30 VDC 10A, 250VAC	5A, 30 VDC 5A, 240VAC	20A, 240VAC 30A, SPNO	UP TO 15A, 150VAC	UP TO 5A, 240VAC	10A, 24 VDC 10A, 120VAC	6A, 28 VDC 10A, 120VAC
CONTACT FORM	DPDT, 4PDT	UP TO 3PDT	UP TO 3PDT	DPST, DPDT	SPST, SPDT	SPST, SPDT	DPST, DPDT	SPST, SPDT	SPST, SPDT, DPDT	BI-STABLE	SPST, SPDT	SPST,SPDT
NOMINAL OPERATING POWER	.9W DC 1.2VA AC	1.2W DC 2.0VA AC	1.2W DC 2.0VA AC	.9W DC 1.2VA AC	.9W DC 1.2VA AC	530MW	530MW	900MW	100MW (5A) 240MW (15A) 360MW (DPDT)	850MW	360MW	360MW
NOM. OPERATE TIME	15MS	15MS	15MS	15MS	15MS	15MS	15MS	15MS	10MS	20MS	10MS	10MS
NOM. RELEASE TIME	10MS	10MS	10MS	10MS	10MS	10MS	10MS	10MS	8MS	20MS	8MS	8MS
MECHANICAL LIFE	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	5×10^6	10×10^6	5×10^6	5×10^6
LIFE @ RATED LOAD	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4
DIELECTRIC: **CONTACT-CONTACT** **CONTACT-COIL** **LIVE PARTS-GROUND**	 500V 1,500V 1,500V	 500V 1,500V 1,500V	 500V 1,500V 1,500V	 500V 1,500V 1,500V	 500V 1,500V 1,500V	 1,000V 5,000V 3,000V	 1,000V 5,000V 3,000V	 1,500V 1,500V 1,500V	 500V 1,000V 1,000V	 500V 1,000V 1,000V	 500V 1,000V 1,000V	 500V 1,500V 1,500V
SEALED VERSION	NO	NO	NO	NO	NO	YES	YES	YES	YES	NO	YES	YES
TERMINAL TYPE	SOLDER LUG/ PLUG-IN P.C.	SOLDER LUG/ QUICK CONNECT; P.C.	8 PIN PLUG/ 11 PIN PLUG	SOLDER LUG/ QUICK CONNECT; P.C.	SOLDER LUG/ QUICK CONNECT; P.C.	SOLDER LUG/ QUICK CONNECT; P.C.	P.C.	P.C.	SOLDER LUG/ P.C.	SOLDER LUG/ P.C.	P.C.	P.C.
CASE SIZE (L x W x H)	1.08×.846×1.41	1.49×1.37×1.87	1.37×1.29×2.14	1.08×.846×1.41	1.08×.850×1.38	1.14×.511×1.00	1.14×.511×1.00	1.25×1.08×.72	1.24×.766×1.20	1.46×.750×1.18	.826×.614×.688	.800×.640×.930
FOOTPRINTS: **ALL DIMENSIONS ARE IN THOUSANDTHS**												

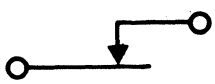
*CSA PENDING

MINIGLOSSARY
RELAY CONTACT FORMS

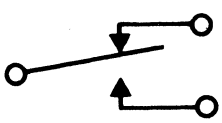
A
Make
SPST-NO



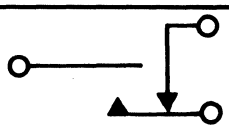
B
Break
SPST-NC



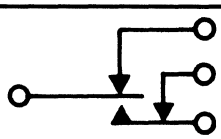
C
Break, Make
(Transfer)
SPDT



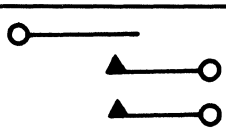
D
Make, Break
(Continuity
Transfer)



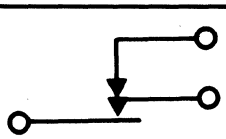
E
Break,
Make,
Break



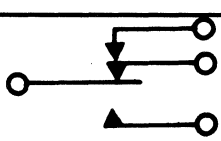
F
Make,
Make



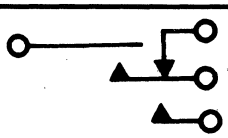
G
Break,
Make



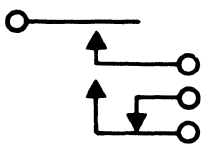
H
Break,
Break,
Make



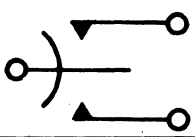
I
Make,
Break,
Make



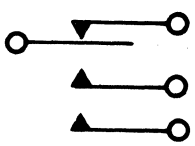
J
Make,
Make,
Break



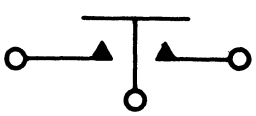
K
Center off
SPDT



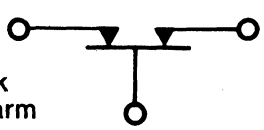
L
Break,
Make,
Make



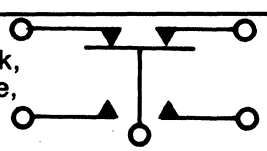
U
Double
make
Contact
on arm



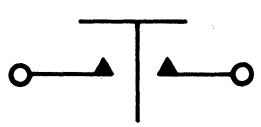
V
Double break
Contact on arm



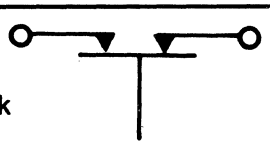
W
Double break,
Double make,
Contact
on arm



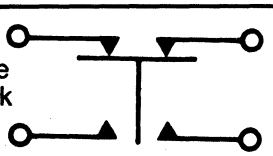
X
Double
make



Y
Double break



Z
Double make
Double break
SPDT-DB

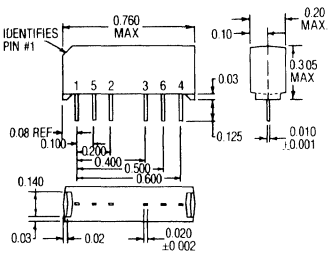


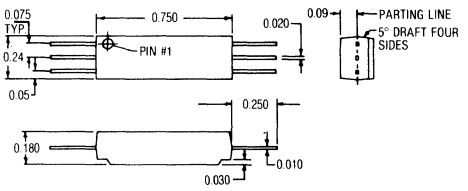
COTO WABASH

55 DuPont Drive, Providence, R.I. 02907
(401) 943-2686 FAX (401) 942-0920

MOLDED REED RELAYS SIP (SERIES 9000) AND SURFACE MOUNT (SERIES 9200)

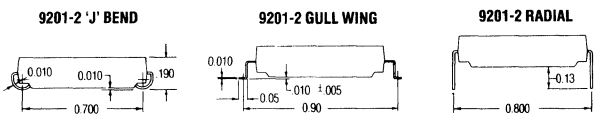
MECHANICAL SPECIFICATIONS





TERMINAL STYLE

LOCATION AND COPLANARITY TOLERANCE ±.003



ORDERING INFORMATION

To order a Coto relay, assemble a part number from the data to describe the desired parameters.

SIP

Model Number — **90XX – XX – XX**

- 01 = SPST, 4 Pin SIP
- 02 = 50Ω Coxial Shield.SPST, 6 Pin SIP
- 03 = SPST, 4 Pin SIP, Recommended For Load Switching

Coil Voltage

- 05 = 5 Volts Nominal
- 12 = 12 Volts Nominal
- 00 = No Option – Omit 0's
- 01 = Internal Diode*

SURFACE MOUNTED

Model Number — **92XX – XX – X0** — Terminal Style

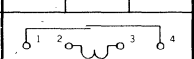
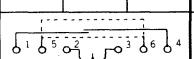
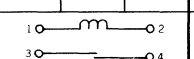
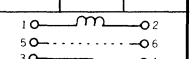
- 01 = SPST, Recommended For Low Level Switching 4 Pin
- 02 = SPST, 50Ω Coaxial Shield 6 Pin

Coil Voltage

- 05 = 5 Volts Nominal
- 12 = 12 Volts Nominal

Terminal Style

- 0 = Gull Wing
- 1 = Axial
- 2 = 'J'
- 3 = Radial

MODEL NUMBER			9001			9002			9201			9202		
PARAMETERS & TEST CONDITIONS		UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
COIL RESISTANCE	5 VOLT COIL	Ω	450	500	550	315	350	385	225	250	275	135	150	165
	12 VOLT COIL	Ω	900	1000	1100	675	750	825	585	650	715	585		715
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	—	5	6.5	—	5	6.5	—	5	6.5	—	5	6.5
	12 VOLT COIL	VDC	—	12	15	—	12	15	—	12	15	—	12	15
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	—	—	3.75	—	—	3.75	—	—	3.75	—	—	3.75
	12 VOLT COIL	VDC	—	—	9.0	—	—	9.0	—	—	9.0	—	—	9.0
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.4	—	—	0.4	—	—	0.4	—	—	0.4	—	—
	12 VOLT COIL	VDC	1.0	—	—	1.0	—	—	1.0	—	—	1.0	—	—
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	—	200	—	—	200	—	—	200	—	—	200
SWITCHING CURRENT (DC/Peak AC, Resistive)		Amps	—	—	0.5	—	—	0.5	—	—	0.5	—	—	0.5
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	—	1.0	—	—	1.0	—	—	1.0	—	—	1.0
CONTACT POWER RATING (DC/Peak AC, Resistive)		W	—	—	10	—	—	10	—	—	10	—	—	10
LIFE EXPECTANCY	(@ Signal Level <1.0 V, .010A)	$\times 10^6$	500	—	—	500	—	—	500	—	—	500	—	—
	(Switching >1.0 V, Consult Factory)	$\times 10^6$	—	—	—	—	—	—	—	—	—	—	—	—
STATIC CONTACT RESISTANCE (Max. initial, measured with .050 V, .010A)		Ω	—	—	0.150	—	—	0.150	—	—	.150	—	—	.150
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	—	0.200	—	—	0.200	—	—	.200	—	—	.200
INSULATION RESISTANCE (Between all isolated pins)	25°C, 40% RH	Ω	10^{10}	10^{13}	—	10^{10}	10^{13}	—	10^{12}	10^{13}	—	10^{12}	10^{13}	—
MEASURED WITH 100 V @	40°C, 95% RH	Ω	10^{10}	10^{12}	—	10^{10}	10^{12}	—	10^{10}	10^{12}	—	10^{10}	10^{12}	—
DIELECTRIC STRENGTH (DC/Peak AC)	ACROSS OPEN CONTACTS:	Volts	250	—	—	250	—	—	250	—	—	250	—	—
	CONTACTS TO SHIELD:	Volts	—	—	—	500	—	—	—	—	—	500	—	—
	CONTACTS & SHIELD TO COIL:	Volts	500	—	—	500	—	—	500	—	—	500	—	—
CAPACITANCE ACROSS OPEN CONTACTS	No shield	pf	—	0.70	1.00	—	—	—	—	0.70	1.0	—	—	—
	Shield floating	pf	—	—	—	—	0.80	1.0	—	—	—	—	0.80	0.80
	Shield guarding	pf	—	—	—	—	0.10	0.30	—	—	—	—	0.10	0.30
OPEN CONTACTS TO COIL	No shield	pf	—	1.4	2.0	—	—	—	—	1.4	2.0	—	—	—
	Shield floating	pf	—	—	—	—	1.4	2.0	—	—	—	—	1.4	2.0
	Shield guarding	pf	—	—	—	—	—	1.0	—	—	—	—	0.2	0.4
CONTACT TO SHIELD Contacts open and shield floating		pf	—	—	—	—	1.4	1.6	—	—	—	—	1.4	1.6
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec.	—	0.35	1.0	—	0.35	1.0	—	0.35	1.0	—	0.35	1.0
RELEASE TIME	No supression	msec.	—	0.05	0.10	—	0.05	0.10	—	0.05	0.10	—	0.05	0.10
	Diode supression	msec.	—	0.35	0.50	—	0.35	0.50	—	0.35	0.50	—	0.35	0.50
	Diode & Zener suppressed	msec.	—	0.10	0.20	—	0.10	0.20	—	0.10	0.20	—	0.10	0.20
TEMPERATURE RANGE	Operate:	°C	−20	—	70	−20	—	70	−20	—	70	−20	—	70
	Storage:	°C	−50	—	100	−50	—	100	−50	—	100	−50	—	100
	Max. allowable temp during mounting process:	°C			221			221			221			221
ALL RATINGS AT 25°C UNLESS NOTED.														
PIN DIAGRAMS (Top View) *If diode is selected, pin #2 is positive.														

COTO WABASH

55 DuPont Drive, Providence, R.I. 02907
(401) 943-2686 FAX (401) 942-0920

ULTRA-LOW THERMAL EMF REED RELAYS FOR LOW-LEVEL DATA ACQUISITION SYSTEMS

THERMAL EMF

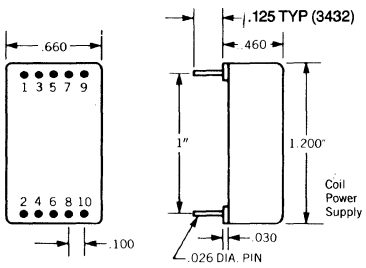
Ratings. Thermal EMF is specified differentially between the two thermal EMF switches (pins 5-6 and 7-8). It is directly proportional to coil power or the square of the applied voltage. When the relays are operated in a scanning mode, the thermal EMF is also proportional to the coil duty cycle.

Coto Series 3600 relays are available with maximum differential thermal EMF ratings of <5μV, <3μV, <1μV, or <0.5μV.

The Mercury wetted 3432 Relay is available with maximum differential thermal EMF ratings of <5μV, <10μV.

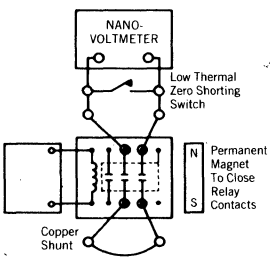
Note: The must operate and must release voltages and the coil resistance are specified at 25°C. These values vary by approximately 0.4%/°C as the ambient temperature varies.
Vibration: 20 G's to 2000Hz Shock: 50 G's

MECHANICAL SPECS



All dimensions are nominal
Pin 9 is the electrostatic shield pin.

Thermal EMF Test Circuit



ORDERING INFORMATION

To order – assemble a part number from the parameters.
Specifications subject to change without notice.

3602, 3650, 3660

Model Number (02,50,60) **36XX-XX-X X**
Coil Voltage (05 or 12)
Thermal
- <5μV – Suffix 9
- <3μV – Suffix 8
- <1μV – Suffix 7
- <0.5μV – Suffix 5

Pin Length
- Standard (0.135" ± 0.020") "2" – Suffix 2
- VME (0.110" ± 0.010) "3" – Suffix 3

3432-XX-1X

Hg Wet
Coil Voltage
Thermal <10μV – Suffix 1
<5μV – Suffix 9
Contact Isolation (Ohms)
- 10^{10} – Suffix "0"
- 10^{12} – Suffix "1"

MODEL NUMBER			3602			3650			3660			3432[1]		
CONTACT ARRANGEMENT			2A DRY			3A DRY			3A DRY			2A HG WET		
PARAMETERS & TEST CONDITIONS		UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
COIL RESISTANCE	5 VOLT COIL	Ω	315	350	385	315	350	385	315	350	385	97.5	105	115.5
	12 VOLT COIL	Ω	1800	2000	2200	1800	2000	2200	1800	2000	2200	540	600	660
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	—	5	6.5		5	6.5	—	5	6.5	—	5	6.5
	12 VOLT COIL	VDC	—	12	15	—	12	15	—	12	15	—	12	15
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	—	—	3.8	—	—	3.8	—	—	3.8	—	—	3.8
	12 VOLT COIL	VDC	—	—	9.0	—	—	9.0	—	—	9.0	—	—	9.0
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.4	—	—	0.4	—	—	0.4	—	—	0.4	—	—
	12 VOLT COIL	VDC	1.0	—	—	1.0	—	—	1.0	—	—	1.0	—	—
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	—	150	—	—	150	—	—	150	—	—	500
SWITCHING CURRENT (DC/Peak AC, Resistive)		mA	—	—	250	—	—	250	—	—	250	—	—	1.0
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	—	1.5	—	—	1.5	—	—	1.5	—	—	2.0
CONTACT POWER RATING (DC/Peak AC, Resistive)		W	—	—	5.0	—	—	5.0	—	—	5.0	—	—	5.0
LIFE EXPECTANCY	(@ Signal Level <1.0 V, .010A)	×10⁶	500	—	500	500	—		500	—		1000	—	—
	(Switching >1.0 V, Consult Factory)	×10⁶	—	—		—	—		—	—	—	—	—	—
STATIC CONTACT RESISTANCE (Max. initial, measured with .050 V, 10mA Contact Lead)		Ω	—	—	0.100	—	—	0.100	—	—	0.100	—	—	0.050
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	—	0.200	—	—	0.200	—	—	0.200	—	—	0.100
INSULATION RESISTANCE (Between all isolated pins)	25°C, 40% RH	Ω	10^{10}	10^{10}	—	10^{12}	10^{13}	—	10^{12}	10^{13}	—	10^{10}	10^{12}	—
MEASURED WITH 100 V @	40°C, 95% RH	Ω	—	—	—	—	—	—	—	—	—	—	—	—
DIELECTRIC STRENGTH	ACROSS OPEN CONTACTS:	VDC	250	—	—	250	—	—	250	—	—	1000	—	—
	CONTACTS TO SHIELD:	VDC	500	—	—	500	—	—	500	—	—	1000	—	—
	CONTACTS & SHIELD TO COIL:	Vrms	1500	—	—	1500	—	—	1500	—	—	1500	—	—
CAPACITANCE ACROSS OPEN CONTACTS	Shield floating	pf	—	1.2	—	—	1.2	—	—	1.2	—	—	1.2	—
	Shield guarding	pf	—	0.2	—	—	0.2	—	—	0.2	—	—	0.2	—
OPEN CONTACTS TO COIL AND SHIELD		pf	—	2.5	—	—	2.5	—	—	2.5	—	—	2.5	—
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec.	—	.75	1.0	—	.75	1.0	—	.75	1.0	—	2.0	3.0
RELEASE TIME	Diode & Zener supressed:[2]	msec.	—	100	500	—	100	500	—	100	500	—	1.5	2.5
TEMPERATURE RANGE	Operate:	°C	−20	—	+70	−20	—	+70	−20	—	+70	−20	—	+70
	Storage:	°C	−50	—	+100	−50	—	+100	−50	—	+100	−30	—	+100
ALL RATINGS AT 25°C UNLESS NOTED.														
PIN DIAGRAM (Bottom View) Switches connected to pins 5-6 and 7-8 are the low thermal EMF switches.			1 3 5 7 9 / 2 4 6 8 10			1 3 5 7 9 / 2 4 6 8 10			1 3 5 7 9 / 2 4 6 8 10			1 3 5 7 9 / 2 4 6 8 10		

1. Mercury-wetted Relay 3432 must be mounted vertically with the arrow pointing up and shield pin at the top.
2. Consists of 20V Zener-diode and 1N4002 diode in series connected in parallel to coil.
3. For Series 3660, the third non-low thermal switch (9-10) is connected in common with the electrostatic shield at pin 9.

COTO WABASH

DuPont Drive, Providence, R.I. 02907
(401) 943-2686 FAX (401) 942-0920

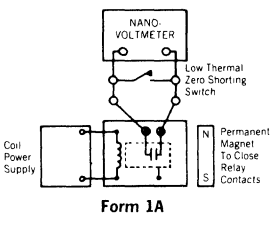
LOW THERMAL EMF REED RELAYS SERIES 3500

THERMAL EMF

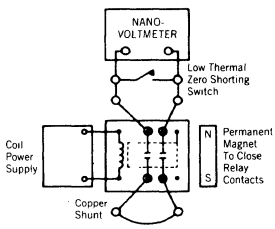
Ratings. The thermal EMF is specified individually for Form 1A relays and differentially between the switches for Form 2A relays. This measurement is made as shown in block diagram. Form 2A relays are measured by shorting pins 2 and 4 with a copper shunt and connecting a nanovolt meter across pins 8 and 10.

The 3500 relays are available with maximum differential thermal EMF ratings of either <10μV, <5μV, <3μV, <1μV or <500nV. The ratings are determined by 100% testing and sorting according to the thermal EMF's measured after the coil has been energized for 5 minutes at its nominal voltage.

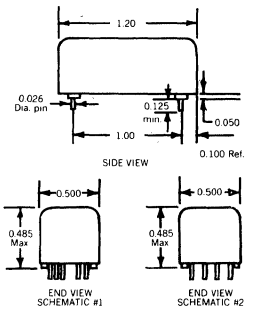
Thermal EF Test Circuits:

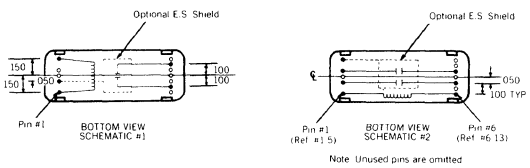


Form 1A



Form 2A





Note: Unused pins are omitted

ORDERING INFORMATION

To order – assemble a part number from the parameters. Specifications subject to change without notice.

35 XX-XX-XXX

- Model No.
- Coil Voltage: 05, 12
- Thermal:
  - <10μV – Suffix "1" Hg Wet
  - <5μV – Suffix "9" Dry & Hg Wet
  - <3μV – Suffix "8" Dry Only
  - <1μV – Suffix "7" Dry Only
  - <500nV – Suffix "5" Dry Only
- Contact Isolation (Ohms)
  - 10^{10} – Suffix "0"
  - 10^{12} – Suffix "1"
- No electrostatic shield – "0"
- Electrostatic shield – "1"

Model Number			3501			3502			3520			3530			3531			3540			3541		
Features			High Sensitivity			High Sensitivity			Mercury Wetted			Intermediate High Voltage			Intermediate High Voltage			High Voltage			High Voltage		
Contact Form			1A			2A			2A Hg[1]			1A			2A			1A			2A		
Electrostatic Shield Available			Yes			Yes			Yes			No			No			Yes			Yes		
Thermal EMF Options Available 4		μV Max	Individual 5,3,1,0.5			Differential 5,3,1,0.5			Differential 10,5			Individual 5,3,1,0.5			Differential 5,3,1,0.5			Individual 5,3,1,0.5			Differential 5,3,1,0.5		
PARAMETERS & TEST CONDITIONS		UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
COIL RESISTANCE[2]	5 VOLT COIL	Ω	315	350	385	315	350	385	180	200	220	225	250	275	225	250	275	225	250	275	225	250	275
	12 VOLT COIL	Ω	1800	2000	2200	1800	2000	2200	765	850	935	1350	1500	1650	1350	1500	1650	1350	1500	1650	1350	1500	1650
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	–	5	6.5	–	5	6.5	–	5	6.5	–	5	6.5	–	5	6.5	–	5	6.5	–	5	6.5
	12 VOLT COIL	VDC	–	12	15	–	12	15	–	12	15	–	12	15	–	12	15	–	12	15	–	12	15
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	–	–	3.8	–	–	3.8	–	–	3.8	–	–	3.8	–	–	3.8	–	–	3.8	–	–	3.8
	12 VOLT COIL	VDC	–	–	9.0	–	–	9.0	–	–	9.0	–	–	9.0	–	–	9.0	–	–	9.0	–	–	9.0
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.4	–	–	0.4	–	–	0.4	–	–	0.4	–	–	0.4	–	–	0.4	–	–	0.4	–	–
	12 VOLT COIL	VDC	1.0	–	–	1.0	–	–	1.0	–	–	1.0	–	–	1.0	–	–	1.0	–	–	1.0	–	–
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	–	–	200	–	–	200	–	–	500	–	–	250	–	–	250	–	–	500	–	–	500
SWITCHING CURRENT (DC/Peak Ac, Resistive)		Amps	–	–	0.5	–	–	0.5	–	–	1.0	–	–	0.5	–	–	0.5	–	–	0.5	–	–	0.5
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	–	–	1.5	–	–	1.5	–	–	2.0	–	–	2.5	–	–	2.5	–	–	2.0	–	–	2.0
CONTACT POWER RATING (DC/Peak AC, Resistive)[3]		W	–	–	10	–	–	10	–	–	28	–	–	20	–	–	20	–	–	10	–	–	10
LIFE EXPECTANCY	(@ Signal Level <1.0 V, .010A)	10^6	500	–	–	500	–	–	1000	–	–	500	–	–	500	–	–	100	–	–	100	–	–
	(Switching>1.0 V, Consult Factory		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
STATIC CONTACT RESISTANCE (Max. initial, measured with .050V, 10 mA Contact Load)		Ω	–	–	0.200	–	–	0.100	–	–	0.050	–	–	0.200	–	–	0.100	–	–	0.200	–	–	0.100
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	–	–	0.300	–	–	0.200	–	–	0.100	–	–	0.300	–	–	0.200	–	–	0.300	–	–	0.200
INSULATION RESISTANCE (Between all isolated pins) MEASURED WITH 100 V @ 25°C. 40% RH		Ω	10^{10}			10^{10}			10^{10}			10^{10}			10^{10}			10^{10}			10^{10}		
DIELECTRIC STRENGTH (DC/Peak AC)	ACROSS OPEN CONTACTS:	Volts	700	–	–	350	–	–	1500	–	–	1500	–	–	750	–	–	1500	–	–	1500	–	–
	CONTACTS TO SHIELD:	Volts	500	–	–	500	–	–	500	–	–	500	–	–	500	–	–	500	–	–	500	–	–
	CONTACTS & SHIELD TO COIL:	Volts	1500	–	–	1500	–	–	1500	–	–	1500	–	–	1500	–	–	1500	–	–	1500	–	–
CAPACITANCE ACROSS OPEN CONTACTS	Without shield	pf	–	3.0	–	–	1.7	–	–	1.7	–	–	3.0	–	–	1.7	–		3.0			1.7	
	Shield guarding	pf	–	1.9	–	–	0.2	–	–	0.2	–	–	1.9	–	–	0.2	–	–	1.9	–	–	0.2	–
OPEN CONTACTS TO COIL AND SHIELD		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
OPERATING TIME (Incl. bounce @ Nom. voltage)		msec	–	0.75	–	–	0.75	–	–	2.0	–	–	1.0	–	–	1.0	–	–	1.0	–	–	1.0	–
RELEASE TIME Diode & Zener suppressed:		msec	–	0.1	–	–	0.1	–	–	0.1	–	–	0.2	–	–	0.2	–	–	0.2	–	–	0.2	–
TEMPERATURE RANGE	Operate:	C°	−20	–	+70	−20	–	+70	−20	–	+70	−20	–	+70	−20	–	+70	−20	–	+70	−20	–	+70
	Storage:	C°	−35	–	+100	−35	–	+100	−35	–	+100	−35	–	+100	−35	–	+100	−35	–	+100	−35	–	+100
ALL RATINGS AT 25°C UNLESS NOTED																							
SCHEMATIC NUMBER			1			2			2			1			2			1			2		

1 Must be mounted vertically. Pin #1 is up.
2 The coil resistance & operate & release voltages are specified at 25°C. These values vary by approx. 0.39%/°C as the ambient temperature changes.
3 The life expectancy when switching intermediate voltages and currents may vary widely. Consult the factory for your exact load requirements.
4 Measured after 5 minutes at nominal coil voltage.

COTO WABASH

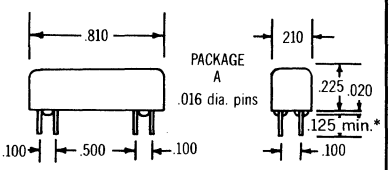
55 DuPont Drive, Providence, R.I. 02907
(401) 943-2686 FAX (401) 942-0920

MICROMINIATURE REED RELAYS
SERIES 2200

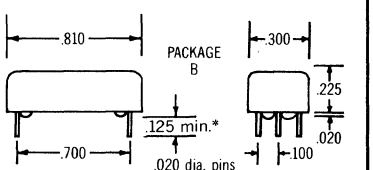
For a complete product line catalog, technical assistance, life test data or other ordering information, please contact us directly. Our philosophy incorporates working hand-in-hand with our customers (Partners in Design) to develop custom designed reed relays that meet their special design requirements.

OPERATING PARAMETERS @ 25°C		
Nominal Volts	05	12
Coil #2 Resistance Ohms*	150	900
Coil #3 Resistance Ohms*	230	1500
Coil #4 Resistance Ohms*	370	—

*Resistance figures are ± 10%



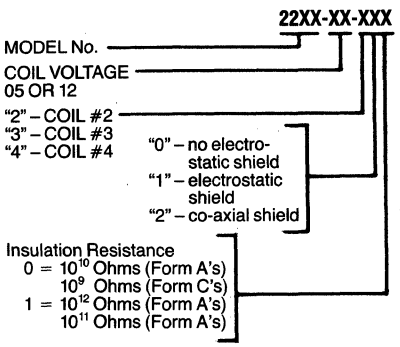
All dimensions are nominal



*.105 ±.015 for models #2200-2310 and #2200-2311

ORDERING INFORMATION

To order, assemble a part number from the data below to describe the desired parameters.



MODEL NUMBER			2200-2301			2200-2302			2200-2311			2204			2211		
Available Coil Options			150Ω			150Ω			250Ω			2, 3, 4			2, 3		
Contact Form			1A			1A			2A			1A			1C		
Package Size			A			A			B			A			A		
Available Shield Options			Electrostatic 5 pin relay			Co-Axial 6 pin relay			N/A			Optional Electrostatic or Co-Axial[1]			N/A		
PARAMETERS & TEST CONDITIONS		UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
COIL RESISTANCE	5 VOLT COIL	Ω	135	150	165	135	150	165	225	250	275	See Chart Above			See Chart Above		
	12 VOLT COIL	Ω	—	—	—	—	—	—	—	—	—						
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	—	5	6.5	—	5	6.5	—	5	6.5	—	5	6.5	—	5	6.5
	12 VOLT COIL	VDC	—	12	15	—	12	15	—	12	15	—	12	15	—	12	15
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	—	—	3.6	—	—	3.6	—	—	4.0	—	3.75	—	—	3.75	—
	12 VOLT COIL	VDC	—	—	—	—	—	—	—	—	—	—	9.0	—	—	9.0	—
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.5	—	—	0.5	—	—	1.0	—	—	0.4	—	—	0.4	—	—
	12 VOLT COIL	VDC	—	—	—	—	—	—	—	—	—	1.0	—	—	1.0	—	—
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	—	150[1]	—	—	150	—	—	200	—	200	—	—	100	—
SWITCHING CURRENT (DC/Peak AC, Resistive)		Amps	—	—	0.5	—	—	0.5	—	—	0.5	—	0.5	—	—	0.25	—
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	—	1.0	—	—	1.0	—	—	1.0	—	1.0	—	—	0.5	—
CONTACT POWER RATING (DC/Peak AC, Resistive)		W	—	—	10	—	—	10	—	—	10	—	10	—	—	3	—
LIFE EXPECTANCY	(@ Signal Level <1.0 V, .010A)	10^6	—	500	—	—	500	—	—	500	—	—	500	—	—	100	—
	(Switching >1.0 V, Consult factory)		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
STATIC CONTACT RESISTANCE (Max. initial, measured with .050 V, 10mA Contact Load)		Ω	—	—	0.150	—	—	0.150	—	—	0.100	—	—	0.100	—	—	0.150
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	—	0.200	—	—	0.200	—	—	0.200	—	—	0.200	—	—	0.200
INSULATION RESISTANCE (Between all isolated pins) MEASURED WITH 100 V @ 25°C, 40% RH		Ω	10^{10}	—	—	10^{10}	—	—	10^{10}	—	—	10^{10} Min. 10^{12} Optional			10^8 Min. 10^{11} Optional		
DIELECTRIC STRENGTH (DC/Peak AC)	ACROSS OPEN CONTACTS:	Volts															
	CONTACTS TO SHIELD:	pf	250	—	—	250	—	—	250	—	—	250	—	—	200	—	—
	CONTACTS & SHIELD TO COIL:	pf	1,000	—	—	1,000	—	—	1,000	—	—	1,000	—	—	1,000	—	—
CAPACITANCE ACROSS OPEN CONTACTS	Shield floating	pf	—	0.9	—	—	0.9	—	—	1.0	—	—	0.9	—	—	1.8	—
	Shield guarding	pf	—	0.2	—	—	0.2	—	—	N/A	—	—	0.2	—	—	N/A	—
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec.	—	—	0.55	—	5	0.55	—	—	0.650	—	0.5	—	—	1.0	—
RELEASE TIME	Diode & Zener supressed[2]	msec.	—	0.1	—	—	0.1	—	—	0.020	—	—	0.1	—	—	2.0	—
TEMPERATURE RANGE	Operate:	°C	−20	—	+70	−20	—	+70	−20	—	+70	−20	—	+70	−20	—	+70
	Storage:	°C	−50	—	+100	−50	—	+100	−50	—	+100	−50	—	+100	−50	—	+100
ALL RATINGS AT 25°C UNLESS NOTED.																	
Schematics (Bottom View) Not to scale																	

Unused pins are omitted.
Pin numbers for reference only.
Black dot on top of relay denotes pin #1.

1. On model 2204 pin #7 is the optional electrostatic shield pin, pins #6 and #7 are the optional co-axial shield pins.
2. Consists of 20V Zener-diode and 1N4002 diode in series connected in parallel to coil.

COTO WABASH

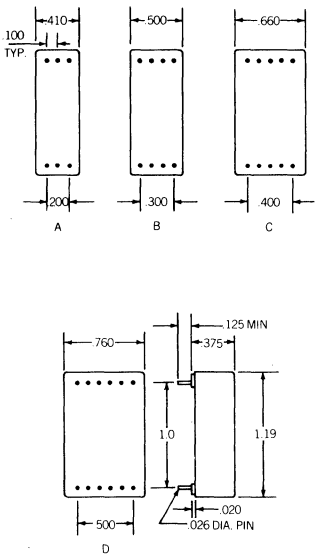
DuPont Drive, Providence, R.I. 02907
(401) 943-2686 FAX (401) 942-0920

HIGH RELIABILITY REED RELAYS
SERIES 7000

Contact Type	Contact Form	Part No.	Coil V.D.C.	Res. Ohms ±10% @ 25°C	Max. Pick-up V.D.C. @ 25°C	Min. Drop-out V.D.C. @ 25°C	D W G.	Pin Diagram Bottom View • End to End	Pin Diagram Bottom View • Same End
DRY STANDARD	1A	7101	5 12 24	300 1600 4200	3.75 9 18	0.4 1.0 2.0	A		
	2A	7102	5 12 24	150 1000 3500	3.75 9 18	0.4 1.0 2.0	B		
	3A	7103	5 12 24	100 800 2400	3.75 9 18	0.4 1.0 2.0	C		
	4A	7104	5 12 24	80 550 2000	3.75 9 18	0.4 1.0 2.0	D		
	1C	7141	5 12 24	175 1100 4200	3.75 9 18	0.4 1.0 2.0	A		
	2C	7142	5 12 24	65 490 1550	3.75 9 18	0.4 1.0 2.0	C		
	1A Latch *	7150	5 12	550/550 1750/1750	3.75 9	0.4 1.0	B		
MERCURY WETTED	1A	7201	5 12 24	70 450 1785	3.75 9 18	0.4 1.0 2.0	A		
	2A	7202	5 12 24	60 340 1330	3.75 9 18	0.4 1.0 2.0	B		
HIGH VOLTAGE	1A	7301	5 12 24	175 1100 4200	3.75 9 18	0.4 1.0 2.0	A		
	2A	7302	5 12 24	100 640 2450	3.75 9 18	0.4 1.0 2.0	B		

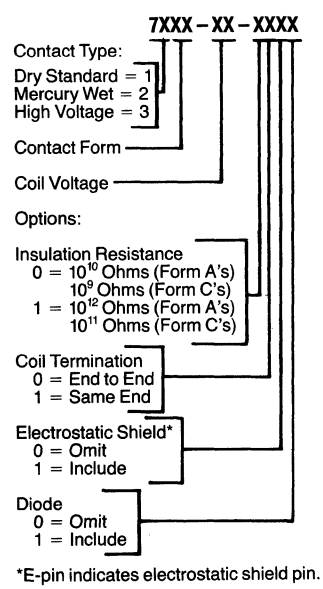
• Black dot on top of relay denotes Pin #1.
* These relays contain bias magnets. Correct polarity must be observed. Diode coil suppression is required for proper operation of latching relays. If internal diode option is selected on 7150 Pins #1 and #8 are positive. On all other relays Pin #1 is Positive.

Package and Pin Configuration
(Bottom View)



ORDERING INFORMATION
To order a Coto relay, assemble a part number from the data to describe the desired parameters.

MODEL NUMBER			7100						7200			7300		
CONTACT TYPE			DRY STANDARD						MERCURY WET			HIGH VOLTAGE		
CONTACT FORM			A's AND B's			C's			A's			A's		
PARAMETERS & TEST CONDITIONS		UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	—	200	—	—	150	—	—	500	—	—	500
SWITCHING CURRENT (DC/Peak AC, Resistive)		Amps	—	—	0.5	—	—	0.250	—	—	1.0	—	—	0.5
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	—	2.0	—	—	1.0	—	—	2.0	—	—	2.0
CONTACT POWER RATING (DC/Peak AC, Resistive)[3]		W	—	—	10	—	—	3	—	—	50	—	—	10
LIFE EXPECTANCY	(@ Signal Level <1.0 V, .010A) ‡	CYC	—	10^8	—	—	10^8	—	—	10^8	—	—	10^8	—
	(Switching>1.0V, Consult Factory)	CYC	—	*	—	—	*	—	—	10^5	—	—	*	—
STATIC CONTACT RESISTANCE (Max. initial, measured with .050 V, 10 mA Contact Load)		Ω	—	—	.100	—	—	.150	—	—	.050	—	—	.100
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	—	.150	—	—	.200	—	—	.100	—	—	.150
INSULATION RESISTANCE (Between all isolated pins) MEASURED WITH 100 V @ 25°C, 40% RH		Ω	10^{10}	10^{12}	—	10^9	10^{11}	—	10^{10}	10^{12}	—	10^{10}	10^{12}	—
DIELECTRIC STRENGTH	ACROSS OPEN CONTACTS:	Volts	250	—	—	200	—	—	1000	—	—	1200	—	—
(DC/Peak AC)	CONTACTS TO SHIELD	Volts	500	—	—	500	—	—	500	—	—	500	—	—
GS	CONTACTS & SHIELD TO COIL:	VRMs	1500	—	—	1500	—	—	1500	—	—	1500	—	—
CAPACITANCE ACROSS OPEN CONTACTS	WITHOUT SHIELD	pf	—	1.0	—	—	2.0	—	—	1.0	—	—	1.0	—
	SHIELD GROUNDED	pf	—	0.2	—	—	1.0	—	—	0.2	—	—	0.2	—
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec	—	1.0	—	—	2.0	—	—	2.0	—	—	1.0	—
RELEASE TIME	Diode & Zener suppressed:	msec	—	0.100	—	—	2.5	—	—	1.0	—	—	0.100	—
TEMPERATURE RANGE (C°)	Operate:	C°	−20	—	+70	−20	—	+70	−20	—	+70	−20	—	+70
	Storage:	C°	−50	—	+100	−50	—	+100	−50	—	+100	−50	—	+100
ALL RATINGS AT 25°C UNLESS NOTED.														



*E-pin indicates electrostatic shield pin.

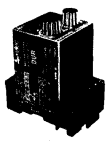
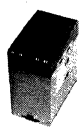
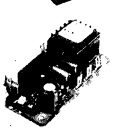
* Life expectancy at full rated load is dependent upon the combination current/voltage switched. While typical life expectancy is >5 × 10^6. Consult factory for life data at your load levels.
‡ Consists of 20V Zener-Diode and IN4002 Diode in series, connected in parallel to coil.

CONTROL RELAYS

Syrelec

Crouzet Corporation
2445 Midway Road
Carrollton, TX 75006-2503
Tel: 214-250-1647
1-800-527-5311 • Fax: 214-250-3865

Syrelec offers several variations of controls. Five models for liquid level controls, 3 phase 220V, 380V and 440V for phase loss or reversal protection, current and voltage detection and control, motion detection, solid state relays, and alternating relays are also available. If a standard control requires modification or a special product is needed to meet your exact needs, please call us or the Syrelec Sales Representative nearest you. *Most Controls are UL recognized and CSA approved.*

	SERIES	FUNCTION	FEATURES	OUTPUT
	**WRU** Phase Control Relay	Motor phase control 3 phase 220V 60 Hz. 3 Phase 380V 60 Hz. 3 Phase 440V 60 Hz. 3 Phase 575V 60 Hz. Consult factory for 50 Hz.	Motor phase control relay monitors: phase sequence, loss of any phase (even if induced voltage reaches 95% of normal voltage), under and over voltage.	10 Amp SPDT
	**IART + TIXP3** Current Control Relay	Output when current overshoots selected level 5 to 100 Amps AC using a current transformer (TIXP3).	Control of AC current level. Selection of threshold and hysteresis separate. LED Status indicator. Hysteresis adjustment 5 to 50% of current point.	10 Amp SPDT
	**DUR** Voltage Control Relay	Output when voltage exceeds selected threshold. 0.1 to 10V, 0.4 to 40V, 4.0 to 400V.	AC or DC control. From 0.1V to 400V. Threshold and hysteresis selection separately. LED state of relay indicator. Latching in "ON" state possible.	10 Amp SPDT
	**FMR** Analog Control Relay	Output relay is energized when voltage or current exceeds threshold. Din-rail mounting.	Settable threshold selection from 0 to 30VDC or from 0 to 30 mA DC. Pushbutton Presetting. Low alarm output at 4 mA. Din-rail mounting.	10 Amp SPDT
	**ARS** Solid State Relay	Operates as an open or closed switch. Control input: 90 to 280VAC (AC Version) or 3 to 32VDC (DC Version).	10, 25 or 40 Amp output. Zero voltage switching. Opto-isolated to 4000V.	10, 25 or 40 Amp Triac Solid State
	**RKT, RIT RPT** General Purpose Relay	Blade Plug-in, Ice Cube or 8 and 11 Plug-in Versions.	Surface mount, Indicating light also available.	DPDT or 3PDT 10 Amp
	**FJR 3** Triplexor	Control of multi-pump systems. Replaces mechanical duplexor and triplexor controls.	Triplex or duplex mode selectable by jumper. LED status indicators.	3 x SPDT 5 Amp
	**JR** Alternating Relay	Duplex or alternating action output relay.	LED status indicators. Transient protected, low cost 12, 24, 110, 220VAC 50/60HZ.	10 Amp SPDT 10 Amp SPDT DPDT Crosswired
	**NNR** Liquid Level Control	Pump-up or Pump-down, slide switch selectable. May be used in fresh water, sea water, sewage or chemical solutions.	Adjustable sensitivity from 4.7K to 47K ohms. Senses changes in resistance across probes. Open PC board design or enclosed with three mounting styles. Several accessories available.	1 Amp AC 1 Amp DC SPDT Relay
	**NR NRU** Liquid Level Control	Control of two liquid levels. Relay will energize when liquid reaches the high or low probe.	Automatic regulation and control of liquid levels, completely solid state detection, sensitivity adjustment on front panel, conventional relay mounting.	10 Amp AC 1 Amp DC SPDT
	**DVLR LVLR** Under Speed Monitor	Output when speed drops below preset threshold. Inhibit time adjustable at factory of .1 to 20 sec.	Detection and control of underspeed, stopping or jamming condition. Operates from 3 wire proximity switch, contact closure or voltage input. Timimg range .06 sec. to 10 hrs. with four subranges.	10 Amp AC 1 Amp DC SPDT

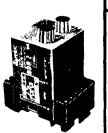
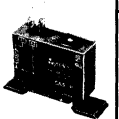
TIME DELAY RELAYS

Syrelec

Crouzet Corporation
2445 Midway Road
Carrollton, TX 75006-2503
Tel: 214-250-1647
1-800-527-5311 • Fax: 214-250-3865

Syrelec Corporation offers a broad line of Timers to meet the requirements of most industrial and instrument applications. Numerous accessories and options are available for convenient and compatible installation. If a standard Syrelec Timer does not meet your exact requirements, a custom designed or modified standard device could be the solution to fit your need. Contact your nearest Syrelec Sales Office or our Customer Service Department at 1-800-527-5311, for information regarding custom Timers and Controls. *Most Timers are UL recognized and CSA approved.*

	SERIES	FUNCTION	FEATURES
	**LR2** Multi-Function Relay	1. Delay on Make 2. Single Shot 3. Delay on Break 4. Interval Timer *Single Function Relay	Four functions in one unit. 0.06 sec.-640 min. in 2 time ranges, each with four subranges. 12VDC to 220VAC, 50/60 Hz. Din-rail; plug-in; panel mount. **OUTPUT:** 10 Amp DPDT relay
	**LRU** Multi-function Relay CRU Series	1. Delay on Make 2. Single Shot 3. Delay on Break 4. Interval Delay on Break	4 delay functions in one unit. Timing Range from .1 sec to 10 hrs in one unit **OUTPUT:** 10 Amp SPDT
	**813** Multi-function LCD or LED Timer	1. Delay on Make 2. Single Shot 3. Delay on Break 4. Interval 5. Repeat Cycle	3 Digit LCD or LED. Timing Range from .1 sec. to 999 hours. Push-button presetting. Multi-voltage **OUTPUT:** 5 Amp SPDT
	**LR2 U** Multi-function Relay	1. Delay on Make 2. Single Shot 3. Delay on Break 4. Interval	Timing Range from .1 sec. to 10 hours in one unit. Direct reading. Big setting Dial. **OUTPUT:** 10 Amp DPDT
	**88220** Multi-function Motor timer	Multi-function motor driven timer. Din-rail, 8 pin plug-in and panel mounting.	Five functions in one unit. Timing range from .3 sec to 12 hours. Direct reading. Memory. **OUTPUT:** 8 Amp 2X SPDT
	**AXR 2** Timing Relay	Delay on Make DPDT or Delay on Make + one Instantaneous Output Relay.	Timing range from .1 sec. to 10 hours in one unit. Direct Reading. Big Setting Dial. **OUTPUT:** 10 Amp 2X SPDT
	**AR2** Timing Relay	Delay on Make electronic timing relay. Din-rail, 8 and 11 pin plug-in, 11 pin spade, and panel mounting.	2 time range models available: 0.06 sec. to 160 sec. or 15 sec. to 640 min. LED relay status indicator. Five input power voltages. **OUTPUT:** 10 Amp DPDT
	**AR U** Timing Relay	Delay on Make Din-rail and 8 pin plug-in mounting.	Timing range from .1 sec to 10 hours in one unit. Direct reading. Dual voltage. **OUTPUT:** 10 Amp SPDT
	**813 AX2** Timing Relay	Delay on Make DPDT or Delay on Make + one Instantaneous Output Relay	3 Digit LCD Timing Range from .1 sec. to 999 hours. Push-button Presetting. **OUTPUT:** 5 Amp 2X SPDT
	**AXR** Delay on Make And Instanta-neous Output Relay	Dual function: 1 relay Delay on Make and 1 relay Instantaneous. Din-rail, 8 and 11 pin plug-in and panel mounting.	2 time ranges available: 0.06 sec. to 160 sec. or 15 sec. to 640 min. Time within range adjustable in four subranges. Five input power voltages. LED relay status indicator. **OUTPUT:** 10 Amp AC 1 Amp DC Two SPDT relays
	**KR** True Delay On Break Timer	Delay on Break timing begins on removal of power. Relay energizes when the input power is applied to the timer.	LED input power status indicator. Two time range models available each with four subranges. Four AC input power voltages, 50/60 Hz. **OUTPUT:** 5 Amp AC 1 Amp DC SPDT

	SERIES	FUNCTION	FEATURES
	**FR2** Combina-tion Timing Relay	2 independently timed outputs. Delay on Make and Delay on Break. Five mounting styles and five input power voltages.	LED relay status indicator. Each output in two ranges: 0.06 sec. - 160 sec. or 15 sec. - 640 min. T1 is Delay on Make; T2 is Delay on Break. **OUTPUT:** 10 Amp AC 1 Amp DC SPDT or DPDT
	**NAR 2** **NBR 2** **NCR 2**	Delay on Make Single Shot Delay on Break	Timing range potentio-meter fine tuned. Models in two ranges: 0.06 sec. - 160 sec. or 15 sec. - 640 min. Open PC board. Time range slide switch selected. **OUTPUT:** 10 Amp DPDT
	**AR2C** Preset Timer Preset Counter	Delay on Make timer or Preset Counter. Count to 999 at 10 Hz. speed in count mode. Din-rail, 11 or 8 pin plug-in.	Count or time preset selectable with thumbwheel switches on top of enclosure. 24 VAC to 220 VAC, 50/60 Hz. **OUTPUT:** 10 Amp DPDT
	**DR2 U** Repeat Cycle Timer	Repeat cycle. Both OFF and ON time indepen-dently set. Din-rail, 8 and 11 pin plug-in mounting.	Timing Range from .1 sec. to 10 hours for ON and OFF time selectable in one unit. Direct reading. **OUTPUT:** 10 Amp DPDT
	**DR2** Repeat Cycle Timer	Repeat cycle. Both OFF and ON time selectable. Din-rail, 8 and11 pin plug-in or panel mounting: T1 is OFF and T2 is ON time	2 time ranges available for OFF and ON time functions. Separate controls for ON and OFF setting. Each time range with four subranges. Five input power voltages. **OUTPUT:**10 AMP SPDT
	**DR U** Repeat Cycle Timer	Repeat cycle. Both OFF and ON time indepen-dently set. Din-rail and 8 pin plug-in mounting.	Timing range from .1 sec to 10 hours in one unit. Direct reading. Dual Voltage. **OUTPUT:** 10 Amp SPDT
	**SAS** **SHS** Solid State Timer	Delay on Make Interval Fast-on Terminals Small Size 1.77" x 1.96"	Available in fixed timing, external potentiometer and internal potentiometer models. Economical, epoxy encapsulated, 10 to 260VAC. 50/60 Hz. **OUTPUT:** Solid State .7 Amp SCR
	**SASCB** Solid State Compres-sor Timer	A time of 3 or 5 minutes is needed to equalize the interior pressure in the system. The SASCB is available to prevent reset of the thermostat	2 wire Device. Compact, encapsulated design for Din-rail mounting or through hole with screws. **OUTPUT:** Solid State .7 Amp SCR
	**QAS** **QHS** Solid State Timer	Delay on Make Interval 2" x 2" Package Fast on Terminals	Available in fixed timing, external potentiometer and internal potentiometer models. Economical, epoxy encapsulated, 10 to 260VAC. 50/60 Hz. **OUTPUT:** Sclid State 1 Amp SCR
	**QBS** **QCS** Solid State Timer	Single Shot Delay on Break 2" x 2" Package Fast on Terminals	Available in fixed timing, external potentiometer and internal potentiometer models. Economical, epoxy encapsulated, 10 to 260VAC. 50/60 Hz. **OUTPUT:** Solid State 1 Amp SCR
	**QDS 1 & 2** Solid State Timer	Repeat Cycle Off/On or On/Off 2" x 2" Package Fast on Terminals	Independent Off and On timing. Available in fixed timing, external potentiometer and internal potentiometer models 10 to 260VAC. 50/60 Hz. **OUTPUT:** Solid State 1 Amp SCR

Crouzet® Time Delay Relays

MULTI-FUNCTION
on-delay, interval and single shot in one timer

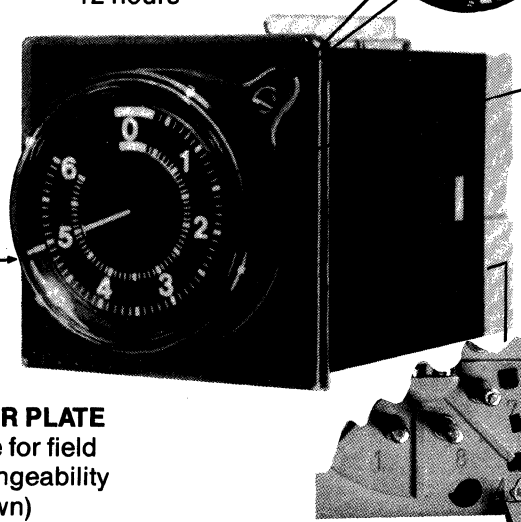
MULTI-RANGE
2 models/3 time ranges each cover from 0.3 sec. to 12 hours

TRANSIENT IMMUNITY
Built-in

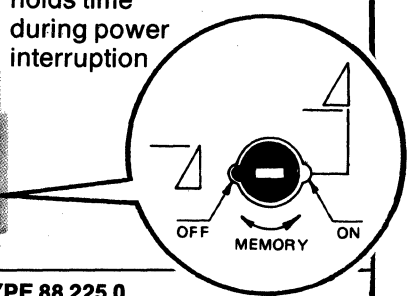
CYCLE PROGRESS
dial shows time remaining in cycle

±2% SETTING ACCURACY

±1.5% REPEAT ACCURACY

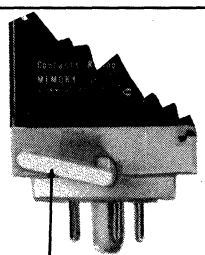


MEMORY
when "on," holds time during power interruption



ADAPTER PLATE
available for field interchangeability (not shown)

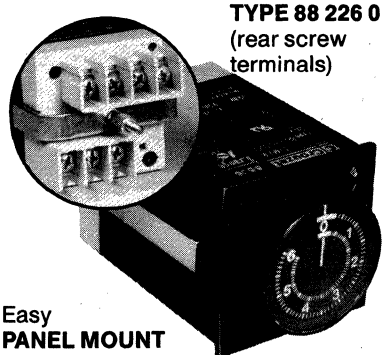
TYPE 88 226 5
(octal plug-in)



spring clip included for easy panel mounting

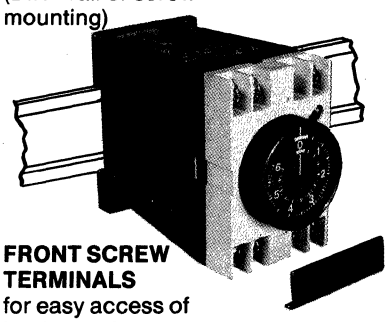
OCTAL LOCK
prevents timer from vibrating out of its socket

TYPE 88 226 0
(rear screw terminals)



Easy **PANEL MOUNT** with no additional hardware (clamp included)

TYPE 88 225 0
(DIN - rail or screw mounting)



FRONT SCREW TERMINALS
for easy access of back panel mounted timer

removable dust covers on terminals

SPECIFICATIONS

Time ranges
Minimum setting: 5% of time range.

Model	Multi-Range*
Model 1	6 sec./60 sec./12 min.
Model 2	6 min./60 min./12 hrs.

*Select any time range with screwdriver on either model

Repeat accuracy
±1.5% (except 4% on 6 sec. range).

Overall accuracy
±1.5% (except 4% on 6 sec. range) throughout entire operating temperature (– 4° F to 131° F) and voltage range (±10%).

Setting accuracy
±2% (except 5% on 6 sec. range).

Reset time
.2 sec.

Timing modes
"Interval," "on delay," "single shot;" possibility of keeping time when memory is "on" even in case of power interruption.

Output ratings
1 instantaneous N O contact, 8A-1/3 HP - 120/220 V AC,
1 delayed SPDT contact, 8A-1/3 HP - 120/220 V AC.

Life expectancy
Over 2.5 million operations or 10,000 hrs of continuous "on" time.

Power requirements
115 V 60 Hz + 10%, – 10%, 24 V 60 Hz + 10%, – 10%,
Optional: 240 V 60 Hz, 220 V 50 Hz, Input power: 3 VA.

Temperature rating
Operating: –20° C, + 55° C (–4° F to 131° F).
Storage: –20° C + 70° C (–4° F to 158° F)

Weight
6.4 oz. (185 grams).

CERTIFICATIONS

UL and CSA. VDE and other European standards.

Crouzet *Motors - Switches - Timers - Counters - Pneumatic Controls*

Crouzet Corporation 2445 Midway Road, Carrollton, TX 75006-2503 • Tel: 214-250-1647 • 1-800-527-5311 • Fax: 214-250-3865

eem MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

Encapsulated: Imbedded in a suitable potting compound.

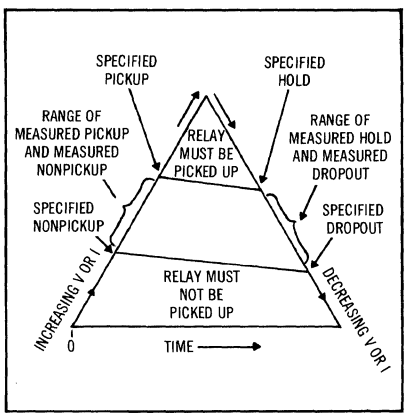
Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.



OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

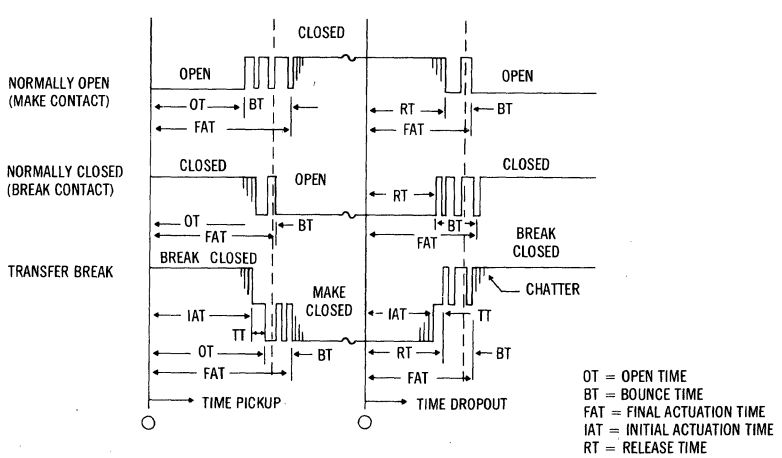
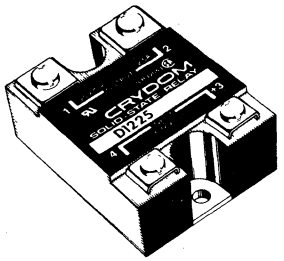


Fig. 2. Typical time vs. current (non-inductive load)

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES 1



2.5 TO 90 AMP, 120, 240 AND 480 VAC SCR AC OUTPUT, PANEL MOUNT SOLID-STATE RELAYS

These Crydom SSRs make it possible to switch AC power loads up to 47 kw. Output circuit consists of inverse-parallel (back-to-back) dual SCRs to meet the most demanding requirements. Features include zero voltage switching, phase control and normally closed models available. UL recognized, CSA certified & VDE approved.

AC Control Models—SCR Output

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
A1202	24-140	2.5	22.5
A1210	24-140	10	120
A1225	24-140	25	250
A1240	24-140	40	625
A2402	48-280	2.5	22.5
A2410	48-280	10	120
A2425	48-280	25	250
A2440	48-280	40	625
A2450	48-280	50	625
A2475	48-280	75	1000
*HA4812	80-530	12	140
*HA4825	80-530	25	250
*HA4840	80-530	40	625
*HA4850	80-530	50	625
*HA4875	80-530	75	1000
*HA4890	80-530	90	1200

*HA = 1200 VPK Blocking

General Specifications
Isolation Voltage: 4000 VAC Std. (Input to Output)
Operating Temperature Range: – 30°C to 80°C.

DC Input Control Models
Control Signal Range ..... 3-32 VDC
Must Operate Voltage ..... 3 VDC Max
Must Release Voltage ..... 1 VDC Min
Input Current ..... 4 mA max @ 5 VDC

AC Input Control Models	Standard	"E" Suffix
Control Signal Range	90-280 VAC	18-36 VAC
Must Operate Voltage	90 VAC Max.	18 VAC MAX
Must Release Voltage	10 VAC Min	4 VAC Min
Input Current	2 mA max @ 120 VAC	2.4 mA @ 24 VAC

DC Control Models—SCR Output

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
D1202	24-140	2.5	22.5
D1210	24-140	10	120
D1225	24-140	25	250
D1240	24-140	40	625
D2402	48-280	2.5	22.5
D2410	48-280	10	120
D2425	48-280	25	250
D2440	48-280	40	625
D2450	48-280	50	625
D2475	48-280	75	1000
*HD4812	80-530	12	140
*HD4825	80-530	25	250
*HD4840	80-530	40	625
*HD4850	80-530	50	625
*HD4875	80-530	75	1000
*HD4890	80-530	90	1200

*HD = 1200 VPK Blocking

ADDITIONAL DC INPUT MODELS AVAILABLE:
"NORMALLY CLOSED" ..... —B SUFFIX
"NON-ZERO SWITCH" ..... —10 SUFFIX
"400 Hz" ..... —4 PREFIX

5 & 90 AMP, 48-660 VAC AC OUTPUT SOLID-STATE RELAYS 1200V BLOCKING

The highest power rated SSRs, up to 59 kw, 4000V of isolation with the highest available blocking voltages (1.2 KV) below which the SSRs will not mistrigger. The wide margin between operating and blocking voltages permits the proper use of transient suppression (MOV) devices on the 480V line. Features include high dv/dt and zero voltage switching. UL & CSA

General Specifications
Control Signal Range "C", "WD" 4 to 32 VDC
"CA" . . . 90 to 140 VAC
Input Current @ 5 VDC . . . . . 15 mA max.
Isolation Voltage 50/60 Hz . . . . 4000 VRMS
Operating Temperature Range . . . . . —30°C to 80°C

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current Amps (RMS)	One Cycle Surge Amps (pk)
H12CA4850	48-660	50	625
H12CA4890	48-660	90	1200
H12WD4850	48-660	50	625
H12WD4890	48-660	90	1200

7.0 TO 40 AMP, 100 TO 500 VDC CMOS DC OUTPUT SOLID STATE RELAYS

This new Crydom series of DC power SSRs incorporates a power MOSFET as the output device in the classic Crydom package. The input can be driven from most logic circuits, requiring less than 1.6 mA at 5 VDC.

General Specifications
Control Signal Range . . . . . 3.5 to 32 VDC
Input Current @ 5 VDC . . . . . 1.6 mA max.
Isolation Voltage 50/60 Hz . . . . 2500 VRMS
Operating Temperature Range . . . . . —30°C to 80°C

Crydom Model No.	Line VDC	Max. Load Current @ 40°C Amps	10MS Surge Amps
D1D07	0-100	7.0	15
D1D12	0-100	12	28
D1D20	0-100	20	42
D1D40	0-100	40	106
D2D07	0-200	7.0	22
D2D12	0-200	12	27
D4D07	0-400	7.0	17
D4D12	0-400	12	36
D5D07	0-500	7.0	19
D5D10	0-500	10	29

10 TO 75 AMP, 120-240V DC CONTROLLED, AC OUTPUT SSRs FEATURE IC DRIVEN, LOW LEAKAGE (≤ 1mA) W/O INTEGRAL SNUBBER

Combining integrated circuit technology and the proven Crydom series 1 high power dissipation output system results in superior SSRs.

SCR OUTPUT

Crydom Model No.	Input Control Voltage	Output Load Current	Ratings Volts (RMS)
CSD2410	3.5-15 VDC	10A	120/240
CSD2425	3.5-15 VDC	25A	120/240
CSD2440	3.5-15 VDC	40A	120/240
CSD2450	3.5-15 VDC	50A	120/240
CSD2475	3.5-15 VDC	75A	120/240
CSE2410	15-32 VDC	10A	120/240
CSE2425	15-32 VDC	25A	120/240
CSE2450	15-32 VDC	50A	120/240

TRIAC OUTPUT

CTD2410	3.5-15 VDC	10A	120/240
CTD2425	3.5-15 VDC	25A	120/240

SERIES 1—HEATSINK SELECTION GUIDE

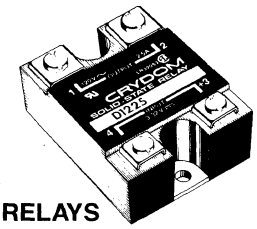
Maximum Operating Current (SSR Rating)	Crydom Heatsink Type	Maximum Ambient Temperature (@ Max. Current)
10A	HS-1	40°C
20A	HS-2	40°C
50A	HE-54	40°C

CRYDOM COMPANY: P.O. Box 3699 Lakewood, CA 90711-3699 TELEPHONE: (213) 865-3536 FAX: (213) 865-3318 TELEX: 910 250-5756

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES 1



5 THRU 25 AMP/120 AND 240 VAC TRIAC AC OUTPUT SOLID-STATE RELAYS

Crydom Triac SSRs are quality-made devices designed for general purpose switching applications where performance requirements are less demanding than those offered by SCR output types.
UL recognized, CSA certified & VDE approved.

General Specifications	DC Input	AC Input
Control Signal Range . .	3 to 32 VDC	90 to 280 VAC
Input Current	4 mA @ 5 VDC	2 mA @ 120 VAC
Isolation Voltage	4000 VRMS	4000 VRMS
Oper. Temp. Range	– 30°C to 80°C	– 30°C to 80°C

DC Control Models—Triac Output

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
TD1210	24-140	10	100
TD1225	24-140	25	250
TD2410	48-280	10	100
TD2425	48-280	25	250

AC Control Models—Triac Output

TA1210	24-140	10	100
TA1225	24-140	25	250
TA2410	48-280	10	100
TA2425	48-280	25	250

TIME DELAY RELAYS 48 TO 280 VAC, 10, 25 OR 50 AMP 2 TIMING RANGES

Standard series 1 relay with built-in Time Delay (On-Operate) (External resistor for 0 to 1.0 Megohm.)

General Specifications

Control Voltage Range . . . . . .3.5 to 15 VDC
Timing Range "DSD" . . . . . .0.1 to 83 sec
Timing Range "DLD" . . . . . .1.6 to 133 sec

Crydom Model No.	Max Load Current, Amps (pk)	One-Cycle Surge Amps (pk)
DSD2410	10	120
DSD2425	25	250
DSD2450	50	625
DLD2410	10	120
DLD2425	25	250
DLD2450	50	625

SOFT-START POWER MODULES/RELAYS 90-140 AND 180-280 VAC 10 TO 75 AMPS

A control module is used in combination with a Crydom phase control relay to provide gradual applicaton of power to the load.

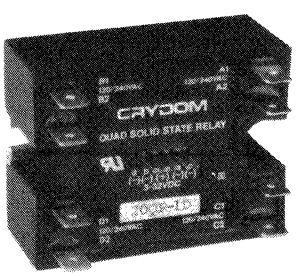
General Specifications: All models.

Input Operate Voltage Range . . . . . .3.5 to 10 VDC
Minimum Release Voltage . . . . . .1 VDC
Input Current @ 5 VDC . . . . . .1.6 mA

Crydom Model No.	Output Voltage Range VAC	Max Load Current Amps
SST120	90-140	*
10SST120	90-140	10
25SST120	90-140	25
40SST120	90-140	40
SST240	180-280	*
10SST240	180-280	10
25SST240	180-280	25
40SST240	180-280	40
75SST240	180-280	75

*Control Module only, must use with – 10 suffix type DC input relay





25, 40 AMP Dual-SCR Output 20 AMP Quad-Triac Output

General Specifications

Isolation Voltage: . . . . . .2500 VAC
Temperature Range:
Storage . . . . . – 40°C to 120°C
Operating: . . . . . – 30°C to 80°C
Weight: . . . . . .3.5 oz. (98G) Max.
Control Signal Range . . . . . .4-15 VDC
Must Operate Voltage . . . . . .4 VDC Max.
Must Release Voltage . . . . . .1 VDC Min.
Input Current . . . . . 45 mADC Max.
Off-State dv/dt . . . . . .200V/usec Min.

These space saving and cost saving "dual" and "quad" series provide two (2) or four (4) totally independent AC output solid state relays in a single Series 1 package. The "dual" types employ inverse parallel SCR outputs and are available in 25 AMP and 40 AMP models. The "quad" types have triac outputs. Protection is provided by an internal dv/dt snubber network across the output switch which restricts the rate of rise of most voltage transients to within acceptable limits. Features include 2500 VRMS optical isolation, zero voltage turn-on and zero current turn-off of the the load. Random voltage turn-on units (– 10 suffix) are also available for phase control applications.

These series are ideal when multiple SSR's are required for interfacing between the logic output of TTL, HTL, MOS or microprocessor circuits and AC loads such as motors, heaters, lamps, solenoids and transformers.

DUAL—SCR OUTPUT **UL Recognized, CSA Certified**

Crydom Model No.	Line VAC (47-70 Hz)	Max. Load Current Amps (RMS) (Per Section)	One-Cycle Surge Amps (PK) (Per Section)	Switching Mode
D2425D	24-280	25	350	Zero
D2425D-10	24-280	25	350	Non-Zero
D2440D	24-280	40	500	Zero
D2440D-10	24-280	40	500	Non-Zero

QUAD—TRIAC OUTPUT **UL Recognized, CSA Certified**

TD2420Q	24-280	20	250	Zero
TD2420Q-10	24-280	20	250	Non-Zero

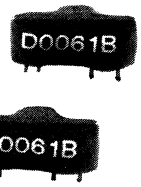
CRYDOM COMPANY: P.O. Box 3699 Lakewood, CA 90711-3699 TELEPHONE: (213) 865-3536 FAX: (213) 865-3318 TELEX: 910 250-5756

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES DO 061

DC MINI-SIP



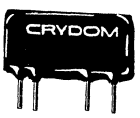
Crydom Model No.	Line Voltage VDC	Max. I @ 60°C A (RMS)	Control Voltage Range	Must Operate Voltage, Max.	Must Release Voltage, Min.	Surge Current 1 Sec.
DO 061A	3-60	1.0	3.0-9.0 VDC	3.0 VDC	1.0 VDC	5A
DO 061B	3-60	1.0	1.7-9.0 VDC	1.7 VDC	0.8 VDC	5A

The DO 061 are miniature DC output modules in a conformally coated SIP package, measuring only 0.46 x 0.9 x 0.4 in. with pinouts on the popular 100-mil grid. The input-to-output isolation is 4000VRMS with an isolation resistance of 1×10^9 ohms. The units are derated 10mA per degree C above 60°C ambient temperature. Operating temperature range is – 30°C to + 80°C. When used for inductive loads, diode suppression across the load is recommended.

SERIES AO 241

1.0 AMP, 24-280 VAC TRIAC OUTPUT DC CONTROL

AC MINI-SIP



The CRYDOM A0241/R AC relays are 1.0 amp rated SPST-NO miniature SIP solid state relays. Utilizing the popular 100-mil. grid they occupy only 0.36 square inches of board space. These miniature relays have the same high technology and reliable design found in all CRYDOM products. UL, CSA pending.

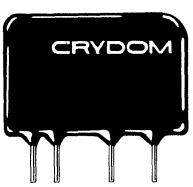
Features
- Compact Package For High Density PC Board Mounting
- TTL Logic Compatible Input
- 4000 Vrms Optical Isolation
- Both "Zero Voltage" & Phase Controllable "Random" Switching Versions

Input Specifications		
Control Voltage Range	3.0-9.0	Vdc
Input Current (Max.) @5.0V / @Max. V	12/25 & 15/30	mA
Output Specifications		
Load Current Range (Fig. 1)	.02-1.0	Arms
Surge Current, 1 Cycle (Max.)	15	Apk
Load Voltage Range	24-280	Vrms
Transient Over-Voltage	600	Vpk
Frequency Range	47-70	Hz
General Specifications		
Dielectric (Min). ①	4000	Vrms

Switch Mode	Zero-Cross	Random
Model No.	A0241	A0241R

SERIES CX

5.0 AMP, 12-280 VAC SCR OUTPUT DC CONTROL



The CX series is a group of solid state relays designed by CRYDOM to achieve the highest power switching capability in a PC mounted air cooled package. They feature exceptional steady state and high surge ratings by means of over sized inverse-parallel SCR chips, together with highly efficient thermal management for greatly increased cycle life. UL, CSA & VDE pending.

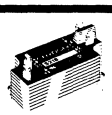
Features
- Extra High Surge Rating
- Extra Low Leakage (Off-state)
- Opto-Isolated 4000 Vrms
- Random And Zero Voltage Switching
- Compact Package For High Density
- PC Board Mounting
- 3-15 Vdc Logic Compatible Input

Switch Mode	Zero-Cross	Random
Model No.	CX240D5	CX240D5R

Input Specifications		
Control Voltage Range	3-15	Vdc
Maximum Input Current: @5.0V/@Max. V	14 / 47	mAdc
Output Specifications		
Load Current Range (Fig. 1)	.06-5.0	Arms
Surge Current, 1 Cycle (Max.)	250	Apk
Load Voltage Range	12-280	Vrms
Transient Over-Voltage	600	Vpk
Frequency Range	47-63	Hz
General Specifications		
Dielectric (Min). ①	4000	Vrms

SERIES 2

8 AMPS, 120 AND 240 VAC AC OUTPUT, PANEL MOUNT SOLID-STATE RELAYS



Series 2
0.85" (21.59mm) x 1.75" (44.5mm) x 0.83" (21.08mm)

The Crydom Series 2 solid-state relays combine small size, zero voltage switching and high current rating in a package designed for heat sink or panel mounting. Standard 0.187" push-on terminals allow quick connection and are positioned to provide maximum isolation between control and power circuits. UL recognized & CSA certified.

General Specifications
Control Signal Range. . . . . .3.5 to 8 VDC
Control Signal Range"221C" 3.5 to 7 VDC
Must Operate Voltage . . . . . .3.5 VDC max
Must Release Voltage . . . . . .1 VDC min
Must Operate Current . . . . . .12 mA max
Isolation Voltage . . . . . .2500 VAC
Operating Temperature Range . . . . . – 30°C to 80°C
Snubber . . . . . .Internal

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current @ 40°C Amps (RMS)	One-Cycle Surge Amps (PK)
S218	20-140	8	120
S228	40-280	8	120
S228C	24-280	8	120

SERIES 3

AC OUTPUT, PC BOARD MOUNT SOLID-STATE RELAYS 0.3 TO 3 AMPS 120 AND 240 VAC



Case Style 30A



Case Style 3

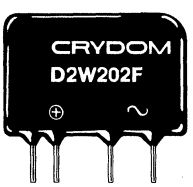
Designed for PCB applications. Units require only 1 sq. in. space on boards. Overall height of 0.45" on case 3 allows spacing on 0.5" centers. High current rating. Zero voltage switching. UL & CSA certified.

General Specifications
Control Signal Range. . . . . .3.5 to 8 VDC
(Models S3013A/S3023A . . .3.5 to 18 VDC)
Must Operate Voltage . . . . . .3.5 VDC max
Must Release Voltage . . . . . .1 VDC min.
Isolation Voltage . . . . . .2500 VAC
(Models S3013A/S3023A. . . . . .4000 VAC)
Operating Temperature Range. . . – 30°C to 80°C

Crydom Model No.	Line VAC (47-63 Hz)	Max. I @ 40°C A (RMS)	One-Cycle Surge Amps (PK)	Internal Snubbers	Case Style
S312	20-140	2	55	No	3
S3012A	20-140	2	55	Yes	30A
S3013A	24-140	3	55	Yes	30A
S322	40-280	2	55	No	3
S3022A	40-280	2	55	Yes	30A
S3023A	48-280	3	55	Yes	30A

SERIES D2W

LOW COST AC OUTPUT 60 TO 280 VAC, 2 AMPS SOLID-STATE RELAYS



The D2W202F is designed to achieve optimum performance at a record low cost by means of completely automated assembly using labor saving robotics. The package has a hard, skin-tight epoxy coating which provides excellent environmental protection and a pinout that matches the Series 6.
UL recognized & CSA certified.

General Specifications
Control Signal Range . . . . . .3 to 28 VDC
Must Operate Voltage, max. . . . . .3 VDC
Must Release Voltage, min. . . . . .1 VDC
Input Current @ 5 VDC max. . . . . .4 mA
Input Impedance, min. . . . . .1500 OHMS
Dielectric Strength: 50/60 Hz . .2500 VRMS
Operating Temperature Range. . . – 20°C to 80°C

Crydom Model No.	Control Voltage Range	Output Ratings	Surge One Cycle
D2W202F	3-32 VDC	2A @ 60-280 VAC	28A pk
D2W203F	3-32 VDC	3A @ 60-280 VAC	—
D2W203F-11	3-32 VDC	3.5A @ 60-280 VAC	80A pk

CRYDOM COMPANY: P.O. Box 3699 Lakewood, CA 90711-3699 TELEPHONE: (213) 865-3536 FAX: (213) 865-3318 TELEX: 910 250-5756

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

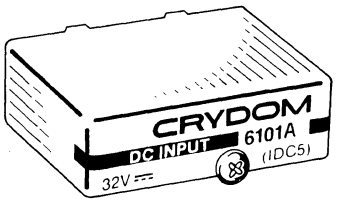
SERIES 6 AC AND DC MICROPROCESSOR INPUT/OUTPUT MODULES

3.5 AMPS, 60 VDC, 120 and 240 VAC
Standard Input/Output Modules (and Equivalents)
*IN COMPLIANCE WITH NEMA 2-230 (NOISE IMMUNITY)

5 Volt Models		15 Volt Models					
P-N	Equivalent	P-N	Equivalent	Type	Input Current vs. Voltage	Maximum Load Voltage	Maximum Load Current
6101/6101A*	IDC5	6131	IDC15	DC/IN	7 mA@32 VDC	30 VDC	25 mA@80°C
6201A*	IAC5	6231	IAC15	AC/IN	6 mA@120 VDC	30 VDC	25 mA@80°C
6202A*	IAC5-A	6232	IAC15-A	AC/IN	6 mA@240 VAC	30 VDC	25 mA@80°C
6301A*	ODC5			DC/OUT	15 mA@5 VDC	60 VDC	3 ADC@45°C
6401A*	OAC5			AC/OUT	15 mA@5 VDC	140 VDC	3A RMS@45°C
6402A*	OAC5-A			AC/OUT	15 mA@5 VDC	280 VDC	3A RMS@45°C
6102	—	—	—	DC/IN	6 mA@180 VDC	30 VDC	25 mA@80°C
6200	—	—	—	AC/IN	6 mA@24 VAC	30 VDC	25 mA@80°C
6302	ODC5-A	—	—	DC/OUT	12 mA@5 VDC	200 VDC	1.5A@45°C

Buffered Output Modules
*SINK CURRENT (NON-INVERTING) **SOURCE CURRENT (INVERTING)

Crydom Part No.						
5V Models	15V Models	Type	Input Current vs. Voltage 5 Volt Models	Input Current vs. Voltage 15 Volt Models	Maximum Load Voltage	Maximum Load Current
6311	6341	DC/OUT	75 µA@0.8 VDC*	175 µA@2.0 VDC*	60 VDC	3.5 ADC@45°C
6321	6351	DC/OUT	75 µA@2.4 VDC**	75 µA@8.0 VDC**	60 VDC	3.5 ADC@45°C
6411	6441	AC/OUT	75 µA@0.8 VDC*	175 µA@2.0 VDC*	140 VDC	3.5A RMS@45°C
6412	6442	AC/OUT	75 µA@0.8 VDC*	175 µA@2.0 VDC*	280 VDC	3.5A RMS@45°C
6421	6451	AC/OUT	75 µA@2.4 VDC**	75 µA@8.0 VDC**	140 VDC	3.5A RMS@45°C
6422	6452	AC/OUT	75 µA@2.4 VDC**	75 µA@8.0 VDC**	280 VDC	3.5A RMS@45°C



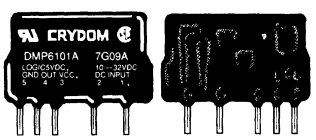
For electrically clean, photo-isolated, noise free interfacing between logic level programmable controllers, microprocessors and machine controls and power level loads.
Input modules accept power level signals and convert them to logic level signals. Output modules accept logic level signals to switch AC or DC loads to 3.5 Amps. UL recognized & CSA certified.

General Specifications—All Models

Dielectric (Input/Output) . . . . . 4000 VRMS
Isolation Resistance
(Input/Output@500V) . . . . . 10^{10} Ohms
Capacitance (Input/Output) . . . . . 8.0 pF
Operating Temperature
Range . . . . . – 40°C to 80°C

SERIES DMP

AC AND DC INPUT/OUTPUT MODULES 3 AMPS, 30, 60 VDC AND 280 VAC

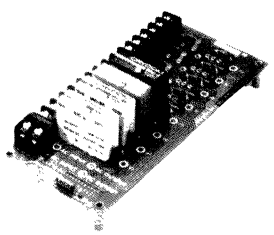


Electrically identical to Series 6 models. Packaged in a hard, skin-tight epoxy conformal coating for excellent environment protection and fast heat-transfer. Pin-out matches Series 6. UL recognized & CSA certified.

Crydom Model Number	Module Type	Input Current vs. Voltage	Max. Load Voltage
DMP6101A	DC/IN	32 mA@ 32 VDC	30 VDC
DMP6201A	AC/IN	6 mA@120 VAC	30 VDC
DMP6202A	AC/IN	6 mA@240 VAC	30 VDC
DMP6301A	DC/OUT	15 mA@ 5 VDC	60 VDC
DMP6402A	AC/OUT	15 mA@ 5 VDC	280 VDC

SERIES PB

MOUNTING BOARDS FOR I/O MODULES



These mounting boards will accept input/output modules in any combination of input or output types of the same style (single or quad channel). Modules can be easily and quickly inserted, without disturbing field wiring. The single channel models provide an LED status indicator, plug-in 5 amp fuse and 3.3. Kohm pull-up resistor for each module.

Features

- LED Status Indicators
- Plug-in Fuses
- Pull-up Resistors
- Barrier Strip Screw Terminals for Field Wiring
- Card Edge Logic Connections Available
- Screw Terminal Logic Connections Available
- UL Recognized Types
- CSA Certified Types

General Specifications	MODEL NUMBER							
	PB-4	PB-4R	PB-8	PB-16A	PB-16T	PB-24	PB-24Q	PB-32DEC*
Module Positions	4	4	8	16	16	24	6 Quad	8 Quad
Input/Output Channels	4	4	8	16	16	24	24	32
Designed to Operate with Negative True Logic Systems and One Logic Voltage	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Designed to Operate with Negative or Positive True Logic Systems and Different Logic Voltage	No.	Yes	No	No	No	No	No	No
Connections, Fuses, Approvals								
Barrier Strip Screw Terminals for Field Connections	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Logic Connection Type	Screw Terminal	Screw Terminal	26, 50-Pin Card Edge	50-Pin Card Edge	Screw Terminal	50-Pin Card Edge	50-Pin Card Edge	50-Pin Card Edge
Connector Part Number Code	—	—	①②	②	—	②	②	②③
5 Amp Fuse: Bussman GFAI, or Littlefuse 275-005, or Littlefuse 255005	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1 Amp Fuse: Bussman GFAI, or Littlefuse 275-001, or Littlefuse 255001	No	No	No	No	No	Yes	Yes	Yes
UL Recognized*	Pending	Yes	Pending	Pending	Yes	Pending	Pending	Pending
CSA Certified**	Yes	Yes	Yes	Yes	Yes	Yes	Pending	Pending

Connector Park Numbers *Card Edge Connector Are Spaced On 0.1" (3mm) Centers

① 26-Pin Card Edge Connector: T&B Ansley P/N 609-2615M
3M PN 3462-001

② 50-Pin Card Edge Connector: T&B Ansley P/N 609-5015M
3M PN 3415-001
Dale P/N EB43K25SGFW (Wire Wrap or Solder Connector)

③ Will Accept 27-Pin Single Row Header:
Female (Straight): Samtec P/N SSW-127-02-T-S
Methode P/N 1000-027-2101
Female (Rt. Angle): Samtec P/N SSW-127-03-T-S-RA
Male (Straight): Samtec P/N TSW-127-08-T-S
Methode P/N 1100-1-127-01
Amp P/N 2-102202-4
Male (Rt. Angle): Samtec P/N TSW-127-09-T-S-RA
Methode P/N 1100-3-127-01
Amp P/N 2-102203-4

*DEC Q-bus compatible. **Recognized/Certified for 125V max. with 5 amp fuses, for 250V max. with #22 solid copper jumper wire instead of 5 amp fuses.

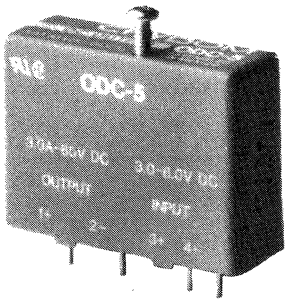
CRYDOM COMPANY: P.O. Box 3699 Lakewood, CA 90711-3699 TELEPHONE: (213) 865-3536 FAX: 9213) 865-3318 TELEX: 910 250-5756

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES IAC/IDC OAC/ODC

SOLID-STATE OPTO-ISOLATED I/O MODULES 5, 15, 24 VDC



Industrial environments can subject sensitive microelectronic circuits to undesirable stress in the form of voltage transients, electrical noise, shock, vibration, etc. These can result in permanent damage, spurious operations or false indications. Crydom's I/O modules are designed to provide an electrically clean, photo-isolated, noise-free "output" interface from logic level control systems to external loads such as motors, valves, solenoids, etc., or, an "input" interface from the load or sensors to microprocessor or computer-based logic level systems. Used with Crydom's I/O mounting boards, these solid-state modules exhibit long, reliable life in industrial environments.

FEATURES

- Color-coded by Function
- 4000 Vrms Optical Isolation
- Industry Standard Package and Pin-out
- High Transient Noise Immunity
- Series Operation Compatibility
- UL Recognized, CSA Certified, SEV Approved Types Available

	System Voltage 5 VDC								
	Model Number								
General Specifications	IAC-5	IAC-5A	IDC-5	IDC-5B	IDC-5D	OAC-5	OAC-5A	ODC-5	ODC-5A
Voltage Type	AC or DC Input	AC or DC Input	DC Input	DC Input	DC Input	AC Output	AC Output	DC Output	DC Output
Color Code	Yellow	Yellow	White	White	White	Black	Black	Red	Red
Input Specifications									
Voltage Range	90-140 VAC	180-280 VAC	10-36 VDC	4-16 VDC	3-32 VDC	3-6 VDC	3-6 VDC	3-6 VDC	3-6 VDC
Typical Current @ Rated Volt. (mA)	6	4	4	4	8	4	4	3	3
Typical Current @ Max. Volt. (mA)	10	7	13	20	12	20	20	14	14
Output Specifications									
Load Current Over Load Voltage Range	.1-100mA @ .4-30 VDC	.1-100mA @ .4-30 VDC	.1-100mA @ .4-30 VDC	.1-100mA @ .4-30 VDC	.1-100mA @ .4-30 VDC	.02-3A @ 12-280 VAC	.02-3A @ 24-280 VAC	.02-3A @ 5-60 VDC	.02-1A @ 10-200 VDC
Max. Turn-on/Turn-off Time (mS)	20/20	20/20	5/5	.05/.1	1/1.5	Half/Half (cycle)	Half/Half (cycle)	0.5/0.5	0.5/0.5
Switching Type	Random	Random	Random	Random	Random	Zero	Zero	Random	Random
Notes	1, 2, 3, 5, 7	1, 2, 3, 5, 7	1, 2, 5	1, 2, 5	1, 2, 5	1, 2, 4	1, 2, 4	1, 2, 4	1, 2, 4

	System Voltage 15 VDC						
	Model Number						
General Specifications	IAC-15	IAC-15A	IDC-15	OAC-15	OAC-15A	ODC-15	ODC-15A
Voltage Type	AC or DC Input	AC or DC Input	DC Input	AC Output	AC Output	DC Output	DC Output
Color Code	Yellow	Yellow	White	Black	Black	Red	Red
Input Specifications							
Voltage Range	90-140 VAC	180-280 VAC	10-36 VDC	9-18 VDC	9-18 VDC	9-18 VDC	9-18 VDC
Max. Input Current @ Rated Volt. (mA)							
Max. Input Current @ Max. Volt (mA)							
Output Specifications							
Load Current Over Load Voltage Range	.1-100mA @ .4-30 VDC	.1-100mA @ .4-30 VDC	.1-100mA @ .4-30 VDC	.02-3A @ 12-280 VAC	.02-3A @ 24-280 VAC	.02-3A @ 5-60 VDC	.02-1A @ 10-200 VDC
Max. Turn-on/Turn-off Time (mS)	20/20	20/20	5/5	Half/Half (cycle)	Half/Half (cycle)	0.5/0.5	0.5/0.5
Switching Type	Random	Random	Random	Zero	Zero	Random	Random
Notes	1, 2, 3, 5, 7	1, 2, 3, 5, 7	1, 2, 5	1, 2, 3, 4	1, 2, 3, 4	1, 2, 4	1, 2, 4

	System Voltage 24 VDC					
	Model Number					
General Specifications	IAC-24	IDC-24	OAC-24	OAC-24A	ODC-24	ODC-24A
Voltage Type	AC or DC Input	DC Input	AC Output	AC Output	DC Output	DC Output
Color Code	Yellow	White	Black	Black	Red	Red
Input Specifications						
Voltage Range	90-140 VAC	10-36 VDC	18-28 VDC	18-28 VDC	18-28 VDC	18-28 VDC
Max. Input Current @ Rated Volt. (mA)	8	4	10	10	7	7
Max. Input Current @ Max. Volt (mA)	10	13	17	17	12	12
Output Specifications						
Load Current Over Load Voltage Range	.1-100mA @ .4-30 VDC	.1-100mA @ .4-30 VDC	.02-3A @ 12-280 VAC	.02-3A @ 24-280 VAC	.02-3A @ 5-60 VDC	.02-1A @ 10-200 VDC
Max. Turn-on/Turn-off Time (mS)	20/20	5/5	Half/Half (cycle)	Half/Half (cycle)	0.5/0.5	0.5/0.5
Switching Type	Random	Random	Zero	Zero	Random	Random
Notes	1, 2, 3, 5, 7	1, 2, 3, 5, 7	1, 2, 3	1, 2, 3, 4	1, 2, 4	1, 2, 4

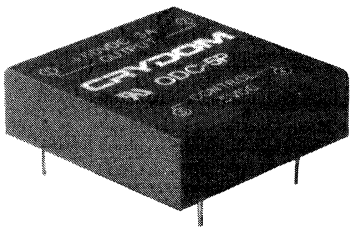
NOTES: 1. UL recognized. 2. CSA certified. 3. SEV approved. 4. The output of the AC output module is compatible with the input of the AC input module and the output of the DC output module is compatible with the input of the DC input module. 5. Input modules provide an output that is active low. 6. Output modules can be controlled from active or active high logic. 7. Input will operate on AC or DC voltage.

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES IACP/IDCP OACP/ODCP

FLAT PACK I/O MODULES



These flat pack modules offer reliable input-output interfacing in a low profile package outline that permits PC board spacing on half-inch centers.

FEATURES

- Low Profile Permits 0.50 inch (12.70mm) PC Board Spacing
- Industry Standard Footprint
- Color-Coded by Function
- 4,000 Vrms Optical Isolation
- High Transient Noise Immunity
- Series Operation Compatibility
- UL Recognized, CSA Certified

General Specifications	Model Number			
	IAC-5P	IDC-5P	OAC-5P	ODC-5P
Voltage Type	AC or DC Input	DC Input	AC Output	DC Output
System Voltage VDC	4.5-28	4.5-28	5	5
Color Code	Yellow	White	Black	Red
Input Specifications				
Voltage Range	90-14[illegible]	10-36 VDC	3-6 VDC	3-6 VDC
Max. Input Current @ Rated Volt. (mA)	8	8	19	14
Max. Input Current @ Max. Volt. (mA)	9	13	24	18
Output Specifications				
Load Current Over Load Voltage Range	>0-100mA @ >0-30 VDC	>0-100mA @ >0-30 VDC	.02-3A @ 12-280 VAC	.02-3A @ 5-60 VDC
Max. Turn-on/Turn-off Time (mS)	20/20	5/5	Half/Half (cycle)	0.5/0.5
Blocking V Peak	—	—	500	—
Switching Type	Random	Random	Zero	Random
Notes	1, 2, 3, 4, 6, 7, 8	1, 2, 3, 4, 6, 7, 8	1, 2, 3, 5, 6, 7	1, 2, 3, 5, 6, 7

NOTE: 1. UL recognized. 2. CSA certified. 3. The outputs of the output modules are compatible with the input of input modules, making them suitable for series operation. 4. Input modules provide an output which is active low. 5. Output modules can be controlled from active low or active high logic. 6. Transient noise immunity >3000 $V_{p\text{-}p}$ (NEMA ICS—230). 7. Capacitance: 10 PF maximum (input to output). 8. Input will operate on AC or DC.

SERIES 53TP

3 PHASE SOLID STATE RELAYS
25A AND 50A RMS
530V RMS

The Crydom 53TP range of three phase solid state relays is designed to switch line voltages of up to 530V rms directly to loads such as motors, transformers and heating elements. The use of power semiconductor technology ensures precise, clean make and break operation. Standard units incorporate circuitry which ensures switch-on at close to the zero cross-over point of load voltage thus virtually eliminating the generation of r.f.i. and electrical noise. For switching of highly inductive loads, an instantaneous turn-on option is available. Power semiconductors generate heat energy during operation and a suitable heatsink must be used to keep the unit within its temperature ratings. The high current surge characteristics allow trouble-free switching of capacitive loads. UL, CSA & VDR pending.

Characteristics

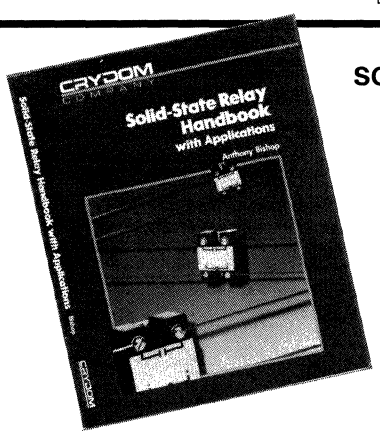
Type	Irms	Vrms	Vpk	Input	Itsm	I^2t
A53TP25-D	25A	48-520	1200	90-280vac	300A	450
A53TP50-D	50A	48-530	1200	90-280vac	500A	1250
D53TP25-D	25A	48-530	1200	3-32vdc	300A	450
D53TP50-D	50A	48-530	1200	3-32vdc	500A	1250

NOTE: ADD – 10 SUFFIX FOR RANDOM TURN-ON

Control Circuit	D...Types		
V_{IN}	Input voltage range–max.	V dc	3-32
Control Circuit	**A...Types**		
V_{IN}	Input voltage range–max.	V rms	90-280
General			
V_{IS}	Isolation voltage (in-out) test 1 min.	kV rms	4.0

FEATURES

- Opto-isolated input-output 4000V rms
- Electrically isolated mounting base
- dc or ac control signal option
- Zero cross-over load voltage turn-on standard; instantaneous turn-on option available[7]



SOLID-STATE RELAY HANDBOOK

WITH APPLICATIONS
BY ANTHONY BISHOP

This comprehensive 223 page reference to the use and applications of Solid-State Relays (SSRs) incorporates a detailed tutorial on what SSRs are and why they are used in various industrial applications. In its pages you will find:

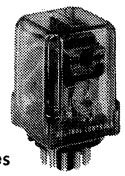
- A thorough introduction to solid-state relays
- Descriptions of various coupling methods
- SSR operation and parameters
- Coverage of different drive methods
- Thermal considerations
- Applications of SSRs in microprocessor-based equipment for industrial machine control
- A cross reference of types and manufacturers
- A handy glossary of terms

ORDER: HDBK-899

CRYDOM COMPANY: P.O. Box 3699 Lakewood, CA 90711-3699 TELEPHONE: (213) 865-3536 FAX: (213) 865-3318 TELEX: 910 250-5756

DELTROL RELAYS

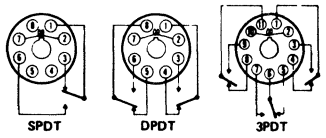
SEE SECTION 4550 FOR SOLENOIDS



105 Series

L = 1-3/8
W = 1-3/8
H = 2

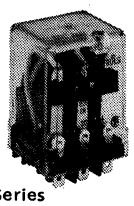
General purpose plug-in relay for continuous duty operation. Plastic cover. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).



BASE DIAGRAMS FOR 105 SERIES



B-3 HOLD DOWN SPRING
S/N 20171-00



165/166 Series

L = 1-13/32
W = 1-1/2
H = 2-3/16

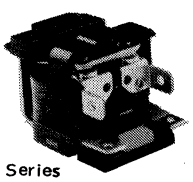
Plastic covered general purpose plug-in relay. Molded nylon coil. Continuous duty operation. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). Also CSA Recognized.



170 Series

L = 1-7/8
W = 1-5/8
H = 1-1/4

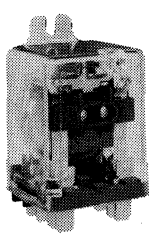
High current relays for industrial control applications. Molded nylon encapsulated coil is resistant to fungus and moisture. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).



177 Series

L = 1-7/8
W = 1-5/8
H = 1-1/4

High current relays for industrial control applications. Molded nylon encapsulated coil is resistant to fungus and moisture. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).



267F Series

L = 1-13/32
W = 1-1/2
H = 2-29/32
Mounting Center = 2-1/2

General purpose relay with plastic cover. Molded nylon coil insures reliable continuous-duty performance. .250 quick connect terminals. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

105 SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20106-82	105	SPDT	10A	24VAC	82	2.0VA
20106-84	105	SPDT	10A	120VAC	2,250	2.0VA
20107-84	105	DPDT	5A	120VAC	1,800	2.2VA
20108-81	105	DPDT	10A	12VAC	19	2.0VA
20108-82	105	DPDT	10A	24VAC	74	2.0VA
20108-84	105	DPDT	10A	120VAC	1,800	2.0VA
20108-85	105	DPDT	10A	240VAC	6,800	2.0VA
20110-82	105	3PDT	10A	24VAC	74	2.2VA
20110-84	105	3PDT	10A	120VAC	1,800	2.2VA
20110-85	105	3PDT	10A	240VAC	6,800	2.2VA
20114-80	105	DPDT	10A	6VDC	30	1.2W
20114-81	105	DPDT	10A	12VDC	120	1.2W
20114-82	105	DPDT	10A	24VDC	472	1.2W
20114-83	105	DPDT	10A	48VDC	1,800	1.2W
20114-84	105	DPDT	10A	110VDC	10,000	1.2W
20116-81	105	3PDT	10A	12VDC	120	1.2W
20116-82	105	3PDT	10A	24VDC	472	1.2W

165/166 SERIES

Flange-Mount Versions are Also Available.

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20307-82	166	DPDT	10A	24VAC	74	2.2VA
20307-84	166	DPDT	10A	120VAC	1,800	2.2VA
20307-85	166	DPDT	10A	240VAC	6,800	2.2VA
20308-82	166	3PDT	10A	24VAC	74	2.2VA
20308-84	166	3PDT	10A	120VAC	1,800	2.2VA
20308-85	166	3PDT	10A	240VAC	6,800	2.2VA
20310-80	166	DPDT	10A	6VDC	30	1.2W
20310-81	166	DPDT	10A	12VDC	120	1.2W
20310-82	166	DPDT	10A	24VDC	472	1.2W
20325-84	165	3PDT	5A	120VAC	1,800	2.2VA
20311-81	166	3PDT	10A	12VDC	120	1.2W
20311-82	166	3PDT	10A	24VDC	472	1.2W
20311-84	166	3PDT	10A	110VDC	9,500	1.2W
20381-82	166A	3PDT	10A	24VAC	74	2.2VA
20381-83	166A	3PDT	10A	120VAC	1,800	2.2VA

170 SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20392-82	170	SPST-	30A	24VAC	44	4.7VA
20392-83	170	NO-DM	30A	120VAC	1,100	4.7VA
20394-81	170	SPST-	30A	12VDC	72	2W
20394-82	170	NO-DM	30A	24VDC	288	2W

177 SERIES

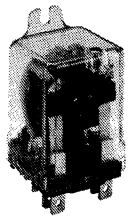
		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20935-82	177	SPST-	30A	24VAC	44	4.7VA
20935-83	177	NO-DM	30A	120VAC	1,100	4.7VA
20936-81	177	SPST-	30A	12VDC	72	2W
20936-82	177	NO-DM	30A	24VDC	288	2W

267F SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20601-84	267F	DPDT	15A	120VAC	1,800	2.2VA
20606-82	267F	SPDT	15A	24VDC	360	1.2W
20607-81	267F	DPDT	15A	12VDC	96	1.2W
20607-82	267F	DPDT	15A	24VDC	360	1.2W

DELTROL RELAYS MADE IN U.S.A.

SEE SECTION 4550 FOR SOLENOIDS



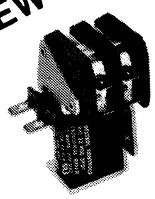
General purpose relays with plastic dust cover with flange mounting, barrier-type .250" quick-connect terminals and molded-nylon coil. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA Recognized.

275F SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20844-82	275F	DPDT	25A	24VAC	55	2.4VA
20844-84	275F	DPDT	25A	120VAC	1,500	2.4VA
20848-82	275F	SPST-NO-DM	35A	24VDC	320	1.8W
20852-82	275F	DPDT	25A	24VDC	320	1.8W

20-AMP POWER RELAYS

NEW

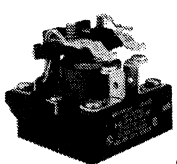


L = 2.07 Max.
W = .940 Max.
H = 2.42 Max.

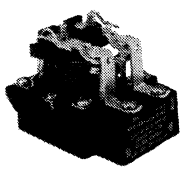
20-Amp Power Relays with molded nylon coils. 0.187 or 0.250 quick-connect terminals. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA Certified (File No. 20690).

871 SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20886-84	871	SPDT	20A	120VAC	800	5.0VA
20887-84	871	DPDT	20A	120VAC	800	5.0VA
20888-82	871	SPDT	20A	24VDC	200	2.9W
20889-82	871	DPDT	20A	24VDC	128	4.5W

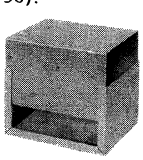


Single Pole
L = 2-1/2
W = 2-1/2
H = 2-3/16



Double Pole
L = 3-11/32
W = 2-1/2
H = 2-3/8

Heavy duty power relay for industrial control applications. Particularly suited for motor controls, heater loads, welder loads, and other power switching applications. Molded nylon coil resists fungus and moisture. Long life, rugged construction. Rating: 30 amps, 1-1/2 hp, 120/240 VAC. Heavy duty screw-type terminals. Mounting: two 3/16" holes on 1-7/8" centers. Listed under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA listed (File No. 20690).



B-5 DUST COVER

L = 5
W = 4
H = 3

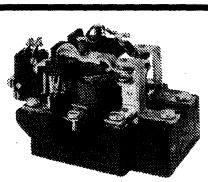
S/N 20257-80

Sealed knock-out holes for standard conduit fittings. Relay mounts on pre-drilled base. Constructed of Aluminum. Snap action cover release. Accommodates relay series 900.

900 SERIES

Auxiliary Switch Models are Also Available.

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20237-82	900	SPST-NO	30A	24VAC	12	9.5VA
20237-83	900	SPST-NO	30A	120VAC	290	9.5VA
20238-82	900	SPST	30A	24VAC	12	9.5VA
20238-83	900	NO-DM	30A	120VAC	290	9.5VA
20239-82	900	SPDT	30A	24VAC	12	9.5VA
20239-83	900	SPDT	30A	120VAC	290	9.5VA
20240-82	900	DPST-NO	30A	24VAC	12	9.5VA
20240-83	900	DPST-NO	30A	120VAC	290	9.5VA
20240-84	900	DPST-NO	30A	240VAC	1,200	9.5VA
20241-82	900	DPDT	30A	24VAC	12	9.5VA
20241-83	900	DPDT	30A	120VAC	290	9.5VA
20241-84	900	DPDT	30A	240VAC	1,200	9.5VA
20243-81	900	SPDT	30A	12VDC	72	2W
20243-82	900	SPDT	30A	24VDC	290	2W
20244-81	900	DPST-NO	30A	12VDC	72	2W
20244-82	900	DPST-NO	30A	24VDC	290	2W
20245-81	900	DPDT	30A	12VDC	72	2W
20245-82	900	DPDT	30A	24VDC	290	2W
20245-84	900	DPDT	30A	110VDC	6,050	2W



L = 4-1/4
W = 2-1/2
H = 2-3/8

900 Series heavy duty power relay with snap-action, 10 amp, 1/4" hp, SPDT auxiliary switch. Molded nylon coil resists fungus and moisture. Listed under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA File No. 20690.

900-1C SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20246-83	900-1C	DPDT	30A	120VAC	290	9.5VA
20249-82	900-1C	DPST-NO	30A	24VDC	290	2W

All Dimensions are Nominal.

DELTROL controls / DIVISION OF DELTROL CORP
2745 S. 19th St., Milwaukee, WI 53215, Phone (414) 671-6800, Telex 2-6871, Fax (414) 671-6809

DOUGLAS RANDALL

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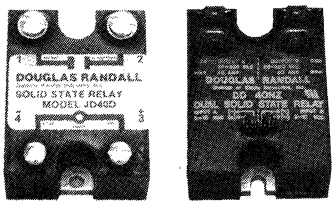

SOLID STATE RELAYS

NEW DISTRIBUTORS WANTED!
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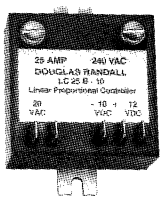
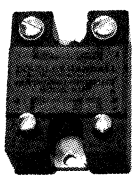
Full line of optically isolated, U.L. recognized solid state relays, A.C. or D.C. input, output to 100 Amps, 480 VAC. New "Dual" solid state relays available to 40 Amps, 120/240 VAC.



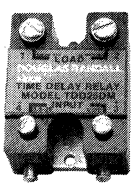
LINEAR PROPORTIONAL CONTROLLER

Optically coupled power control modules utilizing D.C. analog control signal to proportionally control loads up to 100 Amps in a linear fashion. Accepts 0-10V, 0-20V, or 4-20 milli Amp input signals.



PROPORTIONAL CONTROL

Variable AC control products with resistor input and 0-10 VDC input. Controls loads to 40 Amps.



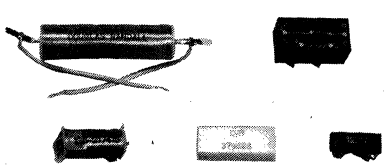
TIME DELAY RELAY

Optically isolated solid state control. Timing set by external resistors. Available to 40 Amps.



FORM C RELAY

Optically isolated, true form C voltage switching. Available to 100 Amps. 240 VAC

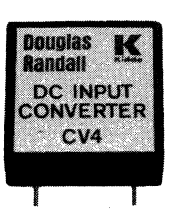


REED RELAYS

Full line of standard and custom reed relays.

CV-CONVERTER RELAY

Printed circuit board mountable solid state relay. Model CV-1 and CV-2.



INPUT DATA			OUTPUT DATA	
	CV1	CV2		CV1 & CV2
Nominal Voltage	5.5VDC	28VDC	Current	3A RMS
Voltage Range	4-10VDC	10-32VDC	Surge Current	80A Peak
Must Operate	4VDC	10VDC	Minimum Current	50mA
Must Release	.4VDC	.4VDC	Off State Leakage	8mA
Impedance	1000Ω	4000Ω	Voltage	24 to 240VAC @47 to 63 Hz
Isolation (Input to Output)	1500V 15pF	1500V 15pF	Voltage Drop	2.0VAc
			Offstate dv/dt	100V/µsec.
			Turn On Time	8.3msec.
			Turn Off Time	16 msec.

INPUT DATA			OUTPUT DATA	
	CV3	CV6		CV3 & CV6
Nominal Voltage	5.5VDC	28VDC	Max. Current	3A DC
Voltage Range	4-10VDC	10-32VDC	Voltage Range	4-55VDC
Must Operate	4VDC	10VDC	Voltage Drop	1.6VVDC
Must Release	.4VDC	.4VDC	Off State Leakage	10mA DC
Impedance	1000Ω	4000Ω	Turn On Time	550µsec.
			Turn Off Time	1.5msec.
	CV4	CV5		CV4 & CV5
Voltage Range	10-55VDC	90-130VAC	Voltage	30VDC
Current	10mA	10mA	Current	16mA Max.
Must Not Operate	3mADC	.8mA RMS	Leakage	100µA
Isolation	1500V	1500V	Voltage Drop	.4VDC
Capacitance	10pF	10pF	Logic Supply Volt.	4.5-6VDC
Impedance	—	40KΩ	Logic Supply Cur.	10mA@60

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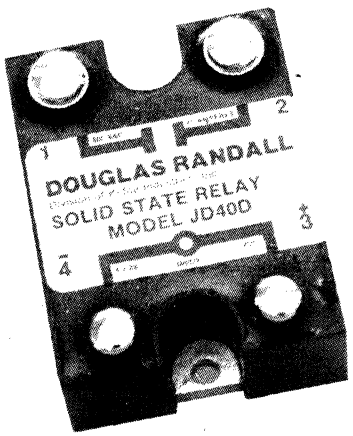
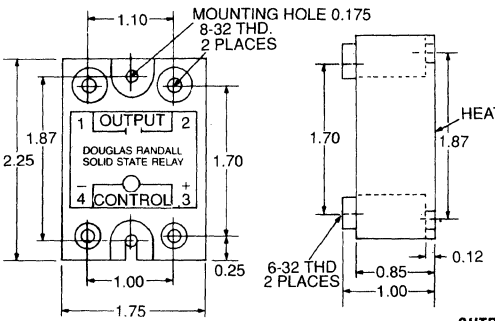
SOLID STATE COMPONENTS
STOCKED FOR IMMEDIATE DELIVERY

SOLID STATE RELAYS/RATINGS TO 100 AMPS

AC Output/DC or AC Control
UL Recognized/File No. E60556/C.C. NMFT2
CSA Certified File LR34149



Douglas Randall's line of solid state AC output relays are UL recognized for resistive, lamp and motor loads. Featuring opto-isolation and random fire or zero-voltage switching, models are available to handle up to 100 Amps. DC or AC control signals can be specified and Form A or B output. Call For Competitive Pricing on The New "J" Series.



NEW DISTRIBUTORS WANTED!
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INPUT SIGNAL DATA

	DC	AC
Range	3.0-32 VDC	*90-260 VRMS
Must Turn On	3.0 VDC	90VRMS
Must Release	1.0 VDC	10 VRMS
Input Impedance	1000 Ohms Min.	13,000 Ohms Min.
Isolation Signal to Load	4000 VRMS	4000 VRMS
Isolation Signal to Base	2500 RMS	2500 VRMS
Temperature Range Operating	−30°C to +80°C	−30°C to +80C
Storage	−40°C to +120°C	−40°C to +120C

*90-130 VRMS on 70 and 100 Amps models.

MODEL NUMBERS/RATINGS

MODEL	INPUT SIGNAL	NOMINAL OUTPUT
JD15B	3-32 VDC	15 Amp 120/240 VAC
JD25B	3-32 VDC	25 Amp 120/240 VAC
JD25D	4-32 VDC	25 Amp 120/240/525 VAC
JD40B	3-32 VDC	40 Amp 120/240 VAC
JD40D	4-32 VDC	40 Amp 120/240/525 VAC
JD70B	3-32 VDC	80 Amp 120/240 VAC
JD100B	3-32 VDC	100 Amp 120/240 VAC
JA15B	90-260 VRMS	15 Amp 120/240 VAC
JA25B	90-260 VRMS	25 Amp 120/240 VAC
JA25D	90-260 VRMS	25 Amp 120/240/525 VAC
JA40B	90-260 VRMS	40 Amp 120/240 VAC
JA40D	90-260 VRMS	40 Amp 120/240/525 VAC
JA70B	90-130 VRMS	80 Amp 120/240 VAC
JA100B	90-130 VRMS	100 Amps 120/240 VAC

OUTPUT DATA

	240 VRMS Models	480 VRMS Models
Range	20-300 VRMS	100-525 VRMS
Voltage Drop at Rated Load	1.6 VPK	1.6 VPK
Typical Turn On Voltage	7 VRMS	7 VRMS
Response Time	0.5 Cycle Max.	0.5 Cycle Max.
Off State DV/DT	J-15B-5V/μS J-25B-150V/μS J-40B-200V/μS J-70B-500V/μS J-100B-500V/μS	J-25D-150V/μS J-40D-200V/μS
Off State Leakage Current	J-15B-10 MA J-25B-15 MA J-40B-20 MA J-70B-20 MA J-100B-30 MA	J-25D-15 MA J-40D-20 MA
Max. Non Repetitive Single Cycle Surge Current	J-15B-150 Amp J-25B-400 Amp J-40B-600 Amp J-70B-1200 Amp J-100B-1600 Amp	J-25D-400 Amp J-40D-600 Amp
I^2T For Fusing (T=8.3 MS)	J-15B-60A² Sec J-25B-400A² Sec J-40B-1000A² Sec J-70B-7200A² Sec J-100B-12,750 A² Sec	J-25D-400A² Sec J-40D-1500A² Sec
Peak Inverse Voltage	600 Volts	1200 Volts

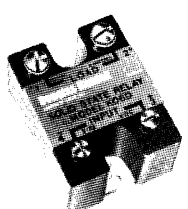
DUAL SOLID STATE RELAY



- Two Independent 15, 25, or 40 Amp Solid State Relays in one standard case
- Both Zero Crossing and Non-Zero Crossing versions available. ZC Units switch on in 1/2 cycle
- Advanced MOS Technology offers a significant increase in both static and commutating dv/dt, improving interference immunity to false triggering. This system exceeds performance of conventional snubber networks.
- Ambient Temperature for all models: −30°C to +80°C operating; −40°C to +120° C storage
- 2500 VRMS Isolation: Input to Output, Input to Base, Output to Base
- All Units have aluminum base plate. Case material is plastic; color is black
- Input is reverse polarity protected

SOLID STATE RELAYS SERIES K & F

DC OUTPUT/
DC CONTROL SIGNAL
NEW OUTPUT TO 300 VDC





SERIES K

Douglas Randall Series K are SPST (NO) or (NC) relays which will switch loads of 4, 8 or 12 Amps to 250 VDC. They provide rapid switching and opto-isolation between input and output. The sensitive inputs are compatible with DTL or TTL logic. Arc-free switching makes these relays suitable for hazardous atmospheres.

SERIES F
500 VDC SWITCHING

Series F Relays are available SPST (NO) or SPST (NC). They provide rapid switching of loads up to 8 amperes DC. Inputs are opto-isolated and compatible with DTL or TTL logic signals. Arc-free switching makes them suitable for hazardous atmospheres as well as machine tool process control equipment.

INPUT SIGNAL DATA

Range	3-32VDC
Must Operate	3VDC
Must Release	1VDC
Input Impedance	1000Ω Min.
Isolation	
Signal to Load	1500V
Signal to Base	1500V
Temperature	−30°C to +80°C

MODEL NUMBERS

Output Voltage	Current	Model
2-32 VDC	4 Amp 8 Amp 12 Amp	K04A K08A K12A
2-55 VDC	4 Amp 8 Amp 12 Amp	K04B K08B K12B
2-250 VDC	6 Amp	K06D

*Inductive loads must be diode suppressed.
†Normally closed add—(NC) K04A-NC.

MODEL	CURRENT	OUTPUT VOLTAGE	SURGE CURRENT (MAX.) 100μ @ 2% DUTY CYCLE
F04E	4 Amp	25-500 VDC	30 Amp
F08E	8 Amp	25-500 VDC	60 Amp

Note: To designate normally closed relays, add suffix "NC"; e.g., F04E-NC.

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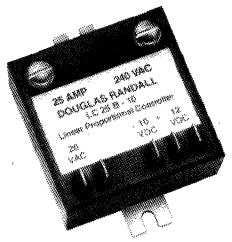
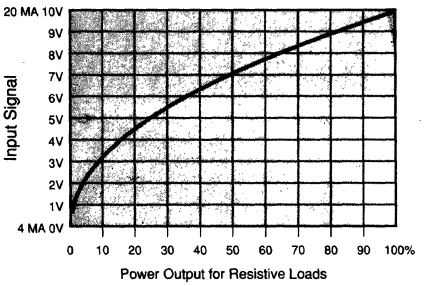
SOLID STATE COMPONENTS STOCKED FOR IMMEDIATE DELIVERY

L.C. SERIES POWER CONTROL MODULES—PROPORTIONAL CONTROLS



OPTICALLY COUPOLED PROPORTIONAL CONTROL



The optically coupled Douglas Randall L.C. series power control modules utilize D.C. analog control signals to proportionally control loads up to 100 amps, 300 Vrms. Changes in input signal linearly vary the firing angle of the thyristor load control device, so only the portion of the sine wave between the firing of the thyristor and zero crossing is available to the load. (see graph 1 on reverse). Average power output versus input voltage/current for resistive loads is shown in Figure 2 on reverse side of this sheet.

INPUT DATA

Range	0-5 DC	0-10 V DC	4-20 mA DC
Turn-on Threshold	.25 V	.5 V	4.5 mA
Input impedence	12.7K ohms	25K ohms	460 ohms
Isolation signal to load	4000 V peak	4000 V peak	4000 V peak
Isolation signal to base	4000 V peak	4000 V peak	4000 V peak

OUTPUT DATA

Model Number	LC25	LC40	LC70	LC100
maximum current	25 A	40 A	70 A	100 A
maximum voltage drop at 100% on	1.6 V	1.6 V	1.6 V	1.6 V
max. non-repetitive single cycle surge current	300 A	400 A	1000 A	1500 A
voltage range (RMS)	20-300	20-300	20-300	20-300
minimum holding current	.10 A	.10 A	.15 A	.20 A
off state DV/DT (V/μsec)	200	200	500	500
on state DI/DT(A/μsec)	150	150	150	150
I^2T for fusing (A^2/sec)	800	1000	7000	12000
off state leakage current (mA)	15	20	30	50
isolation output to ground	4000 V	4000 V	4000 V	4000 V
power factor (min)	.5	.5	.5	.5

PROPORTIONAL CONTROLS/40 AMP @ 480 VAC

Douglas Randall Proportional Control vary loads up to 40 Amp @ 480 VAC from 0 to 99%.

SERIES R— RESISTOR CONTROLS

These controls operate by connecting a variable resistor to the input terminals. See Figs. 1 & 2.

INPUT*
Variable Resistor (150,000Ω, 1 watt)—For 120VAC
Variable Resistor (1 Megohm, 1/2 watt)—For 240VAC, 277VAC or 480VAC



Mechanical Specifications on SSR AC output

Output Voltage		CURRENT 5A	10A	15A	25A	40A
90-130 VAC	Models	R05A	R10A	R15A	R25A	R40A
200-240 VAC	Models	R05B	R10B	R15B	R25B	R40B
400-480 VAC	Models*	R05D	R10D	R15D	R25D	R40D

OUTPUT DATA

Maximum Current	5A	10A	15A	25A	40A
One Cycle Surge Current	75A	100A	150A	225A	400A
Overload (1 Sec., RMS)	20A	30A	50A	70A	150A
Minimum Holding Current	.05A	.05A	.07A	.08A	.09A
AC Line: 90/130 VAC, 200/240 VAC, 250/300 VAC or 400/480 VAC					
Typical Leakage: 90/130 VAC—10 mA; 200-240 VAC—7 mA; 250-300 VAC—6mA; 400-480 VAC—3 mA*.					

*Models R05D. R10D. R15D. R25D and R40D have no snubbers.

INPUT MODULES RDA, RDB & RDD

These modules accept 0-10 VDC signals. Their output is connected to the input terminals of Series R—Resistor Modules, which in turn controls loads up to 40 Amp @ 480 VAC. See Fig. 3.

SERIES RD/LOGIC INPUT CONTROL

Series RD provide full control from 0% to 99% when energized by 0-10 VDC or 0-15m ADC signals.

MODEL RD04A AND MODEL RD04B UL Listed File Number E103645

INPUT SIGNAL	0-10 VDC or 0-15 ma DC(2)	
OUTPUT SIGNAL	RD04A	RD04B
Maximum Current	4A	4A
One Cycle Surge Current	100A	100A
One Second Overload Current	40A	40A
Minimum Holding Current	.05A	.05A
AC Line Voltage	90-130 VAC @ 47-63 Hz	200-240 VAC
Off State Leakage	.01A (typical)	.01A (typical)
Response Time	150 m sec @ 10 VDC (typical)	300 m sec @ 10 VDC
Isolation (Input to Output)	500 VRMS	500 VRMS

Notes: 1. All data is measured at 25°C.
2. The input is not polarity sensitive, but must be protected against voltages above 10 VDC.

GENERAL SPECIFICATIONS —ALL UNITS

- Zero crossover switching
- 7500V opto-isolation
- Back-to-back SCR operation
- Timing: 15K ohm/second nominal; 22 megohms maximum.
- Minimum operation with resistor terminal shorted: 300 milliseconds nominal.
- All units have snubbers

NOMINAL PERCENTAGES OUTPUT VS INPUT RESISTANCE @ 25°C

Models R05 to R40A

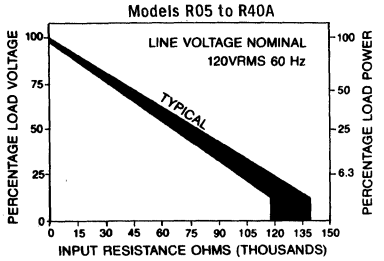


Fig. 1

Models R05 to R40B, R05 to R40D

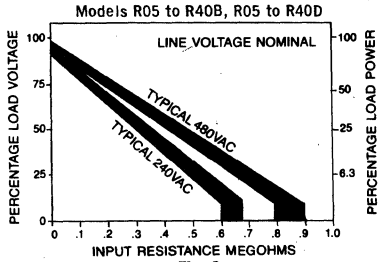


Fig. 2

MODELS RDA, RDB, RDD
PERCENT OUTPUT VOLTAGE vs INPUT VOLTAGE

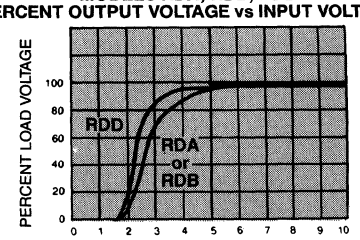


Fig. 3

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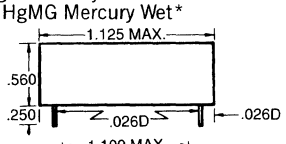
REED RELAYS

MINIATURE REED RELAYS

MOLDED—Series MM Dry, HgM Mercury Wet*
OPEN—Series MG Dry Reed, HgMG Mercury Wet*

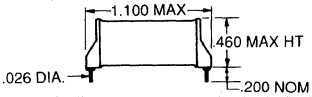
MINIATURE MOLDED, M





MINIATURE OPEN, MG





Form	Nominal Voltage	DCR Ohms ± 10%	MM Series Part Number	MG Series Part Number
1A	6	250	6MM1A	6MG1A
	12	1000	12MM1A	12MG1A
	24	4000	24MM1A	24MG1A
2A	6	170	6MM2A	6MG2A
	12	675	12MM2A	12MG2A
	24	2700	24MM2A	24MG2A
3A	6	110	6MM3A	6MG3A
	12	450	12MM3A	12MG3A
	24	1800	24MM3A	24MG3A
4A	6	60	—	6MG4A
	12	250	—	12MG4A
	24	1000	—	24MG4A
5A	6	50	—	6MG5A
	12	200	—	12MG5A
	24	800	—	24MG5A
6A	6	50	—	6MG6A
	12	200	—	12MG6A
	24	800	—	24MG6A
1B	6	170	6MM1B	6MG1B
	12	675	12MM1B	12MG1B
	24	2700	24MM1B	24MG1B
2B	6	110	6MM2B	6MG2B
	12	450	12MM2B	12MG2B
	24	1800	24MM2B	24MG2B
1A1B	6	110	6MM1A1B	6MG1A1B
	12	450	12MM1A1B	12MG1A1B
	24	1800	24MM1A1B	24MG1A1B
2A2B	6	50	6MM2A2B	6MG2A2B
	12	200	12MM2A2B	12MG2A2B
	24	800	24MM2A2B	24MG2A2B
1C	6	250	6MM1C	6MG1C
	12	1000	12MM1C	12MG1C
	24	4000	24MM1C	24MG1C
2C	6	170	6MM2C	6MG2C
	12	675	12MM2C	12MG2C
	24	2700	24MM2C	24MG2C
3C	6	60	—	6MG3C
	12	250	—	12MG3C
	24	1000	—	24MG3C
4C	6	50	—	6MG4C
	12	200	—	12MG4C
	24	800	—	24MG4C
1A Latch	6	85/85	6MML1A	6MGL1A
	12	340/340	12MML1A	12MGL1A
	24	1350/1350	24MML1A	24MGL1A

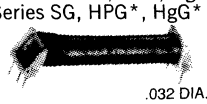
1. E/M shields std. all Series MM and all Form B and Form L.
2. E/S shields optional.
3. 1000VDC switches available all Form A and B relays.
4. Premium run-in switches available all models.
5. Ultra sensitive relays available.
6. Series MML/1A, have internal diodes.

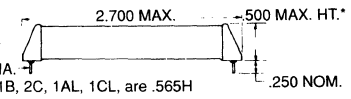
Contact factory for informtion on contact data and pin layouts for Miniature and Standard Series plus additional models available.

STANDARD SIZE REED RELAYS

MOLDED—Series SM, HP*, Hg*
OPEN—Series SG, HPG*, HgG*

STANDARD OPEN, SG, HPG*, HgG*



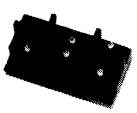


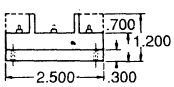
*2A, 1B, 2C, 1AL, 1CL, are .565H

Form	Nominal Voltage	SM Series Molded Part Number	SM Series Molded DCR Ohms ± 10%	SG Series Open Part Number	SG Series Open DCR Ohms ± 10%
1A	6	6SM1A	180	6SG1A	180
	12	12SM1A	725	6SG1A	720
	24	24SM1A	2900	24SG1A	2880
2A	6	6SM2A	175	6SG2A	110
	12	12SM2A	700	12SG2A	440
	24	24SM2A	2750	24SG2A	1760
1B	6	6SM1B	175	6SG1B	110
	12	12SM1B	700	12SG1B	440
	24	24SM1B	2750	24SG1B	1760
2B	6	6SM2B	140		
	12	12SM2B	550		
	24	24SM2B	2200		
1C	6	6SM1C	180	6SG1C	180
	12	12SM1C	725	6SG1C	720
	24	24SM1C	2900	24SG1C	2880
2C	6	6SM2C	175	6SG2C	110
	12	12SM2C	700	12SG2C	440
	24	24SM2C	2750	24SG2C	1760
1A Latch	6	6SML1A	85/85	6SGL1A	85/85
	12	12SML1A	340/340	12SGL1A	340/340
	24	24SML1A	1350/1350	24SGL1A	1350/1350

*For part numbers and DCR values contact factory. See specification table for contact ratings.

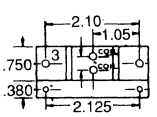
HIGH VOLTAGE RELAYS
HV SERIES



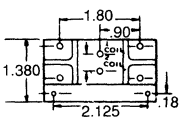


Form	Nom. Volt.	Part Number	DCR Ohms ± 10%
1A (1B*)	6	6HV1A	25
	12	12HV1A	100
	24	24HV1A	400
2A	6	6HV2A	20
	12	12HV2A	80
	24	24HV2A	320

1A or 1B Top View



2A Top View



OPTION:
*Relays available in Form B up to 7,500V.

Note: To order, specify as follows: 6HV1A 35 is a 6HV1A relay with 3,500VDC switch.

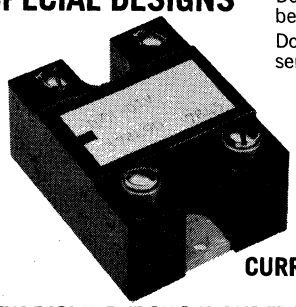
CONTACT DATA

Series	Maximum Resistive Rating			Breakdown Voltage (min.)	Initial Resistance
35	3,500VDC	3.0A	50W	5,000VDC	.100 Ohms
75	7,500VDC	3.0A	50W	10,000VDC	.100 Ohms
100	10,000VDC	3.0A	50W	12,500VDC	.100 Ohms

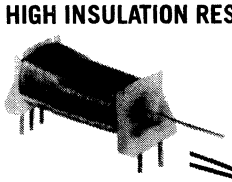
SPECIAL DESIGNS

Douglas Randall makes custom designed relays to solve difficult problems. A few models are shown below to illustrate the variety available.

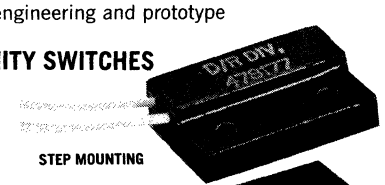
Douglas Randall will gladly review your applications and offer rapid engineering and prototype service.



HIGH INSULATION RESISTANCE RELAYS

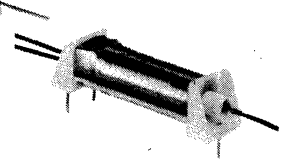


PROXIMITY SWITCHES

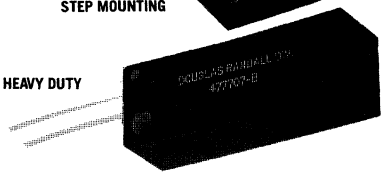


STEP MOUNTING

CURRENT SENSING RELAYS



HEAVY DUTY



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EI&S produces a range of catalog and custom reed relays for switching applications that are not market dependent.

Today's reed relays offer many technical advantages over mechanical relay types, including speed, long life, dry switching and low power input.

Vibration: Reed switch contacts, with only two or three moving parts, offer better response to vibration than mechanical types (e.g. MIL STD 202, Method 204: 20g's @ 10 to 2000 Hz).

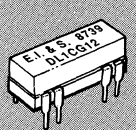
Shock: Dry reed relays withstand relatively high levels of shock (e.g. MIL STD 202, Method 213B, Condition A: 50g's for 11mSec @ ½ sine wave).

CONTACT FORM SPECIFICATIONS (@25°C)*		DRY REED SERIES D DA DL DC DT MC MS PS PT A & B	DRY REED SERIES D DA DL DC DT MC MS PS PT C	MERCURY WET SERIES DM DH ME MH MERCURY "A"
CONTACT: MAXIMUM RATINGS				
Switching Current	(Adc)	0.5	0.25	2
Switching Voltage	(Vdc)	200	100	500
Switching Power	(W)	10	3	50
Breakdown Voltage	(Vdc)	250	200	1000
Contact Resistance	(Ω)	0.150	0.200	0.100
Carry Current	(Adc)	1.0	0.5	3
RELAY: TYPICAL RATINGS				
Timing: Operate	(ms)	0.500	0.500	2.0
Release w/Diode Suppresion	(ms)	0.100	0.500	1.0
Bounce	(ms)	0.150	0.150	0
Breakdown (Coil-Contacts)	(Vdc)	1500	1500	1000
Insulation Resistance	(Ω)	10^{10}	10^{9}	10^{10}
Life Expectancy: @ Rated Load	(opns)	1×10^{7}		50×10^{6}
@ Low Level	(opns)	5×10^{7}		100×10^{6}
Temperature/Range: Operating	(°C)*	-30 to +65°		-30 to +65°
Storage	(°C)*	-55 to +85°		-55 to +85°

* Expanded limits available — contact factory

DL/DH

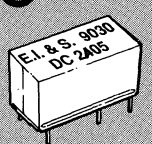
14 Pin Molded DIP (.275 in. high)



- Popular industry standard low cost designs.
- Epoxy-molded for minimum package size.
- DH Series mercury-wet designs for 50W/2Amp switching.

DC

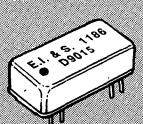
16 Pin Encapsulated DIP (.420 in. high)



- New! Low power coil designs (33mW/5V).
- Form-fit sub for DS type EMR relays.
- 10W/0.5A DPST switching.
- Operate time typically 0.500 mSec.

D/DM

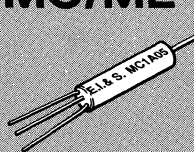
14 Pin Encapsulated DIP (.250 in. high)



- Similar to DL Series with added capability.
- Epoxy-coated metal case for magnetic shielding.
- DM Series mercury-wet designs for 50W/2Amp switching.

MC/ME

Micro-miniature Axial



- Optimized low power designs from 2000 Series.
- Magnetic shielding standard, electrostatic optional.
- Designed for high density applications.

(replacement for 2000 Series)

DA

14 Pin Encapsulated DIP (.420 in. high)



- Redesigned low power replacements for D Series.
- Optimum coil designs (33mW/5V coil).

MS/MH

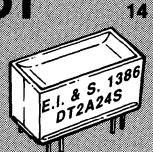
Encapsulated In-line Pinouts



- New! Low power coil designs (<25mW/5V).
- MS Series — to 10W/0.5A dry switching. MH Series — 50W/2A mercury switching.
- Custom designs available.

DT

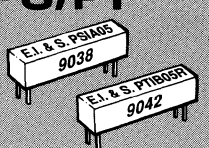
14 Pin Encapsulated DIP (.250 or .430 in. high)



- Meets MIL-R-83516A environmental requirements.
- Ruthenium-plated contacts for low stable contact resistance.
- Optional contact integrity testing.

PS/PT

Pico-Molded/Pico-Encapsulated Pinouts



- Ultra small package high density uses.
- PS: Low profile in a standard molded package.
- PT: Epoxy-coated metal case for magnetic shielding. Electrostatic shielding optional.

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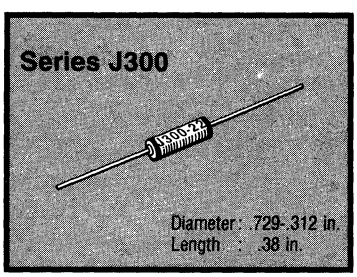
E&S SOLID STATE RELAYS

PC Mount and Chassis Mount Designs

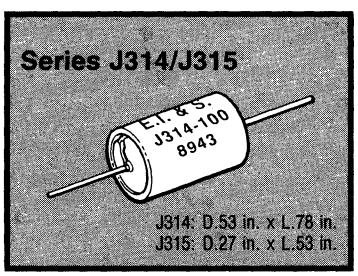
MODEL		INPUT	OUTPUT	FEATURES
STANDARD "HOCKEY PUCK" PACKAGE 1.75" Mounting Centers — **DUAL SCR**	280RS10-04 280RS25-04 280RS45-04	3-32Vdc	10A 25A 45A } 40-280Vac	○ 47-400Hz ○ Low output leakage ○ Optically-isolated ○ Reduced EMI ○ Better heat management ○ Resistant to higher dv/dt
	280RS10-AC2 280RS25-AC2 280RS45-AC2	120Vac	10A 25A 45A } 40-280Vac	
TRIAC (SURGELESS™)	120SS10-04 120SS25-04	3-32Vdc	10A 25A } 40-140Vac	○ 90° phase angle initial turn-on ○ For heavy inductive loads
	240SS10-04 240SS25-04		10A 25A } 90-280Vac	
TRIAC	120EI10-04 120EI25-04	3-32Vdc	10A 25A } 40-140Vac	○ Optically-isolated ○ Zero voltage turn-on ○ RC Snubber
	240EI10-04 240EI25-04		10A 25A } 90-280Vac	
TRIAC 2.50" Mounting Centers	902	3-32Vdc	5A 40-140Vac	○ Rated @ 80°C Ambient ○ Ideal for process control ○ Replaces Models 682, 900, 901
MOSFET Rail or Chassis Mounted	9601	120Vac	Dual	○ Fast switching ○ Hi-Rel design for DC control or robotic systems ○ Low output leakage
	9602	3-32Vdc	5 50Vdc 2X SPST	

E&S RF INDUCTORS



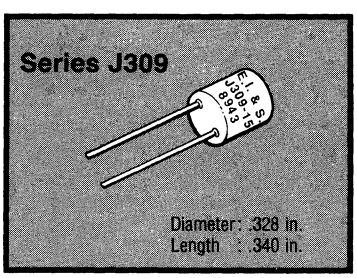
MINIATURE AXIAL-LEADED INDUCTORS

Iron core results in a highly stable design ideal for filters, delay lines and computer applications.



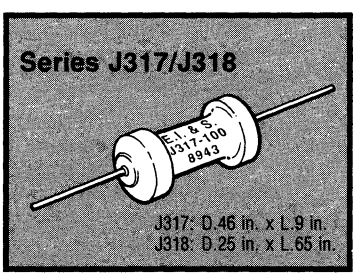
SHIELDED AXIAL-LEADED INDUCTORS

Designed for low DCR . . . for compact audio filters, tone controls, amplifiers, etc. where low inductance is required.



ENCAPSULATED RADIAL-LEADED INDUCTORS

Rugged construction exceeds MIL-C-15305 requirements. Designed for military and commercial packages.



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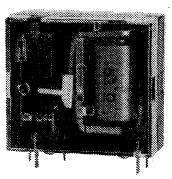
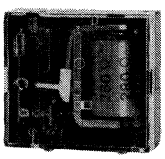
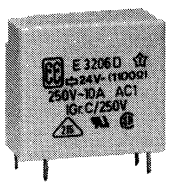
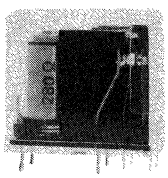
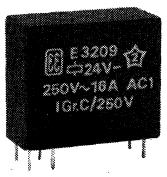
PC-Board Relays

Type	E3206S	E3206L	E3206D	E3208	E3209
	Miniature Relay	Miniature Relay/Flat pack	Miniature Relay	Miniature Relay	Miniature Relay
Contact arrangements	1A, 1B, 1C	1A, 1B, 1C	1A, 1B, 1C	2A, 2B, 2C	1A, 1B, 1C
Contact rating	10A 220V AC	10A 220V AC	10A 220V AC	8A 220V AC	20A 250V AC
					16A 250V AC
Contact material	AgCdO	AgCdO	AgCdO	AgCdO	AgCdO
(flow current switching)	AgCdO5μAu		AgCdO5μAu	AgCdO5μAu	
Service life mechanical	10^7	10^7	10^7	10^7	$>10^7$
electrical	2×10^5	2×10^5	2×10^5	1.5×10^5	1.5×10^5
at rated load ($\cos\varphi=1$)	10A 220V AC	10A 220V AC	10A 220V AC	8A 220V AC	16A 220V AC
Initial break-down voltage					
Contact/contact (V r.m.s)	$\geqq 1000V_{eff}$	$\geqq 1000V_{eff}$	$\geqq 1000V_{eff}$	$\geqq 1000V_{eff}$	$\geqq 1000V_{eff}$
Contact/coil (V r.m.s.)	$\geq 4000V_{eff}$	$\geq 4000V_{eff}$	$\geq 4000V_{eff}$	$\geq 4000V_{eff}$	$\geq 4000V_{eff}$
Coil voltage (V)	6 12 24 48 60	6 12 24 48 60	6 12 24 48 60	6 12 24 48 60	6 12 24 48 60
Nominal coil resistance (Ω)	75 280 1100 3500 6000	75 280 1100 3500 6000	75 280 1100 4000 6000	53 280 1100 3500 6000	75 280 1100 4000 6000
Power consumption (W)	0.5	0.5	0.5	0.5	0.5
Pick-up voltage	75%	75%	75%	75%	75%
Drop-out voltage	10%	10%	10%	10%	10%
General Data					
Drop-out time at nom. voltage	10ms	10ms	9ms	5ms	3ms
Pick-up time at nom. voltage	10ms	10ms	9ms	11ms	7ms
Surge withstand voltage	2500V AC	2500V AC	2500V AC	2500V AC	2500V AC
Insulation resistance	50MΩ/500V	50MΩ/500V	50MΩ/500V	>50MΩ/500V	>50MΩ/500V
Operation temperature	−40°C up to +70°C	−40°C up to +70°C	−30°C up to +70°C	−40°C up to +70°C	−30°C up to +70°C

Approvals:

Eichhoff Electronics, Inc.
205 Hallene Road, Warwick RI 02886
Tel (401) 738-1440
Fax (401) 738-7154

Toll Free 800-678-1040

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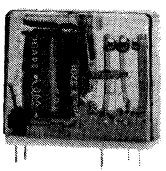
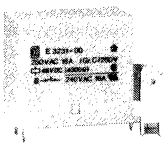
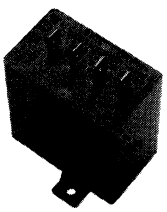
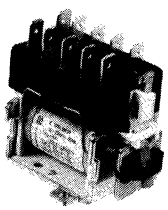
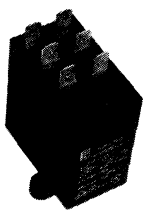
PC-Board Relays
Power Relays

Type	E3201 BV 30/33/35	E3231	E3214	E3250	E3252
	Miniature Relay	Power Relay	Switching Relay	Miniature Contactor	Contactor Relay
Contact arrangements	1A, 1B, 1C	1A, 1B	1A, 1B, 1C	max. 4 poles	2A, 1A, 1A-1B
Contact rating	16A 250V AC	16A 220V AC	10A 380V AC	16A 250V AC	16A 250V AC
			15A 220V AC	10A 380V AC	10A 380V AC
Contact material	AgCdO	AgCdO	AgCdO	AgCdO	AgCdO
(flow current switching)					
Service life mechanical	2×10^7	10^7	2×10^6	5×10^5	10^6
electrical	1×10^5	1.5×10^5	10^5	10^5	10^5
at rated load ($\cos\varphi=1$)	16A 220V AC	16A 220V AC	16A 220V AC	16A 220V AC	16A 250V AC
Initial break-down voltage					
Contact/contact (V r.m.s)	$1000V_{eff}$	$1000V_{eff}$	$1500V_{eff}$ (1s)	$1500V_{eff}$	$1500V_{eff}$
Contact/coil (V r.m.s.)	$2500V_{eff}$ (4000V at 1s)$_{eff}$	$4000V_{eff}$	$2000V_{eff}$	$2000V_{eff}$	$2500V_{eff}$
Coil voltage (V)	5 6 12 24 48 60	6 12 24 48 60	200V AC 240V AC	380/220/240V AC	380/220/240V AC
Nominal coil resistance (Ω)	53 75 280 740 3500 6000	75 280 1100 4000 6000			
Power consumption (W)	0.7	0.5	2.2VA	6VA(3.6W)	3VA(1W)
Pick-up voltage	75%	75%	80%	80%	80%
Drop-out voltage	10%	10%	10%	10%	10%
General Data					
Drop-out time at nom. voltage	6ms	6ms	15ms	20ms	15ms
Pick-up time at nom. voltage	14ms	5ms	25ms	20ms	25ms
Surge withstand voltage	2500V AC		2000V	2000V AC	2500V
Insulation resistance	1000MΩ/500V				
Operation temperature	−40°C up to +70°(125°C)	−40°C up to +70°(125°C)	−40°C up to +70°C	−30°C up to +65°C	−40°C up to +70°C

Approvals:

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205 Hallene Road, Warwick RI 02886
Tel (401) 738-1440
Fax (401) 738-7154

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

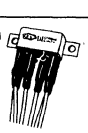
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Electronic Specialty Corporation

P.O. BOX 3501 VANCOUVER, WASHINGTON 98668-3501
PHONE 206/574/5000 FAX 206-573-4635

STANDARD HERMETIC SEALED RELAYS

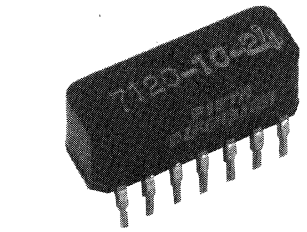
SERIES	General Information	Contact Form	Contact Rating	D×W×H Size	Sensitivity	Coil Voltages
30 	Digital time relay. Operate or release delay. Note: 4DPT available in delay on operate only.	1PDT 2PDT 3PDT 4PDT	2 Amp 28 VDC or 10 Amp 28 VDC	Various	N/A	12 to 48 VDC
35 	Voltage Sensor	1.4PDT	10 Amp	Various	N/A	6 VDC to 115AC
50 	Qualified to M39016/6. Non Latch	2PDT	D/C to 2A 28 VDC Resistive	.4×.800 ×.41	250 mw Pick Up	6 VDC to 115AC
55 	Latching 1/2 size sensitive latching relay qualified to MIL-R-39016/45M.	2PDT	D/C to 2A 28 VDC Resistive	.4×.800 ×.41	90 mw Latch/Reset	6 VDC to 115AC
61 	Qualified to MS27401	2PDT	DC to 12A	.525× 1.025×1.010		6 VDC to 115AC
68 	Crystal can "Lazy S" header.	2PDT	D/C to 2A 28 VDC Resistive	.359×.797 ×.875	300 mw Pick Up	6 VDC to 115AC
71 	Sensitive crystal can relay.	2PDT	D/C to 2A 28 VDC Resistive	4×.8 ×1.280	40 mw Pick Up	6 VDC to 115AC
77 	Crystal can. Sensitive latching relay.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	4×.8 ×.875	90 mw Latch/Reset	6 VDC to 115AC
79 	Non Latch Crystal can. Non-latching relay.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.4×.8 ×.875	250 mw Pick Up	6 VDC to 115AC
90 **92** 	Sensitive—non-latching. Sensitive—Latching.	4PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.601×1.032 ×1.278	80 mw Pick Up 80 mw Latch/Reset	6 VDC to 115AC
93 **94** 	Non-latching Welded or solder sealed. Latching. Welded or solder sealed.	2PDT	10 Amps 28 VDC Resistive	.515×1.032 ×1.300	500 mw Pick Up 150 mw Latch/Reset	6 VDC to 115AC
100 **102** 	Sensitive—non-latching. Sensitive—Latching.	6DPT	Dry Circuit to 3 Amps 28 VDC Resistive	.852×1.032 ×1.278	150 mw Pick Up 150 mw Latch/Reset	6 VDC to 115AC
103 **104** 	Non-latching. Latching.	4PDT	10 Amps 28 VDC Resistive	.852×1.032 ×1.3	1000 mw Pick Up 300 mw Latch/Reset	6 VDC to 115AC
FHT 	Full or Half size crystal can coaxial relays with 8″ min. RG 178 B/U cables attached. T Series sensitive. Welded sealing.	1PDT with Auxiliary Contacts or 2 PDT Coax	RF to 1.5 Amps 50 Watt Max.	Frequency Range to 500 MHz VSWR–1:1.1 Typical. Characteristic Impedance– 50 Ohm Typical. Cross Talk–50 dB Typical.		6 to 32 VDC
300 	The ultimate in high current DC load switching. The load is switched with power semiconductors short term, and carried by the relay hard contacts long term, preventing the semiconductors from overheating. The Arcless™ uses a SPST heavy duty mechanical relay. In addition to switching 70 AMP loads, the Arcless will withstand a 180 AMP inrush current from motor or lamp load. Applications for arcless relays should include all high current DC switching where reliability and long life are important design criteria. **No** arc between contact points–**No** electro-magnetic interference. This non-arcing feature is useful for switching where EMI or RFI might cause damage to equipment, software, or quality of radio signals.					

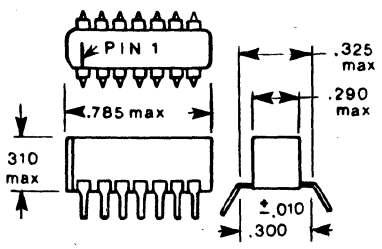
FIFTH DIMENSION INC.

Mercury Relays That Operate in any Position

DIP Relays

- Position-insensitive, bounce-free LCI sealed capsule
- 100% run-in @ 10 VDC-100 mA for 2.5 x 10^6 operations
- 5, 12 and 24 VDC-700 Mw coil drives
- Life expectancy over 50 x 10^6 operations
- Latching or non-latching operation
- Molded diallyl phthalate case





- Operate Time (max.) — 2.5 ms
- Release Time (max.) — 3.0 ms
- Contact Resistance — 75 milliohms

7000 Series (DC to 10 MHz)

- Rated Contact Load — 1.0 amp 4 VDC to 0.3 amp @ 200 VDC

2000 Series (DC to 100 MHz)

(Specifications at 100 MHz)

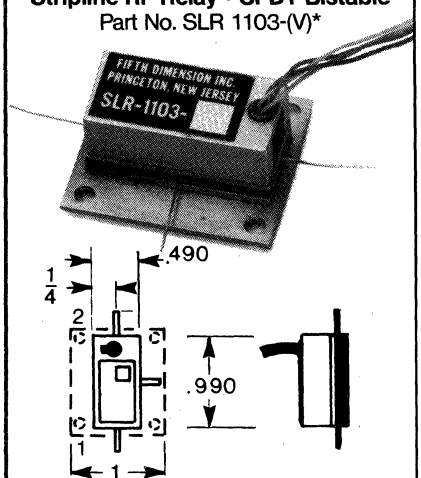
- Rated Contact Load — 10 watts CW
- Insertion Loss (Typical) — 0.2 dB
- Isolation (Typical) — 40 dB
- VSWR (Typical) — 1.5

Bistable (Latching Relays)			Monostable (Non-Latching Relays)		
Part No.	Form	Diode Protection	Part No.	Form	Diode Protection
7120-1A-V*	A	No	7210-1A-V*	A	No
7120-1C-V	C	No	7210-1C-V	C	No
7121-1A-V	A	Yes	7211-1A-V	A	Yes
7121-1C-V	C	Yes	7211-1C-V	C	Yes
2122-1A-V	A	No	2212-1A-V	A	No
2122-1C-V	C	No	2212-1C-V	C	No

*Specify Coil Voltage

50 Ohm Stripline and Coaxial Relays

Stripline RF Relay • SPDT Bistable
Part No. SLR 1103-(V)*

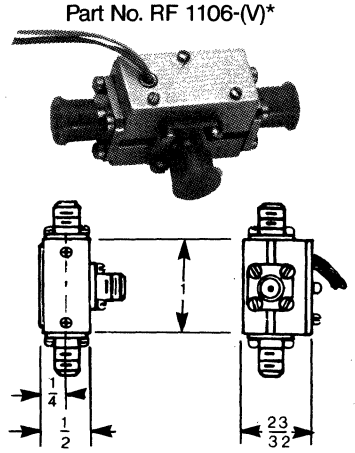


- Position-insensitive, bounce-free LCI sealed capsule
- Bistable operation
- 5, 12 and 24 VDC-700 Mw coil drives
- Operate Time (max.) — 4.0 ms
- Cycling rate — to 40 Hz
- Frequency Range — DC to 1 GHz
- Dielectric strength — 300 VDC
- Rated Load — 10 watts CW

	100 MHz	1.0 GHz
Typ. Insertion Loss (dB)	.07	.30
Typ. Isolation (dB)	56	36
Typ. VSWR	1.03	1.20

*Specify Coil Voltage

Coaxial RF Relay • SPDT Bistable
Part No. RF 1106-(V)*



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FIFTH DIMENSION INC.

Mercury Relays That Operate in any Position

Flame-resistant models available
Meet UL Specification UL94V-0

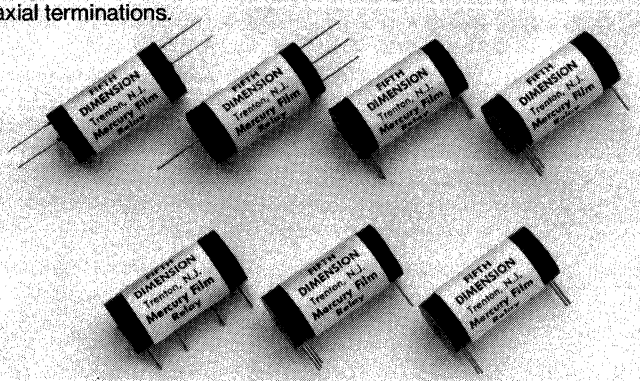
- **No Contact Bounce** — Produce clean square-wave pulses
- **Position Insensitive** — No pool of mercury
- **Self-Healing Contacts** — Always wetted with fresh mercury
- **Rugged Construction** — Welded steel switching capsule
- **Sealed Package** — High density polyethylene (WKS Series)

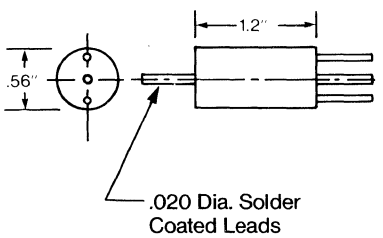
Specifications

Meet Lightning Surge Standards — 2500 volts coil-to-contact breakdown meets FCC standards (WKS Series)
Contact Type: Form A (SPST) mercury film
Contact Bounce: None at 80% of rated voltage or higher
Load Current to 52 VDC: 0.24 amps
Load Current to 200 VDC: 0.10 amps
Contact Resistance: 150 milliohms (max.)
Contact Resistance Stability: ±15 milliohms
Contact Breakdown Voltage: 800 volts DC or AC (rms)
Coil-to-Contact Breakdown: 2500 VAC
Operate Time: 4.0 milliseconds (max.)
Release Time: 4.0 milliseconds (max.)

Molded-Case Magnetically Shielded Series WKS. Relays can be submerged in appropriate cleaning solvents during board assembly.

Series WKS Mercury Relays are available in a wide variety of footprints including 0.1, 0.15 and 0.2-inch PCB spacing as well as with in-line and axial terminations.

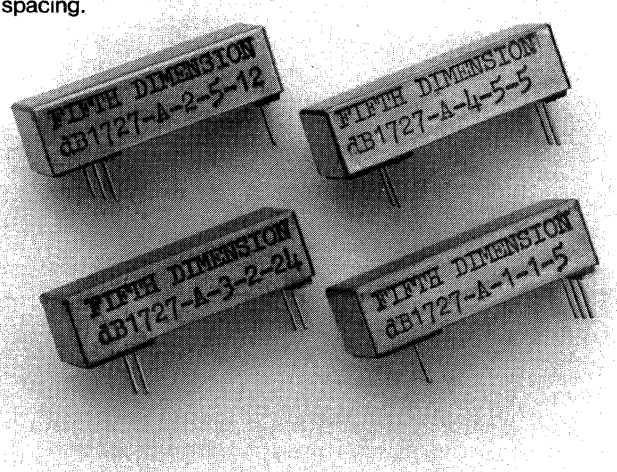


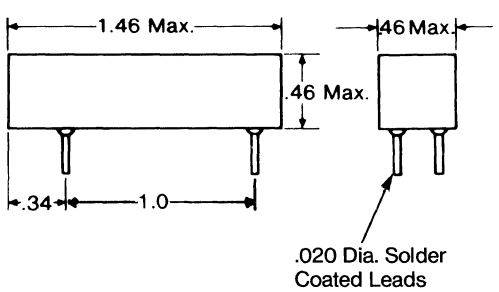


Nominal Coil Volts	Coil Resistance (± 10%) Ohms			Must Operate Volts	Must Release Volts
	250 MW	375 MW	500 MW		
5	100	67	50	4.0	0.5
12	575	384	288	9.6	1.2
24	2300	1536	1150	19.2	2.4

Open-Frame Magnetically Shielded Series dB. Open-frame magnetically shielded.

Series dB Mercury Relays are available with 0.1, 0.15 or 0.2-inch PCB spacing.





Nominal Coil Voltage	Coil Resistance (± 10%) Ohms			Must Operate Volts	Must Release Volts
	125 MW	250 MW	500 MW		
5	200	100	50	4.0	0.5
12	1150	575	288	9.6	1.2
24	4608	2300	1150	19.2	2.4

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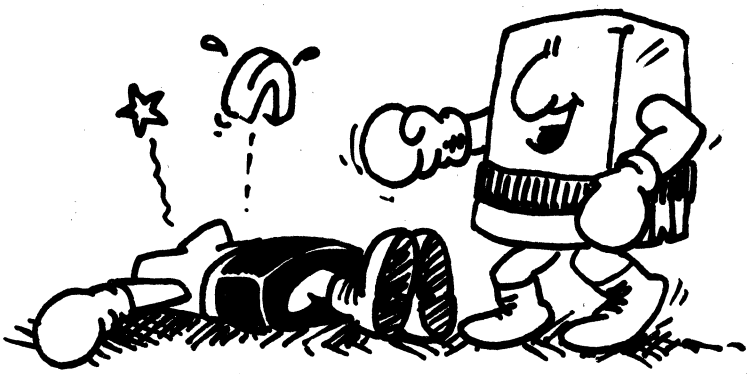
The Current Champions



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You'll appreciate the knockout quality and reliability of our relays — utterly unchallenged by the competition.

What's more, when it comes to customer service, you'll find we're in *your* corner — every step of the way.SM

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Call 1-(800)-642-7616 for more information.

Try our relays once — you're sure to make a comeback.

	Appliance	Automotive	Computer/Peripheral	Industrial Control	Instrumentation	Lighting & Security	Test & Measurement	Telecommunication
FBR20			■		■	■	■	■
FBR40			■		■	■	■	■
FBR110	■	■	■	■	■	■		
FBR160	■	■	■	■	■	■		
FBR210			■		■	■	■	■
FBR240			■		■	■	■	■
FRL260	■			■				
FRL270		■						
FBR600	■	■	■	■		■		

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MICROMINIATURE RELAYS FOR P.C. BOARDS
FBR20 Series

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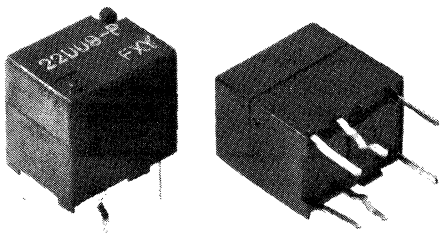
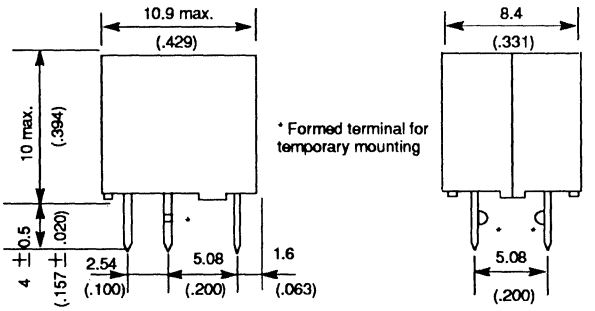


Fujitsu FBR20 series relays are designed for PC board mounting with 1A contact ratings – perfect for microminiature applications.

DIMENSIONS



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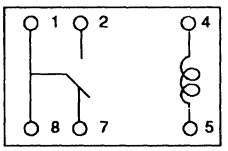
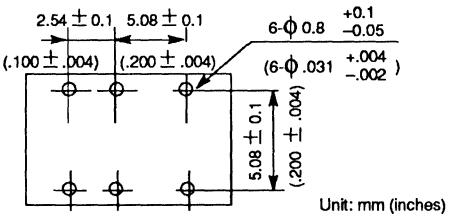


(Bottom View)

MOUNTING HOLE LAYOUT



Unit: mm (inches)

FEATURES

- **Microminiature size.** Two FBR20 series relays can be mounted in the space now required for a single FBR210 series relay.
- **1A contact rating.** Despite their microminiature size, FBR20 series relays have a contact rating of 1A at 24 VDC for convenient installation.
- **Gold overlay on silver-palladium contact.** Contact reliability is assured in low-level applications by contact shapes and materials especially designed for signal switching applications.
- **Low power consumption.** With a rated power consumption of only 0.3 W, today's expensive energy costs can be reduced significantly.
- **Wide range of drive voltages.** Drive voltages from 1.5 VDC to 24 VDC are available for a wide range of applications.
- **Strong shock resistance.** Even with a 50 G shock, FBR20 series relays never miss a switch.
- **Easy-to-pattern design.** Separate terminal connections with drive and output sections allow easy pattern design.
- **Formed terminal available for temporary lock.** The unique design of the forming terminal allows FBR20 series relays to be temporarily mounted for greater design flexibility.
- **Automatic soldering provision.** The terminal is sealed to prevent flux from entering during automatic soldering.
- **Immersion cleaning.** Sealed for immersion cleaning.

ENGINEERING DATA

Item	Specification
Contact Arrangement Contact Shape Contact Material Contact Rating Initial Contact Resistance	SPDT (1 form C) Single contact Gold overlay silver-palladium alloy 24 VDC-1A, 120 VAC-0.5 A (resistive load) 100 megohm max. (measured at 6 V DC-0.1 A)
Maximum Carrying Current Maximum Switching Voltage Maximum Switching Power	2 A 125 VDC, 125 VAC 24 WDC, 60 VA AC (resistive load)
Coil Power Coil Temperature Rise	0.3 W 45 degrees C (at rated voltage, 20 degrees C)
Insulation Resistance Withstanding Voltage	1,000 megohm min. (at 500 VDC) Between contacts: 500 VAC for 1 minute Between contact and coil: 750 VAC for 1 minute
Vibration	20 G, 10 to 300 Hz (dual amplitude, maximum 3.0 mm) No contact chatter longer than 1.0 ms
Shock	Operation error: 50 G (sine half-wave of 11 ms) No contact chatter longer than 1.0 ms
Operate Time Release Time	5 ms max. (at rated voltage) 3 ms max. (after rated operation)
Life Expectancy Mechanical Electrical	 5×10^6 ops. min. 200×10^3 ops. min. (at rated contact load)
Maximum Switching Frequency Mechanical Electrical	 18,000 operations/hour 1,800 operations/hour (at contact rated load)
Ambient Temperature Range Ambient Humidity	−30 degrees C to +65 degrees C (at rated operation) 45 to 85% RH
Weight	1.7 g (approx.)

SELECTION TABLE

Type	Voltage Specifications	Coil Rated Voltage	Coil Resistance (± 10%)	Pick-up Voltage	Drop-out Voltage	Maximum Coil Voltage Allowance	Rated Power Consumption	Part No.
Standard Type	D01	1.5 VDC	7.5 ohm	Less than 80% of rated voltage	More than 5% of rated voltage	160% of rated voltage	Approx. 300 mW (at rated voltage)	FBR21ND01P
	D03	3 VDC	30 ohm					FBR21ND03P
	D05	5 VDC	83 ohm					FBR21ND05P
	D06	6 VDC	120 ohm					FBR21ND06P
	D09	9 VDC	270 ohm					FBR21ND09P
	D12	12 VDC	480 ohm					FBR21ND12P
	D18	18 VDC	1,080 ohm					FBR21ND18P
	D24	24 VDC	1,920 ohm					FBR21ND24P

Note: Measured at 20 degrees C

ULTRA-MINIATURE RELAYS FOR P.C. BOARDS
FBR40 Series

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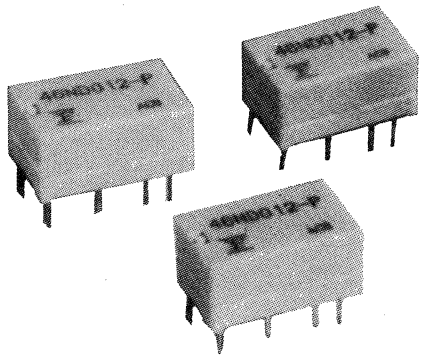
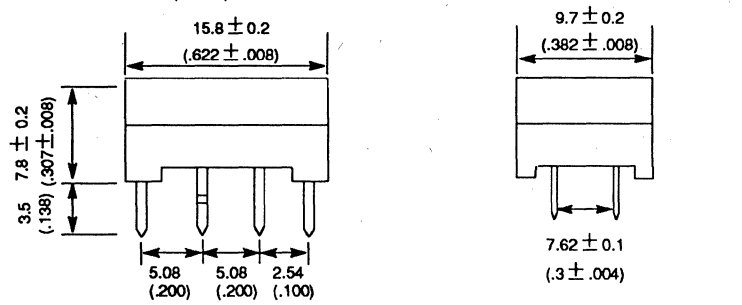


The Fujitsu FBR40 series relay with a pick-up power consumption reduced to 85 mW is an extremely small DPDT CONTACT relay designed for PC board mounting.

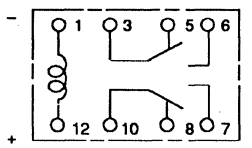
FEATURES

- **Ultra-miniature low-profile design.** At half the size of the conventional FBR240 relay and requiring only three quarters of the board area, a drastic reduction in size has been achieved in the design of the FBR40. 15.8 (L) x 9.7 (W) x 7.8 (H) mm.
- **High dielectric strength.** Dielectric withstanding voltage between contacts and coil is over 1,000 VAC and with the ability to withstand a surge voltage of over 1,500 V, it conforms to FCC 68.302 standard.
- **High-shock resistance.** Even a shock force of 30 G will not result in a malfunction.
- **Low power consumption.** With a high efficiency built-in permanent magnet, operating power consumption is only 85 mW. (Rated power consumption is 150 mW.)
- **Formed terminal for temporary lock.** The terminals of the FBR40 are specially formed so that they can be temporarily attached to the PC board.
- **Pattern design is easy.** The terminal connections are designed so that the drive portion (coil) and the output portion (contacts) are isolated, which simplifies pattern design.
- **Immersion cleaning.** Sealed for immersion cleaning.
- **UL and CSA approved.** UL File No. (E63615), CSA File No. (LR64026-17).
- Contact sales representative for availability of models meeting BELCOR 2500 V surge test.

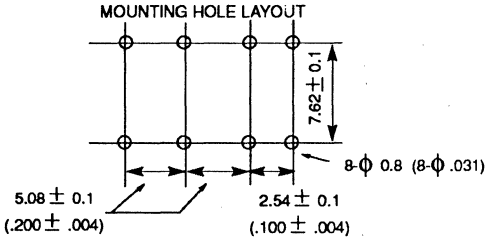
DIMENSIONS Unit: mm (inches)



SCHEMATIC



MOUNTING HOLE LAYOUT



Notes: [1]This relay is polarized. Please refer to the schematic when designing a circuit.
[2]An abbreviated designation is marked on the top surface of the dust cover as follows:
(ex.) Designation: FBR46D012-P Marking: 46D012-P
[3]Terminal numbers are not shown on the relay.

ENGINEERING DATA

Item	Specification
Contact Arrangement Contact Materials Initial Contact Resistance	DPDT (2 Form C) bifurcated contact Gold overlay silver-palladium alloy 100 megohm max. measured at 6 V DC, 0.1 A
Insulation Resistance Dielectric Withstanding Voltage	100 megohm min. at 500 VDC Between open contacts 500 VAC for 1 min. Between contact and coil and between adjacent contacts 1,000 VAC for 1 min.
Surge Voltage (FCC 68.302)	1,500 V/10 microsec/700 microsec Between coil and contact Between adjacent contacts 1,500 V 750 V 10 microsec 700 microsec
Electrostatic Capacitance Between Contacts (Reference)	Between open contacts approx. 1 pF Between coil and contact approx. 2 pF
Vibration	Operation malfunction 10-55 Hz (Dual amplitude 1.5 mm) Durability 10-55 Hz (Dual amplitude 1.5 mm)
Shock	Operation malfunction 30 G (11 msec) Durability 100 G (11 msec)
Operate Time Release Time	5 msec max. (bounce time not included) 5 msec max. (bounce time not included)
Life Expectancy Mechanical Electrical	 10 x 10^3 ops. min. 100 x 10^3 ops. min. (at rated contact load)
Maximum Switching Frequency Mechanical Electrical	 18 x 10^3 times/hour 1,800 times/hour (at contact rated load)
Operating Temperature Range Operating Humidity Range	−30 degrees C to +70 degrees C 45-85% RH
Weight	3 g (approx.)

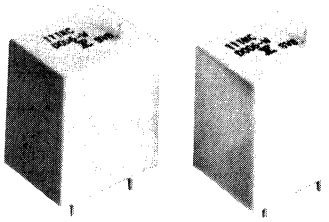
SELECTION TABLE

Type	Rated Coil Voltage (VDC)	Coil Resistance (± 10%) in Ω	Pick-up Voltage	Drop-out Voltage	Rated Power Consumption	Pick-Up Power Consumption	Designation
Standard Type	3	60	Less than 75% of rated voltage	More than 5% of rated voltage	150 mW approx. (when voltage is applied)	Less than 85 mW	FBR46ND003P
	5	167					FBR46ND005P
	6	240					FBR46ND006P
	9	540					FBR46ND009P
	12	960					FBR46ND012P
	24	2,880			200 mW approx.	Approx. 112 mW max.	FBR46ND024P

Note: Measured at 20 degrees C

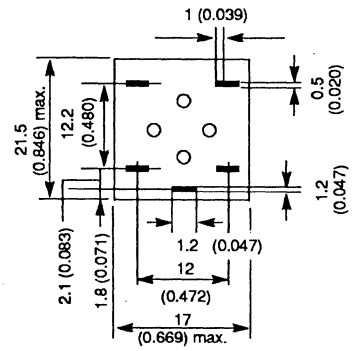
MINIATURE RELAYS FOR P.C. BOARDS
FBR110 Series

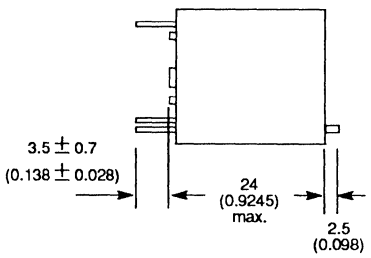
FUJITSU



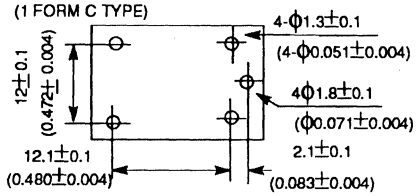
IMMERSION-CLEANABLE N TYPE

Unit: mm (inches)

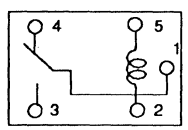




PC BOARD MOUNTING HOLE LAYOUT
(1 FORM C TYPE)



SCHEMATICS
(1 FORM C TYPE)



(Bottom View)

Fujitsu FBR111N series relays are low cost SPDT relays with a versatile switching capability. The contact is rated 3 A, 28 VDC; 3 A, 120 VAC for standard contact, or up to 8.5 A, 28 VDC; 10 A, 120 VAC for special heavy duty contact.

FEATURES

- **Design**
  These small size, sensitive relays, designed to be mounted on printed circuit boards, feature simplified construction and a low power dissipation.
- **Applications**
  Ideal for use in audio equipment, business machines, vending machines, security systems, game machines, and automotive applications.
- **Immersion Cleaning**
  The FBR111N series can be immersion cleaned where printed circuit board cleaning is required.
- **Conforms to Safety Standards**
  Relay FBR111N is UL recognized for office equipment and business machines (File No. E63615). CSA certified (LR45982).

ENGINEERING DATA

Item	Specification
Contact Arrangement	SPDT
Contact Ratings Contact Materials	<table><tr><th rowspan="2">Contact Materials</th><th colspan="2">UL Rating</th></tr><tr><th>28 VDC (Resistive)</th><th>120 VAC (Resistive)</th></tr><tr><td>No Suffix Silver</td><td>3 A</td><td>3 A</td></tr><tr><td>–K Silver-Cadmium Oxide</td><td>3 A</td><td>3 A</td></tr><tr><td>–M Gold-plated Silver</td><td>1 A</td><td>1 A</td></tr><tr><td>–W Special Alloy</td><td>8.5 A</td><td>10 A</td></tr></table>
Initial Contact Resistance	100 megohm max. (0.5 A at 6 VDC for no suffix and –M; 1 A at 6 VDC for –K or –W)
Rated Coil Voltage Coil Power Dissipation Coil Temperature Rise	5, 6, 9, 12, 24 VDC 0.36 W approx. at rated voltage 30 degree C max. at rated voltage
Insulation Resistance Dielectric Withstanding Voltage	1,000 megohm min. (at 500 VDC) 500 VAC for 1 minute
Vibration	10 to 50 Hz (Dual amplitude: 1.5 mm)
Shock	10 G (11 ms)
Operate Time Release Time	20 ms max. (at rated voltage) 10 ms max. (after rated operation)
Life Expectancy Mechanical Electrical	 10 x 10^6 ops. min. 100 x 10^3 ops. min. (at rated contact load)
Temperature Range Standard UL Type	 –30 degrees C to +65 degrees C –30 degrees C to +55 degrees C
Weight	15 g (approx.)

SELECTION TABLE

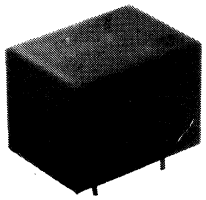
Designation	Nominal Coil Voltage (VDC)	Coil Resistance (ohm)	Pick-Up Voltage	Drop-Out	Maximum Coil Voltage
FBR111NUD005-[1]-CSA[2]	5	70	80% of nominal	10% of nominal	210% of nominal
FBR111NUD006-[1]-CSA[2]	6	100			
FBR111NUD009-[1]-CSA[2]	9	225			
FBR111NUD012-[1]-CSA[2]	12	400			
FBR111NUD024-[1]-CSA[2]	24	1,600			
FBR111NUD048-[1]-CSA[2]	48	5,100			

Notes: [1]Insert contact material suffix. [2]For CSA certified relays, –CSA suffix must be added to part number of UL type.

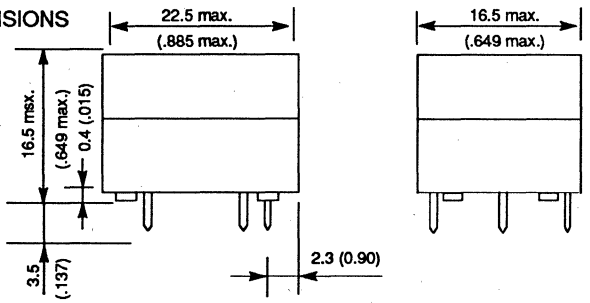
Example Part No.: FBR111NUD005-W1-CSA

SMALL CONTROL RELAYS FOR P.C. BOARDS
FBR160 Series

FUJITSU

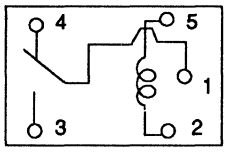


DIMENSIONS



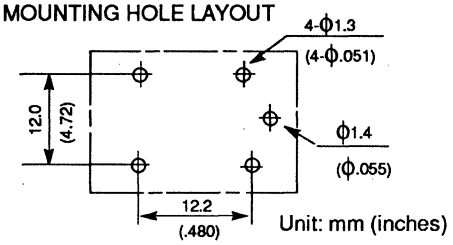
Fujitsu FBR160 series small control relays are PC board mounted and have contact ratings up to 10 A.

SCHEMATIC



(view from terminal side)

MOUNTING HOLE LAYOUT



Unit: mm (inches)

FEATURES

- **Same terminal array as FBR100.** These relays have the same foot print as Fujitsu's conventional FBR100 series.
- **Lower profile.** Since their profile is 7 mm lower than that of the FBR100 series relays, they can be used in smaller equipment.
- **Flux-prevention structure.** The contacts are located on the top of the relay to protect them from solder flux from the terminals.
- **Choices of contact materials.** Two different kinds of contact materials can be specified according to the load.
- **Immersion cleaning.** Sealed for immersion cleaning.
- **Meets major safety standards.** The relays are CSA certified (LR41893-56, LR50924-5, and LR64026-7). The relay structure is designed to meet the Japan Electric Appliance control law (150 V max.) and UL standards (File No. E63614 and E63615).

ENGINEERING DATA

Item	Specification
Contact Arrangement Contact Material	SPDT or SPST – No (Form A) No Suffix (silver) -H (Silver-Cadium-Oxide) -WB (special)
Contact Ratings	3 A at 28 VDC or 120 VAC (No Suffix) 5 A at 28 VDC or 120 VAC (H) 10 A at 28 VDC or 120 VAC (WB)
Initial Contact Resistance	100 megohm max. Silver contacts: Measured at 6 VDC, 0.5 V Other contacts: Measured at 6 VDC, 1.0 A
Insulation Resistance Withstanding Voltage	100 megohm min. (at 500 VDC) Between open contacts: 500 VAC for 1 minute Between contact and coil: 1,500 VAC for 1 minute
Vibration	10 to 55 Hz (dual amplitude: 1.5 mm)
Shock	Operation malfunction: Less than 0.1 ms at 10 G (11 ms) Durability: 100 G (11 ms)
Operate Time Release Time	10 ms max. (at rated voltage, bounce time not included) 5 ms max. (after operation at rated voltage, bounce time not included)
Life Expectancy Mechanical Electrical	 10×10^6 ops. min. (maximum switching frequency: 18×10^3/hour) 100×10^3 ops. min. (at rated contact load, maximum switching frequency: 18×10^2/hour)
Ambient Temperature Range Ambient Humidity	–30 degrees C to +60 degrees C 45 to 85% RH
Weight	11 g (approx.)

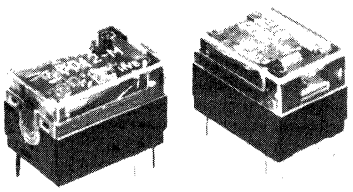
SELECTION TABLE

FBR161 Type	Contact Arrangement	Rated Voltage in VDC	Coil Resistance in Ω (± 10%) at 20 °C	Pick-up Voltage at 20 °C	Designation
Standard	SPDT	5	70	Less than 80% of rated voltage	FBR161NED005U-*
		6	100		FBR161NED006U-*
		9	225		FBR161NED009U-*
		12	400		FBR161NED012U-*
		24	1,600		FBR161NED024U-*

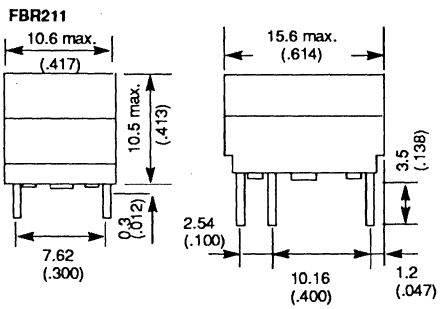
Note: *Insert contact material suffix.
Example Part No.: FBR161NED012U-H

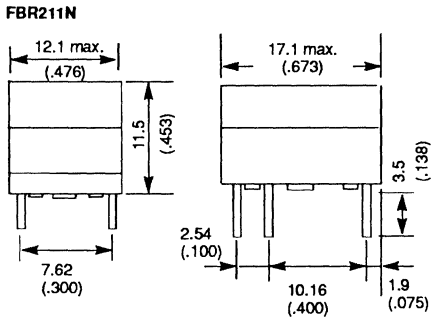
ULTRA-MINIATURE RELAYS FOR P.C. BOARDS
FBR210 Series

FUJITSU

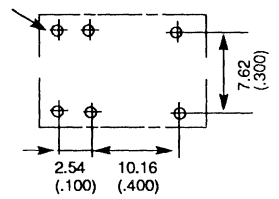


DIMENSIONS Unit: mm (inches)

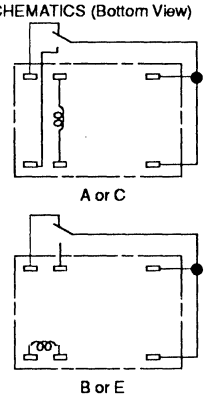




FBR211, FBR211N
MOUNTING HOLE LAYOUT



SCHEMATICS (Bottom View)



Fujitsu FBR210 series of ultra-miniature relays allow high component densities for savings in both equipment size and cost for the printed circuit board. The FBR211N series are suitable for immersion cleaning in freon and aqueous systems.

These highly sensitive relays with gold-clad SPDT contact arrangements are designed to offer load handling capabilities of 1 A at 28 VDC or 0.5 A at 120 VAC under a resistive load. The 0.1 inch grid spacing of terminals makes these relays ideally suited for printed circuit board applications requiring high-density mounting and for use in audio and wireless communications, office vending machines, automobiles and various control applications. Contact sales representative for availability of new 2 A models.

ENGINEERING DATA

Item	Specifications	
	Standard Model	High-Sensitivity Model
Contact Arrangement	SPDT	
Contact Material	Gold overlay silver-palladium alloy or gold overlay silver	
Contact Rating	1 A at 28 VDC, 0.5 A at 120 VAC (resistive)	
Initial Contact Resistance	100 megohm max. at 6 VDC, 0.5 A	
Rated Coil Voltage	1.5, 3, 5, 6, 9, 12, 24 VDC	
Coil Power Dissipation	0.45 W at rated voltage	0.20 W at rated voltage
Coil Temperature Rise	45 degree C approx. at rated voltage	25 degree C at rated voltage
Insulation Resistance	100 megohm min. at 500 VDC (at 20 degree C 65% RH)	
Dielectric Withstanding Voltage	500 VAC for 1 minute	
Vibration	10 to 40 Hz (dual amplitude: 1.5 mm)	
Shock	10 G (11 ms)	6 G (11 ms)
Operate Time	5 ms approx. (at rated voltage, 20 degree C)	
Release Time	5 ms approx.	
Life Expectancy		
Mechanical	5×10^6 ops. min.	
Electrical	300×10^3 ops. min at 1 A 28 VDC, resistive 100×10^3 ops. min. at 0.5 A 120 VAC, resistive	
Temperature Range	-25 degree C to +55 degree C	-25 degree C to +75 degree C
Weight	4 g (approx.)	

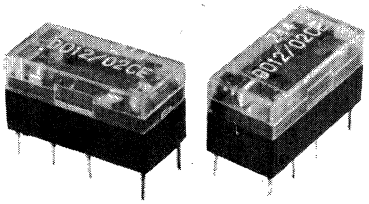
SELECTION TABLE

Designation*[1,2]		Contacts		Schematics		Rated Voltage in VDC	Coil Resistance in ohms (±10%) at 20 degree C		Pick-up Voltage at 20 °C
Standard	High Sensitivity	Arrangement	Materials	Std.	High Sensitivity		Std.	High Sensitivity	
FBR211NAD001P	FBR211NCD001P	SPDT	Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)	A	C	1.5	5	12	Less than 70% of rated voltage
FBR211NAD003P	FBR211NCD003P					3	20	45	
FBR211NAD005P	FBR211NCD005P					5	56	120	
FBR211NAD006P	FBR211NCD006P					6	80	180	
FBR211NAD009P	FBR211NCD009P					9	180	400	
FBR211NAD012P	FBR211NCD012P					12	320	700	
FBR211NAD024P	FBR211NCD024P					24	1280	2800	
FBR211NBD001P	FBR211NED001P		Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)	B	E	1.5	5	12	Less than 70% of rated voltage
FBR211NBD003P	FBR211NED003P					3	20	45	
FBR211NBD005P	FBR211NED005P					5	56	120	
FBR211NBD006P	FBR211NED006P					6	80	180	
FBR211NBD009P	FBR211NED009P					9	180	400	
FBR211NBD012P	FBR211NED012P					12	320	700	
FBR211NBD024P	FBR211NED024P					24	1280	2800	

Notes: [1]Each product bears its own designation on the top of the cover, but initial code "FBR" is omitted.
[2]Change P to M for gold overlay silver.

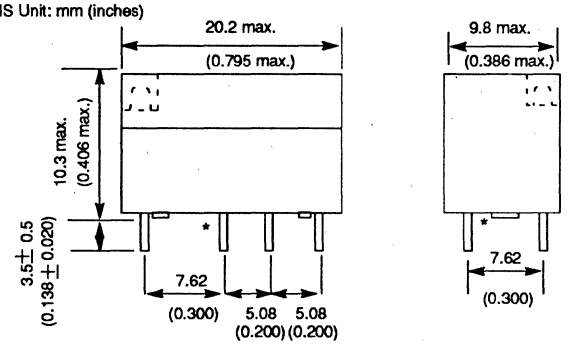
LOW PROFILE RELAYS FOR P.C. BOARDS
FBR240 Series

FUJITSU



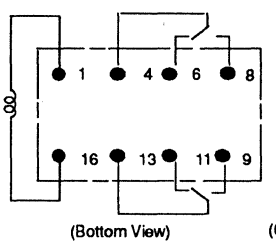
FBR244 and FBR244N series relays are low profile, P.C. board relays with 2 Form C (DPDT) contact arrangements in D.I.P.-compatible plastic housing and have a 2.54 mm pinout grid spacing to provide 16-pin-DIP socket compatibility. Sealed construction allows automatic wave soldering and board washing without relay damage. Single or bifurcated contacts switch 1 A at 28 VDC or 0.5 A at 120 VAC and have a rated-load life-time of 5 x 10^5 operations. These relays are suitable for telecommunication equipment, audio equipment and business machines. The relays are CSA certified (LR41893-35) and UL recognized (file #E63615).

DIMENSIONS Unit: mm (inches)

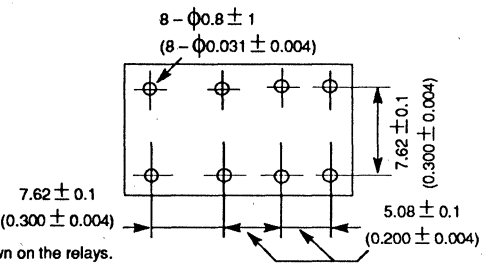


* The terminals marked with an asterisk are formed for temporary mounting on PC board.

SCHEMATIC



PC BOARD MOUNTING HOLE LAYOUT



Note: Terminal numbers are not shown on the relays.

ENGINEERING DATA

Item	Specification
Contact Arrangement	2 Form C
Contact Material	Suffixes: S: Single Gold Overlay Silver P: Single Gold Overlay Silver-Palladium Alloy T: Bifurcated Gold Overlay Silver E: Bifurcated Gold Overlay Silver-Palladium Alloy
Contact Rating	1 A at 28 VDC (resistive), 2 A at 12 VDC (resistive) 0.5 A at 120 VAC (resistive)
Initial Contact Resistance	100 megohm max. at 6 VDC 0.1 A
Coil Power Dissipation	Typical 0.5 W at rated coil voltage
Coil Temperature Rise	50 degree C approx. at rated voltage 20 degree C
Insulation Resistance	100 megohm min. (at 500 VDC)
Dielectric Withstanding Voltage	500 VAC for 1 minute
Vibration	10 to 55 Hz (dual amplitude: 1.5 mm)
Shock	10 G (11 ms)
Operate Time	10 ms max. at coil rated voltage
Release Time	5 ms max.
Life Expectancy	
Mechanical	10^7 ops. min.
Electrical	5 x 10^5 ops. min. at 1 A 28 VDC (resistive) – 0.3 A 120 VAC (resistive) 10^5 ops. min. at 0.5 A 120 VAC (resistive)
Ambient Temperature Range	–30 to +70 degrees C
Weight	4.5 g (approx.)

SELECTION TABLE

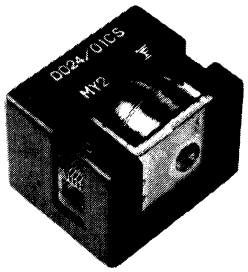
Rated Voltage in VDC	Coil Resistance in Ω (± 10%) at 20 degree C	Pick-up Voltage at 20 °C	Designation
3	18	Less than 75% of Rated Voltage	FBR244ND003/02C*-CSA
5	50		FBR244ND005/02C*-CSA
6	72		FBR244ND006/02C*-CSA
9	162		FBR244ND009/02C*-CSA
12	290		FBR244ND012/02C*-CSA
24	1150		FBR244ND024/02C*-CSA

Note: *Insert contact material suffix.

Example Part No: FBR244ND005/02CS

P.C. BOARD RELAYS FOR AUTOMOTIVE APPLICATIONS
FRL270 Series

FUJITSU



Fujitsu FRL270 series power relays are for PC board mounting and are designed especially for automotive applications.

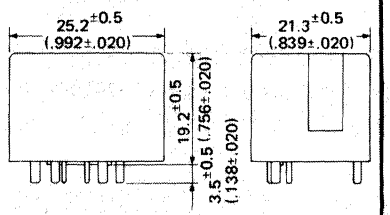
FEATURES

- **Maximum current: 30 A.** The relays are designed for high ambient and storage temperatures to ensure the contacts will endure continuous current of up to 30 A.
- **Rigid, shock-resistant construction.** (1-meter drop test.)
- **Welding resistant contact materials.** Three types of welding resistant contact materials are available as standard.
- Choice of wide terminal model (-01 suffix) for maximum heat/power transfer or standard terminal model (no suffix) for conventional hole/conductor sizes at no extra charge.

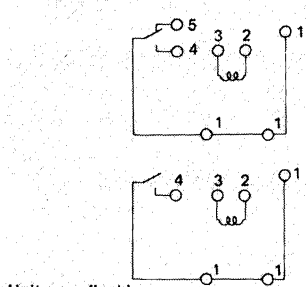
Typical Uses

- **Engine Control.** Electronic fuel injection units.
- **Lamp control.** Flasher control units, headlight control units.
- **Motor, solenoid, and heater controls.** Windshield wiper control units for trucks, automatic door-lock control units, defogger control units, other various control units.
- **Immersion cleaning.** A sealed type is available for immersion cleaning.
- Alternate coil voltages 6 VDC and 9 VDC coils are available at no extra charge.

DIMENSIONS

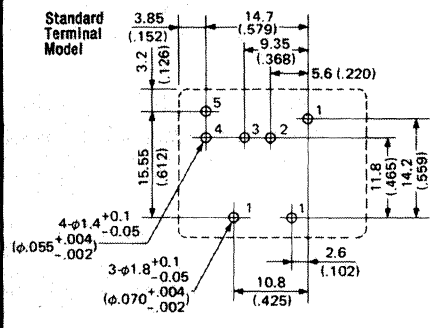


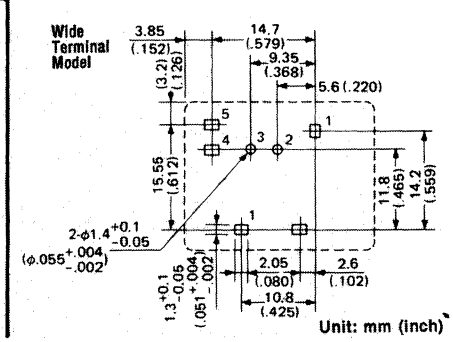
SCHEMATICS (BOTTOM VIEWS)



Unit: mm (inch)

MOUNTING HOLE LAYOUT





Unit: mm (inch)

ENGINEERING DATA

Item	Specification
Contact Arrangement Contact Material Suffixes	SPDT (1 Form C) or SPST (1 Form A) -S (Silver-Copper Alloy) -K (Silver-Cadium Oxide) -Y (Silver-Tin Oxide) -D (Silver-Copper)
Contact Rating N.O. Contact Type "D" Contact: All Other Types: N.C. Contact All Contact Types:	 12 VDC, 30 A 12 VDC, 15 A or 24 VDC, 10 A 12 VDC, 10 A or 24 VDC, 7A
Maximum Carry Current	30 A
Coil Power Coil Temperature Rise	Standard coil: 1.7 W approx. Low power coil: 0.6 W approx. (with rated voltage applied at 20 degree C) Standard coil: 75 deg. approx. Low-power coil: 35 deg approx. (with rated voltage applied at 20 degree C)
Insulation Resistance Withstanding Voltage	100 megohm min. (at 500 VDC) 500 VAC for 1 minute
Vibration	Operation error: With 1.5 mm vibration applied at full amplitude at 10 to 55 Hz, contact chatter lasts less than 1 ms.
Shock	Operation error: 10 G (11 ms sine half-wave) Durability: 100 G (11 ms sine half-wave)
Operate Time Release Time	10 ms max. (Standard coil with 01-type contact gap) 5 ms max. (01-type contact gap) 8 ms max. (51-type contact gap)
Life Expectancy	Mechanical: 100 x 10^4 operations or more Electrical: 250 x 10^3 operations or more (Silver-copper alloy under the rated contact load)

SELECTION TABLE

Type of Coil (Spec. Code)	Rated Voltage (Spec. Code)	Contact Gap (Spec. Code)	Coil Resistance (± 10%)	Rated Power Consumption	Pick-up Voltage	Drop-out Voltage	Part No.
Standard (D)	12 VDC (012)	Standard (01)	85	1.7 W approx.	Less than 6.5 VDC	More than 1.0 VDC	FRL274ND012/01CS[1,2]-A
		1 mm (51)	85	1.7 W approx.	Less than 6.5 VDC	More than 1.0 VDC	FRL274ND012/51CS[1,2]-A
Low Power (H)		Standard (01)	240	0.6 W approx.	Less than 8.4 VDC	More than 0.8 VDC	FRL274NH012/01CS[1,2]-A
Standard (D)	24 VDC (024)	Standard (01)	340	1.7 W approx.	Less than 13.0 VDC	More than 2.0 VDC	FRL274ND024/51CS[1,2]-A
		1 mm (51)	340	1.7 W approx.	Less than 13.0 VDC	More than 2.0 VDC	FRL274ND024/01CS[1,2]-A
Low Power (H)		Standard (01)	960	0.6 W approx	Less than 16.8 VDC	More than 1.6 VDC	FRL274NH024/01CS[1,2]-A

Notes: [1]Insert contact material code [2]Insert 01 for wide terminals. **Example Part No.:** FRL274ND012/01CD-01A

MINIATURE HIGH-POWER RELAYS
FBR600 Series

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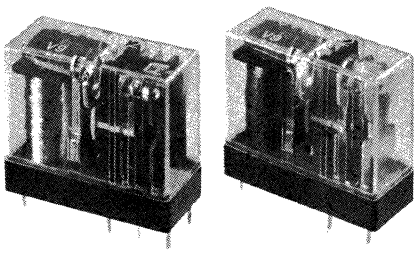
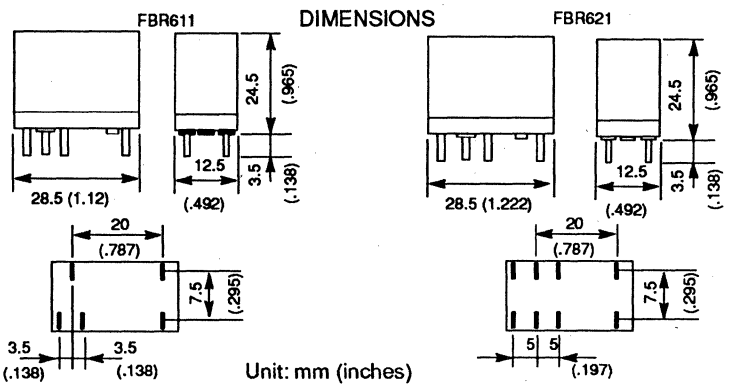


The FBR600 series are miniature high-power relays with a switching capability of 16 A, 30 VDC or 240 VAC for 1 Form C contact and 5 A, 30 VDC or 240 VAC for 2 Form C contacts. These relays are designed for mounting on printed circuit boards.

FEATURES

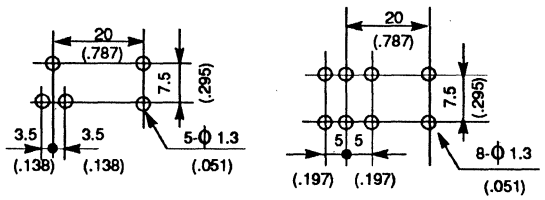
- **Applications.**
  Ideal for use in audio equipment, TV, vending machines, control machines, etc.
- **Conforms to various standards.**
  UL recognized (E63615) for industrial control equipment per UL508. CSA certified (LR41893-50, LR61319-4, and LR64026-10).
- **Immersion cleaning.**
  Sealed for immersion cleaning.

DIMENSIONS



Unit: mm (inches)

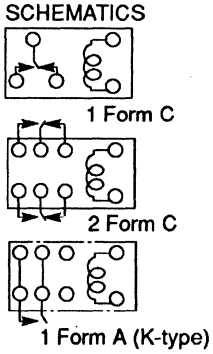
MOUNTING HOLE LAYOUT



1 Pole (Standard)

2 Pole and 1 Pole (K-type)

SCHEMATICS



1 Form C

2 Form C

1 Form A (K-type)

ENGINEERING DATA

Item	Specifications
Contact Arrangement	FBR611, FBR613-1 form C FBR621-2 form C
Contact Material Contact Rating	Silver alloy 10 A at 30 VDC or 240 VAC for FBR611; 10 A at 30 VDC and 16 A at 240 VAC for FBR613; 5 A at 30 VDC or 240 VAC for FBR621
Carrying Current Initial Contact Resistance	FBR611 and FBR613, 16 A; FBR621, 5 A 100 megohm max. at 6 VDC, 1 A
Rated Coil Voltage Coil Power Dissipation Coil Temperature Rise	5, 6, 9, 12, 18, 24, 48, 60 VDC FBR611/621, 0.5 W at 20 degree C FBR611/621, 35 degree C at rated voltage at 20 degree C
Insulation Resistance Dielectric Withstanding Voltage Between coil and contact Between open contacts Between adjacent contacts	1000 megohm min. at 500 VDC (initial) at 20 degree C 65% RH 5000 VAC for 1 minute at 20 degree C, 65% RH 1000 VAC for 1 minute at 20 degree C, 65% RH FBR621, 3000 VAC for 1 minute at 20 degree C, 65% RH
Lightening (1 x 40 microsec) Between coil and contact Between adjacent contacts	 10,000 V min. FBR621, 6000 V min.
Vibration	10 to 55 Hz (dual amplitude: 1.5 mm)
Shock	10 G (11 ms)
Operate Time Release Time	8 ms approx. (at rated voltage, 20 degree C) 2.5 ms approx. at 20 degree C
Life Expectancy Mechanical Electrical	 20 x 10^6 ops. min. 100 x 10^3 ops. min at rated voltage
Temperature Range	-40 to +70 degree C
Weight	16 g (approx.)

SELECTION TABLE

Contact Material	Rated Voltage in VDC	Coil Resistance in Ω (± 10%) at 20 degree C	Pick-up Voltage at 20 °C	Release Voltage at 20 °C	1 pole (standard)	2 pole (standard)	1 pole (16 A)
Silver-Alloy	5	50	Less than 70% of rated Voltage	More than 10% of Rated Coltage (reference)	FBR611ND005-CSA	FBR621ND005-CSA	FBR613ND005-K-CSA
	6	72			FBR611ND006-CSA	FBR621ND006-CSA	FBR613ND006-K-CSA
	9	160			FBR611ND009-CSA	FBR621ND009-CSA	FBR613ND009-K-CSA
	12	285			FBR611ND012-CSA	FBR621ND012-CSA	FBR613ND012-K-CSA
	18	640			FBR611ND018-CSA	FBR621ND018-CSA	FBR613ND018-K-CSA
	24	1150			FBR611ND024-CSA	FBR621ND024-CSA	FBR613ND024-K-CSA
	48	4600			FBR611ND048-CSA	FBR621ND048-CSA	FBR613ND048-K-CSA

GENERAL PURPOSE RELAYS
FRL260 Series

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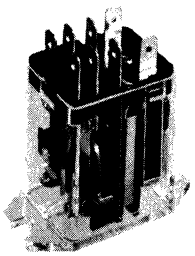


FLANGE MOUNT

The FRL260 series relays have been designed with emphasis on reliability, safety, cost performance, and applicability to a wide range of uses. These relays are top quality with proven performance.

These relays provide SPDT to 4PDT contacts, which are offered for contact ratings from 1 A to 15 A at 30 VDC or 240 VAC, resistive. Moreover, they are also available with four transfer bifurcated contacts that enable them to meet signal level or other light loads.

The FRL260 series relays are available in both DC- and AC-rated coils, and with a selection of mountings, such as solder, plug-in, P.C. boards and quick connect terminals.

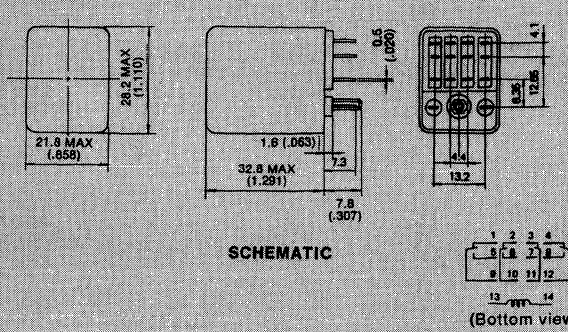
The FRL260 series are UL recognized (File No. E163614/E63615) and CSA certified (File No. LR41893).

ENGINEERING DATA

Item	Specification
Contact Ratings (resistive load) Initial Contact Resistance	As per Selection Table General (S, K V Contact): 100 megohm max. (at 6 VDC, 1 A) Low Level (T, L Contact): 50 megohm max. (at 6 VDC, 0.1 A)
Coil Power Dissipation Coil Temperature Rise	DC: 0.9 W (at rated coil voltage) AC: 1.2 VA (120 V max.) at rated coil voltage of 60 Hz 1.4 VA (200 V min.) at rated coil voltage of 60 Hz DC: 50 degree max. AC: 60 degree max.
Insulation Resistance Dielectric Withstanding Voltage	100 megohm min. (at 500 VDC) 1500 VAC (1000 VAC between open contacts) for 1 minute
Vibration	50 Hz (dual amplitude: 0.5 mm VDC)
Shock	10 G (11 ms)
Operate Time Release Time	25 ms max. (at rated coil voltage) 25 ms max.
Life Expectancy Mechanical Electrical	 50 x 10^6 ops. min. (at rated load) Medium Load SPDT: 500 x 10^3 ops. min. DPDT: 500 x 10^3 ops. min. 3PDT: 500 x 10^3 ops. min. 4PDT: 200 x 10^3 ops. min. 4PST: 100 x 10^3 ops. min. Heavy Load SPDT: 200 x 10^3 ops. min. SPST: 200 x 10^3 ops. min. DPDT: 500 x 10^3 ops. min.
Temperature Range	–30 to +55 degree C
Weight	35 g approx.

DIMENSIONS Unit: mm

04CL: DIMENSION AND CONSTRUCTION
04CS: DIMENSION AND CONSTRUCTION
04CT: DIMENSION AND CONSTRUCTION
04CV: DIMENSION AND CONSTRUCTION



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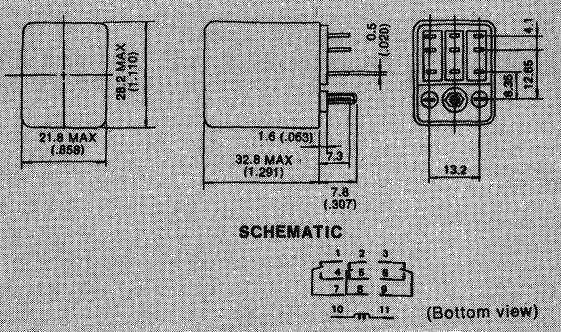

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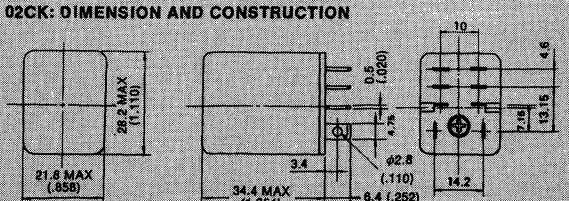

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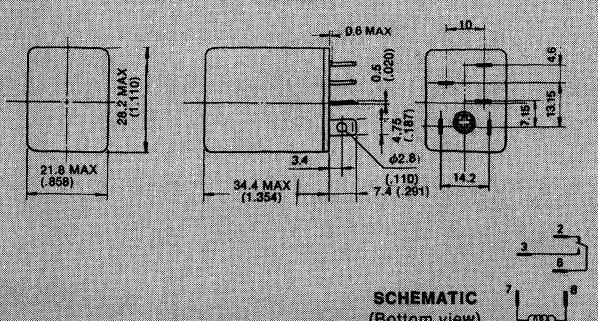

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GENERAL PURPOSE RELAYS
FRL260 Series

FRL260 SERIES RELAYS SELECTION TABLE – DC COIL

Contact Arrangement and Material	Contact Rating (Resistive)	Contact Rating (Horsepower)	Rated Voltage VDC 50/60 Hz	Coil Resistance ±15% Ω at 20 Degree C	Pick-Up Voltage at 20 °C	Fujitsu Part Number (Plug-In)*
SPDT AgCd0	15 A at 30 VDC or 150 VAC 10 A at 240 VAC Flange mount available. See example part no. below.	1/3 HP at 120 VAC 1/2 HP at 240 VAC	6 12 24 48 110	40 160 650 2600 13300	4.5 9 18 36 82.5	FRL263D006/01CK-CSA FRL263D012/01CK-CSA FRL263D024/01CK-CSA FRL263D048/01CK-CSA FRL263D110/01CK-CSA
DPDT AgCd0	10 A at 30 VDC or 240 VAC Flange mount available. See example part no. below.	1/3 HP at 120 VAC 1/2 HP at 240 VAC	6 12 24 48 110	40 160 650 2600 13300	4.5 9 18 36 82.5	FRL263D006/02CK-CSA FRL263D012/02CK-CSA FRL263D024/02CK-CSA FRL263D048/02CK-CSA FRL263D110/02CK-CSA
3PDT AgCd0	5 A at 30 VDC or 240 VAC	1/6 HP at 120 VAC	6 12 24 48 110	40 160 650 2600 13300	4.5 9 18 36 82.5	FRL263D006/03CS-CSA FRL263D012/03CS-CSA FRL263D024/03CS-CSA FRL263D048/03CS-CSA FRL263D110/03CS-CSA
4PDT Ag + Au Clad	3 A at 30 VAC or 120 VAC 3 A at 120 VAC General Purpose	1/10 HP at 120 VAC	6 12 24 48 110	40 160 650 2600 13300	4.5 9 18 36 82.5	FRL263D006/04CL-CSA FRL263D012/04CL-CSA FRL263D024/04CL-CSA FRL263D048/04CL-CSA FRL263D110/04CL-CSA
4PDT Ag	3 A at 30 VAC or 120 VAC 3 A at 120 VAC General Purpose	1/10 HP at 120 VAC	6 12 24 48 110	40 160 650 2600 13300	4.5 9 18 36 82.5	FRL263D006/04CS-CSA FRL263D012/04CS-CSA FRL263D024/04CS-CSA FRL263D048/04CS-CSA FRL263D110/04CS-CSA
4PDT (Bifurcated) Ag + Au Clad	1 A at 30 VAC or 120 V VAC	1/10 HP at 120 VAC	6 12 24 48 110	40 160 650 2600 13300	4.5 9 18 36 82.5	FRL263D006/04CT-CSA FRL263D012/04CT-CSA FRL263D024/04CT-CSA FRL263D048/04CT-CSA FRL263D110/04CT-CSA
4PDT AgCd0	5 A at 30 VAC or 240 VAC 5 A at 120 VAC General Purpose	1/6 HP at 120 VAC	6 12 24 48 110	40 160 650 2600 13300	4.5 9 18 36 82.5	FRL263D006/04CV-CSA FRL263D012/04CV-CSA FRL263D024/04CV-CSA FRL263D048/04CV-CSA FRL263D110/04CV-CSA

FRL260 SERIES RELAYS SELECTION TABLE – AC COIL

Contact Arrangement and Material	Contact Rating (Resistive)	Contact Rating (Horsepower)	Rated Voltage VAC 50/60 Hz	Coil Resistance ±15% Ω at 20 degree C	Pick-Up Voltage at 20 °C	Fujitsu Part Number (Plug-In)*
SPDT AgCd0	15 A at 30 VDC or 150 VAC 10 A at 240 VAC Flange mount available. See example part no. below.	1/3 HP at 120 VAC 1/2 HP at 240 VAC	6 12 24 48 120 240	9.5 40 165 630 4400 13000	4.8 9.6 19.2 38.4 96.0 192.0	FRL263A006/01CK-CSA FRL263A012/01CK-CSA FRL263A024/01CK-CSA FRL263A048/01CK-CSA FRL263A120/01CK-CSA FRL263A240/01CK-CSA
DPDT AgCd0	10 A at 30 VDC or 240 VAC Flange mount available. See example part no. below.	1/3 HP at 120 VAC 1/2 HP at 240 VAC	6 12 24 48 120 240	9.5 40 165 630 4400 13000	4.8 9.6 19.2 38.4 96.0 192.0	FRL263A006/02CK-CSA FRL263A012/02CK-CSA FRL263A024/02CK-CSA FRL263A048/02CK-CSA FRL263A120/02CK-CSA FRL263A240/02CK-CSA
3PDT AgCd0	5 A at 30 VDC or 240 VAC	1/6 HP at 120 VAC	6 12 24 48 120 240	9.5 40 165 630 4400 13000	4.8 9.6 19.2 38.4 96.0 192.0	FRL263A006/03CS-CSA FRL263A012/03CS-CSA FRL263A024/03CS-CSA FRL263A048/03CS-CSA FRL263A120/03CS-CSA FRL263A240/03CS-CSA
4PDT Ag + Au Clad	3 A at 30 VAC or 120 VAC 3 A at 120 VAC General Purpose	1/10 HP at 120 VAC	6 12 24 48 120 240	9.5 40 165 630 4400 13000	4.8 9.6 19.2 38.4 96.0 192.0	FRL263A006/04CL-CSA FRL263A012/04CL-CSA FRL263A024/04CL-CSA FRL263A048/04CL-CSA FRL263A120/04CL-CSA FRL263A240/04CL-CSA
4PDT Ag	3 A at 30 VAC or 120 VAC 3 A at 120 VAC General Purpose	1/10 HP at 120 VAC	6 12 24 48 120 240	9.5 40 165 630 4400 13000	4.8 9.6 19.2 38.4 96.0 192.0	FRL263A006/04CS-CSA FRL263A012/04CS-CSA FRL263A024/04CS-CSA FRL263A048/04CS-CSA FRL263A120/04CS-CSA FRL263A240/04CS-CSA
4PDT (Bifurcated) Ag + Au Clad	1 A at 30 VAC or 120 VAC	1/10 HP at 120 VAC	6 12 24 48 120 240	9.5 40 165 630 4400 13000	4.8 9.6 19.2 38.4 96.0 192.0	FRL263A006/04CT-CSA FRL263A012/04CT-CSA FRL263A024/04CT-CSA FRL263A048/04CT-CSA FRL263A120/04CT-CSA FRL263A240/04CT-CSA
4PDT AgCd0	5 A at 30 VAC or 240 VAC 5 A at 120 VAC General Purpose	1/6 HP at 120 VAC	6 12 24 48 120 240	9.5 40 165 630 4400 13000	4.8 9.6 19.2 38.4 96.0 192.0	FRL263D006/04CV-CSA FRL263A012/04CV-CSA FRL263A024/04CV-CSA FRL263A048/04CV-CSA FRL263A120/04CV-CSA FRL263A240/04CV-CSA

Note: *For PCB type terminals change prefix to FRL264. **Example Part No. for flange mount:** FRL263A024/02CK-0E-CSA

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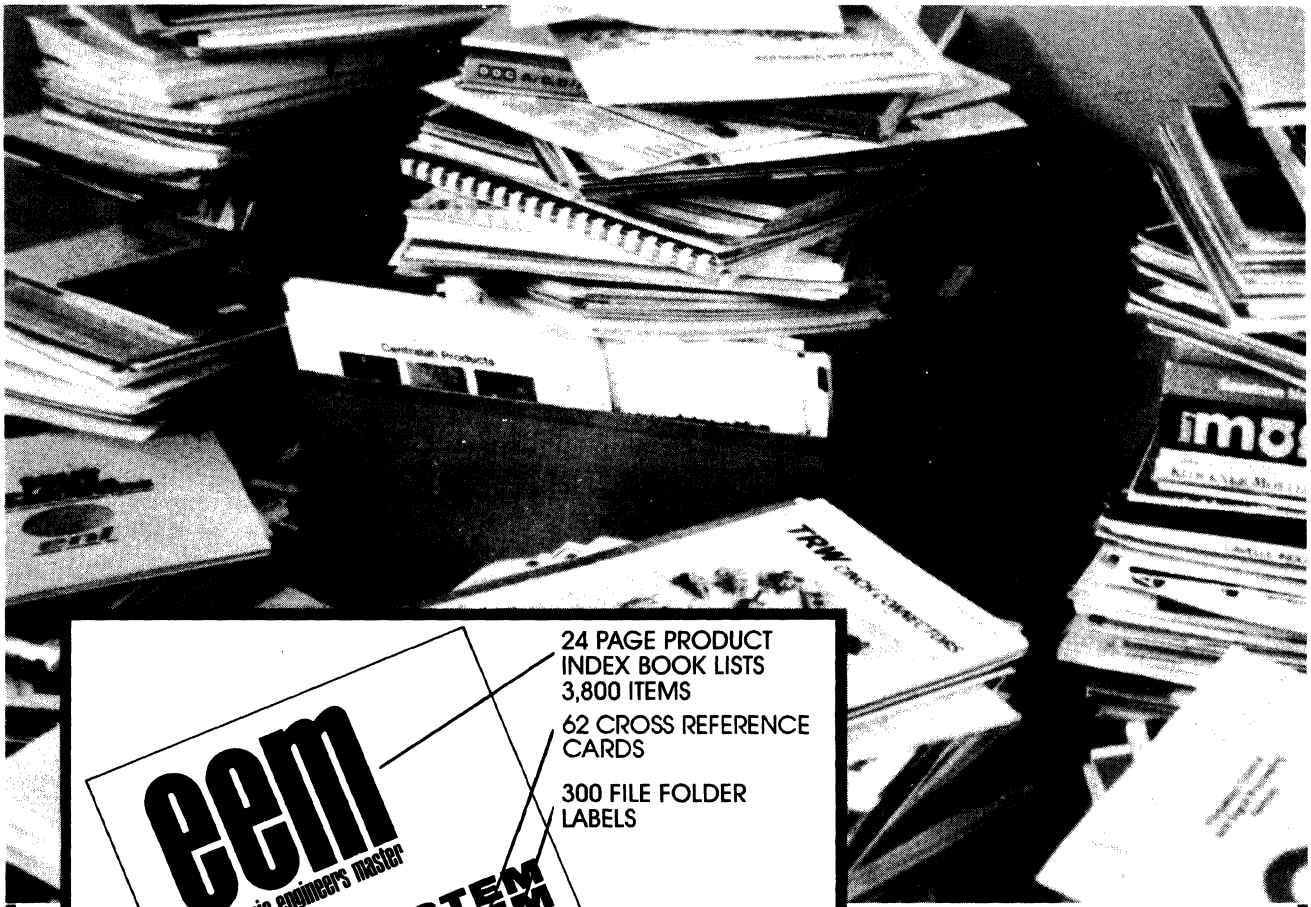

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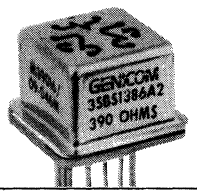
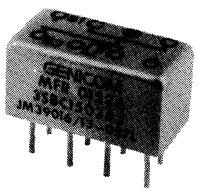
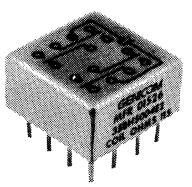
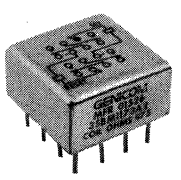
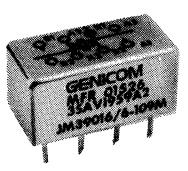
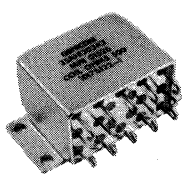
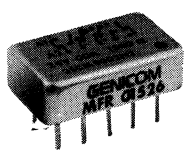
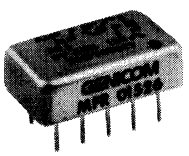
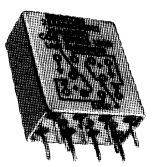
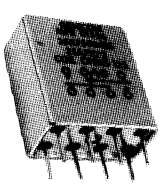
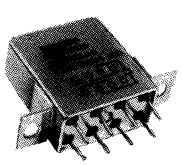
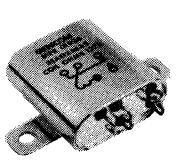
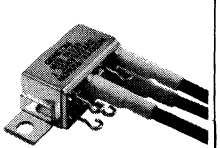
SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE NO MOUNT L" × W" × H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SBS Transistor Size Relay		2PDT	1A DC Res .2A DC Ind Low Level	10^5 / 10^6	Size .37 × .37 × .275 Weight 0.09	120 mW	39016/9 39016/15 39016/20	100G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBC 1/5 Size Two Pole 150 Grid Hybrid		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5-AC Low Level	10^5 / 10^6	Size .61 × .31 × .32 Weight 0.13	135 mW	39016/13 39016/37 39016/38	100G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBH 1/5 Size Four Pole 150 Grid Hybrid		4PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 / 10^6	Size .61 × .61 × .32 Weight 0.24	250 mW	39016/14	100G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBM 1/2 Size 150 Grid Latching Hybrid		4PDT	2A DC Res .5A DC Ind .5A-DC Low Level	10^5 / 10^6	Size .61 × .61 × .32 Weight 0.28	100mW Single Coil or 180mW Dual Coil	39016/31 39016/35 39016/36	150G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SAV Half-Size Sensitive R.F.		2PDT	2A DC Res .5A DC Ind .75 A-AC Low Level	10^5 / 10^6	Size .80 × .40 × .40 Weight 0.30	100mW to 260mW	39016/6 39016/22 39016/33 39016/44	100G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SAH Four Pole Grid		4PDT	2A DC Res .5A DC Ind 1A-AC Low Level	2×10^5 at 2A dc at 1A AC / 2×10^6	Size 1.01 × .61 × .81 Weight 1.0	400 mW	39016/39	50G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SCM DeciGrid® Mag-Latch 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 / 10^6	Size .575 × .350 × .170 Weight .075	2.0 mJ at 5ms	39016/47	100G @ 6ms	30G 55-3000 Hz	−65C +125C

*Single-phase load, case not grounded

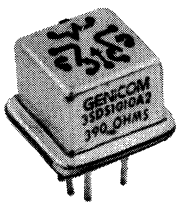
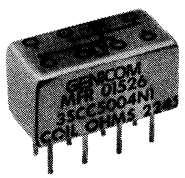
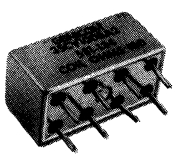
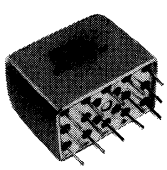
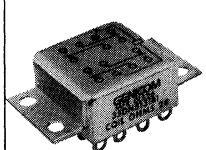
GENICOM®

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE L" × W" × H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SCP DeciGrid® Mono-stable 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 10^6	Size .575 × .350 × .170 Weight .075	68 mW	39016/48	100G @ 6ms	30G 55- 3000 Hz	−65C +125C
3SAM Mag-Latch Grid-Space		2PDT	2A DC Res .5A DC Ind 1A-AC Low Level	10^5 at 2A DC at 1A AC 10^6	Size .80 × .40 × .90 Weight 0.60	50mW Single Coil 75mW Dual Coil	39016/32	150G @ 11ms	30G 55- 3000 Hz	−65C +125C Special +200C
3SAF Grid Spaced Micro Crystal Can		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC 10^6	Size .80 × .40 × .90 Weight 0.50	300 mW	5757/10	100G @ 11 ms	30G 55- 2000 Hz	−65C +125C
3SBK Power Relay		2PDT	5A DC 2A AC 2A DC Ind Low Level	10^5 10^6	Size .80 × .40 × .90 Weight 0.7 max	300 mW	5757	90G @ 11ms	30G 55- 2000 Hz	−65C +125C
3SAC Crystal Can "S" Header		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × 1.187 Weight .090	200 mW	5757/10	50G @ 11ms	10G 55- 500 Hz	−65C +125C
3SAE Crystal Can "S" Header		2PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × .875 Weight 0.45	330mW	5757/10	100G @ 11ms	20G 55- 2000 Hz	−65C +125C
3SAV-RF with Co-ax Cables		2PDT 1PDT	25 Watts 10 Watts	10^5 10^6	Size .86 × .40 × .46 Weight .35 oz. max	260 mW 100 mW	39016/33	100G @ 11ms	30G 55- 3000Hz	−65C +125C

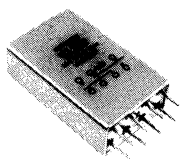
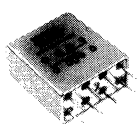
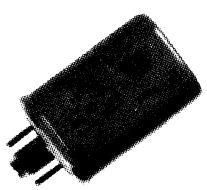
*Single-phase load, case not grounded

Continued on next page.

SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE NO MOUNT L" × W" × H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SDS Long Life		2PDT	1A DC .5A AC Low Level	10^5 / 50×10^6	Size .37 × .37 × .275 Weight 0.13	120 mW		100G @ 11ms	30G 55-3000Hz	−40C +125C
3SCC Long Life		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5-AC Low Level	10^5 / 100×10^6	Size .61 × .31 × .32 Weight 0.13	135 mW		100G @ 11ms	30G 55-3000Hz	−40C +125C
3SCV Long Life Half-Size		2PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 / 100×10^6	Size .80 × .40 × .40 Weight .30	340mW				−40C + 125C
3SCH Long Life		4PDT	2A Res .5A DC Ind 1A-AC Low Level	2×10 at 2A dc at 1A AC / 75×10^6	Size 1.01 × .61 × .81 Weight 1.0	400 mW		50G @ 11ms	30G 55-3000Hz	−40C +125C
3SDH Long Life		4PDT	2A DC .5A AC Low Level	10^5 / 100×10^6	Size .61 × .61 × .32 Weight 0.24	250 mW		100G @ 11ms	55-3000Hz	−40C +125C

*Single-phase load, case not grounded

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE & WEIGHT (OZ.) NO MOUNT L × W × H	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SAT Sensitive Mil Quality		2PDT 1PDT	2A DC 1A AC Low Level	10^5 / 10^6	Size .80 × .400 × 1.125 Weight .95	40 mW & 25 mW	5757	90G @ 11ms	20G 55-3000Hz	−65C +125C Special 200C
3SBF Sensitive Mil Quality		2PDT 1PDT	2A DC 1A AC Low Level	10^5 / 10^6	Size .80 × .40 × .90 Weight .50	75 mW & 50 mW	5757	90G @ 11ms	25G 55-2500Hz	−65C +125C Special 200C
3SAA Power Relay Mil Quality		1Pole to 6 Poles	Low Level to 10 Amps	Depends on Rating	Size 1.67 × 1.48 × 2.1 Weight 4.5	600 mW		30G @ 11ms	55-500 Hz	−65C +125C
3SCA Miniature Industrial Relays		2PDT 4PDT 6NO	10A 5A DC Res 2A DC Ind 5A-AC Low Level	Depends on Contact Rating	1.67 × 1.48 × 2.1 Weight 4.5	350mW 600mW 815mW				0C +71C

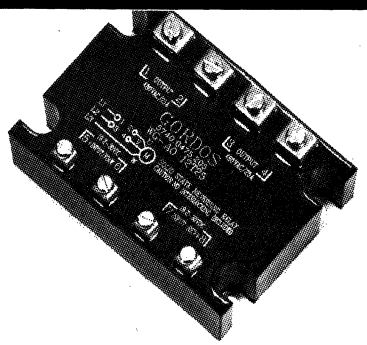
Note: Long Life relays are rated at 50 μA, 50 mV open circuit DC or Peak AC for the number of operations indicated in selection guide with the contact resistance during life test not to exceed 50 ohms. Testing plan is available on request.

***Single-phase load, case not grounded**

For additional publications and product information contact:
GENICOM Corporation, GENICOM Relays
Waynesboro, VA 22980, 1-703-949-1471

GENICOM®
Relays You Can Rely On.

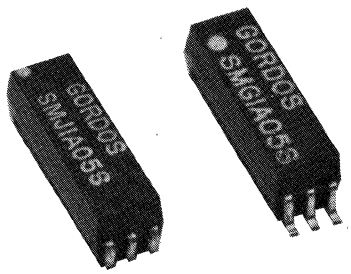
GORDOS SERIAL COMMUNICATION DEVICES



THREE-PHASE MOTOR REVERSING RELAYS

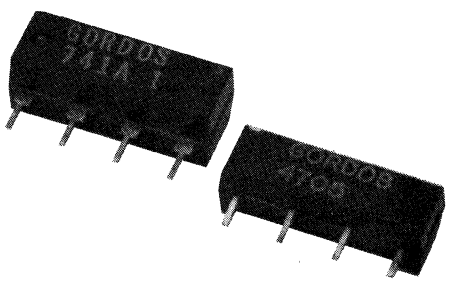
- Convenient Self-Contained Design Eases Installation and Wiring
- 48 to 480VAC Output Voltage Range Suitable for Many Applications
- 1200V Peak Blocking Voltage Helps Protect Against Transients in Harsh Electrical Environments
- 10 Million Operations Provide Long-Life Switching of 25A Three-Phase Loads
- 4000VAC Isolation
- 5, 15, 24V Logic Versions for a Wide Variety of Logic Circuit Applications
- Compact Sealed Package with Screw Terminals

GORDOS REED RELAYS



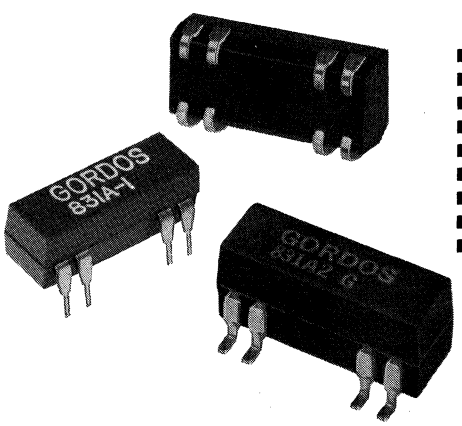
SM SERIES SURFACE MOUNT REED RELAYS

- Available in "J" and Gullwing Versions
- Form "A" and Form "C" Contact Configurations
- Coaxially Shielded Form A Available in 50, 75-ohm Versions
- 5 or 12V Operation
- Semiconductor Grade, 94V-0 Molding Compounds Impervious to Aqueous and Chemical Cleaning Procedures



47 SERIES MINI-SIP
74 SERIES SIP DRY REED RELAYS

- Compatible With Automatic Insertion Equipment
- Form "A" and Form "C" Contact Configurations
- Semiconductor Grade, 94V-0 Molding Compounds
- Coaxially Shielded Form A Available in 50, 75-ohm Versions
- Compatible With RTL, DTL, TTL & HTL Logic
- Available with or without Diodes



83 SERIES DIP THRU-HOLE AND SURFACE MOUNT DRY REED RELAYS

- Choice of Gull or J-Lead Surface Mount or Thru-hole Configurations
- Surface Mount Versions Pass High Reliability Steam Aging Solderability Test
- Surface Mount Versions Compatible with IR Reflow Systems
- Form A, 2A, B or C Contacts
- Logic Compatible 5, 12, or 24V Operation
- Available with or without Diodes
- Compatible with Automatic Insertion Equipment
- Semiconductor Grade, 94V-0 Molding Compounds
- –20°C to 85°C Operating, –20°C to 100°C Storage Temperature Ranges

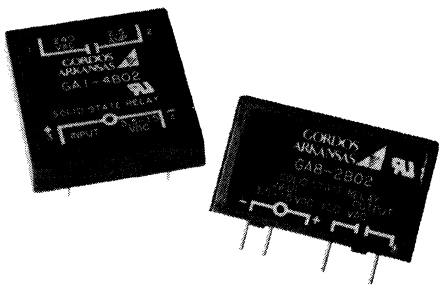
See Data Acquisition Section for additional GORDOS products.

All brand and product names are trademarks or registered trademarks of their respective companies.

For a catalog or application assistance contact GORDOS at 800-726-0300.

Gordos, A Flint Industries Company, 1000 N. Second St., Rogers, AR 72756 / TEL: 501 636-5000 / FAX: 501 636-2305.

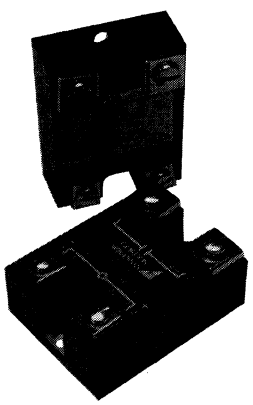
GORDOS SOLID STATE RELAYS



PRINTED CIRCUIT BOARD MOUNTABLE SOLID STATE RELAYS

GA1, GA8 SERIES

- Current Rating: 3.5A @ 140, 250 and 280VAC
- 3VDC to 24VDC Control
- High Current Thyristor for 100A Surge Capability
- Zero Voltage Turn-on
- 4KV Optical Isolation
- Industry Standard Packaging
- Thick Film Hybrid Construction for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming for Optimum Performance
- UL Recognized, CSA Certified



PANEL MOUNT SOLID STATE RELAYS

G, GA5 SERIES POWER RELAYS

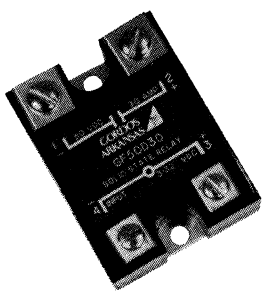
- Output Voltage Ratings from 24VAC to 660VAC
- Output Current Ratings from 10A to 90A
- 18-36 VAC, 90-280VAC and 3-32VDC Inputs
- 4KV Optical Isolation
- Zero AC or Random Turn-on Models
- RC Snubber Network for Inductive Loads
- UL Recognized, CSA Certified
- VDE Approval on Many Models

G SERIES POWER RELAYS

- Back-to-back Dual SCR Output for Severe Inductive Loads
- Superior False Turn-on Immunity and Positive Turn-Off at High dv/dt

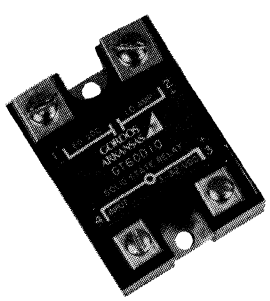
GA5 SERIES POWER RELAYS

- Economical Triac Output for General Purpose Applications



GF SERIES DC POWER FET SOLID STATE RELAYS

- Long Life Switching of DC Loads to 30A
- 10μA Leakage Current Permits Reliable Switching of Sensitive Devices
- Milliohm On-Resistance Minimizes Voltage Drop, Heat Dissipation
- Versatile High or Low-Side Switching
- Output FET Protected Against Transients
- 1500VAC Optical Isolation
- Output Voltage Range Suitable for Many Applications
- 3 to 32VDC Input Compatible with Most Logic Circuits



GT SERIES DC POWER TRANSISTOR SOLID STATE RELAYS

- Long-Life Switching of DC Loads to 10A
- Output Voltage Range Suitable for Many Applications
- Versatile High or Low-Side Switching
- 3 to 32VDC Input Compatible with Most Logic Circuits
- 4KV Optical Isolation
- Fast 25μSec Maximum Turn-On Time
- Cost-Effective General Purpose DC SSR

See Data Acquisition Section for additional GORDOS products.

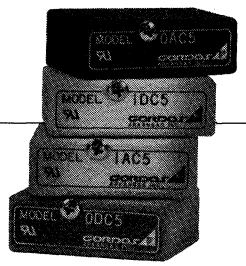
All brand and product names are trademarks or registered trademarks of their respective companies.

For a catalog or application assistance contact factory at 800-726-0300.

Gordos, A Flint Industries Company, 1000 N. Second St., Rogers, AR 72756 / TEL: 501 636-5000 / FAX: 501 636-2305.

GORDOS I/O PRODUCTS

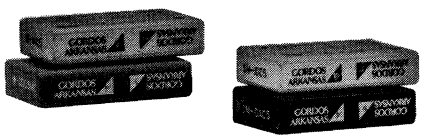
SINGLE POINT, QUAD-PACK & 8-CHANNEL DIGITAL I/O MODULES & MOUNTING BOARDS



- High Current Thyristor for 100A Surge Capability
- 4KV Optical Isolation
- UL Recognized, CSA Certified
- Zero Voltage AC or Random Turn-on Single-Point Output Modules
- Industry Standard Packaging
- Plug into Digital I/O Module Mounting Boards

0.6 INCH SINGLE POINT I/O MODULES

- 5V, 15V, 24V Logic Versions
- Retaining Screw
- Fast-switching DC Versions
- Form A Operation, Form B AC Output Available
- Companion 4 to 32-position Module Mounting Boards



M AND SM SERIES MINIATURE SINGLE POINT I/O MODULES

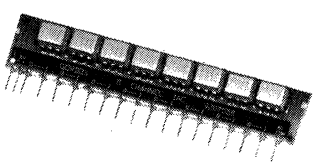
- 33% Thinner than 0.6 inch Modules
- SM Series are Direct Replacements for Larger 0.6 Inch Modules
- M Series may be Plugged-In or Soldered
- 5V, 15V, or 24V Logic Versions
- Companion 8 to 32-position Module Mounting Boards



QUAD-PACK MODULES

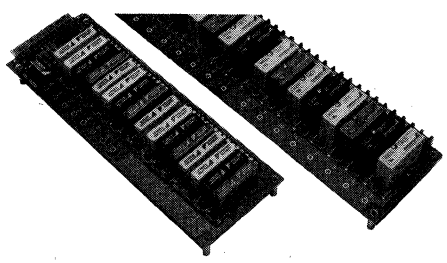
- Four Circuits per Module
- 5, 15, 24 Volt Logic Versions
- Individual LED Status Indication
- AC Input, AC Output, DC Input and DC Output Configurations
- Companion 16, 24 and 32-channel Mounting Boards

8-CHANNEL I/O MODULES



- Thick Film Hybrid Construction, Vapor Phase Soldering Provide Superior Reliability
- Computerized Laser Trimming of Resistors Optimizes Performance
- Ceramic Substrate for Proper Thermal Management
- Solder or Plug into PC Boards
- AC & DC Output Modules Rated at 2.0A per Channel, 10A per Module
- AC Inputs for 120V, 240V
- DC Inputs for 3.3 to 32V, 10 to 60V
- 4KV Optical Isolation
- UL/CSA Approvals Pending

PB SERIES DIGITAL I/O MODULE MOUNTING BOARDS



- Models Available for 0.6 Inch, M and SM Series Single-Point Modules and Quad-Packs
- 4, 8, 16, 24 and 32-point Versions
- UL Recognized, CSA Certified Models Available
- LED Indicators, Replaceable Fuses and Logic Pull-up Resistors
- Barrier Strips for Field Termination
- Logic Termination via Card Edge or Optional Cable Connectors
- Barrier Strip Jumpers and Interconnection Cables Available

ANALOG I/O MODULES

- Wide Variety of mV, V, mA, RTD, TC, Strain Gauge, Wideband mV, Wideband V and Linearized TC Input Models
- 4-20mA and 0-20mA Output Models
- Fully Isolated
- High Accuracy (±0.05%), Low Drift
- IEEE STD-472 Transient Protection
- 240VRMS Field Wiring Protection
- –25°C to 85°C Operating Range
- Mounting Boards Available in 1,2,8, or 16-Module Versions

See Data Acquisition Section for additional GORDOS products.

All brand and product names are trademarks or registered trademarks of their respective companies.

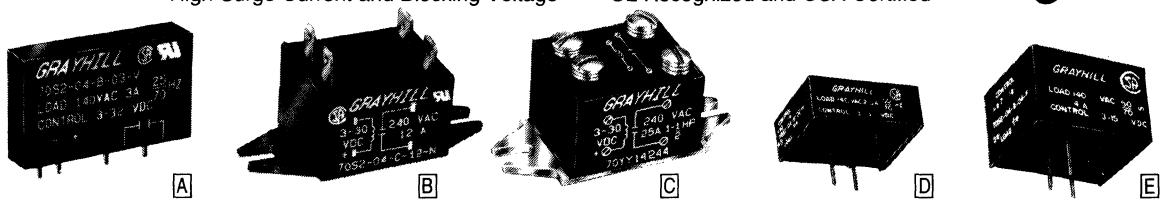
For a catalog or application assistance contact factory at 800-726-0300.

Gordos, A Flint Industries Company, 1000 N. Second St., Rogers, AR 72756 / TEL: 501 636-5000 / FAX: 501 636-2305.

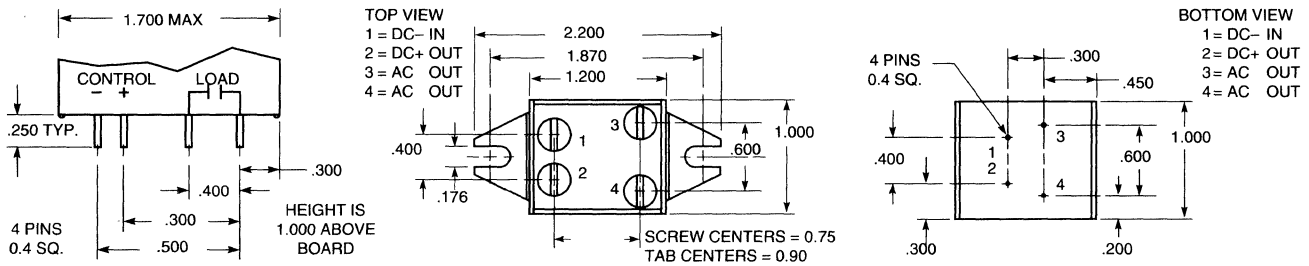
Grayhill INC. Solid State Relays

561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE; (708) 354-1040

- CMOS and TTL Compatible
- High Surge Current and Blocking Voltage
- Internal Transient Protection
- UL Recognized and CSA Certified



STYLE V **STYLE N** **STYLE S** **STYLE H** **STYLE F**



STYLE V SINGLE IN-LINE PACKAGE RELAY (FIGURE A)

PC mounted relay requires only .680 inches of board area; it is form, fit, and function replacement for industry standard. It is constructed of high performance, surface mount components for high reliability. Package is 0.4 inches deep; in-line pins are 0.3 inches from label side.

STYLES N & S MINI PUCK® RELAYS (FIGURES B & C)

Heavy duty relays are fit, and function replacements for old "hockey puck" style relays, but require only 1/2 the space. High thermal conductive epoxy and high quality heat sinks provide superior heat transfer. Minimum panel space for heat sink effectiveness is 12 x 12 inch area, .125 inches thick, mounted with silicon grease. Relay body is 1.2 x 1.0 x 0.85 inches high. Push tabs (Style N) add 0.30 inches to height. Screws (Style S) add approximately 0.08 inches.

STYLES H & F MICRO & MINI CUBE RELAYS (FIGS. D & E)

Low profile, printed circuit mounted relays allow user to stack PC boards closely together, while switching 24, 120, or even 240 Vac loads of up to 4 amperes. They do not require additional heat sinks. Style H is 0.5 inches high; Style F is 0.83 inches high. For a relay with 0.83 inches height and standard plug-in style termination (Style K, not shown), contact a local authorized distributor. For relays with this footprint for larger loads contact GRAYHILL.

SPECIFICATIONS

NOMINAL LOAD VOLTAGES AND CURRENTS: See chart. Current is rated at 25°C and derated with increases. Mini Puck relays are rated as mounted on panel 12 x 12 x 1/8 inches. CONTROL CURRENT: 1-17 mA (3-30 Vdc relays), 1-19 mA (3-32 Vdc relays), and 1-6 mA (all others). SURGE CURRENT RATING (At 1 full cycle, non-repetitive): 60A (2,5A, 3A, 4A, and 6A relays); 110A (12A relay); 250A (25A relay). BLOCKING VOLTAGES: 200V, 400V, and 600V for the 24 Vac, 120 Vac, and 240 Vac relays, respectively. ZERO VOLTAGE OFFSET: 6V, 8V, and 18v for the 24 Vac, 120 Vac and 240 Vac relays. TRANSIENT PROTECTION: 4000 V/μS for 6A and 15A relays, 3000 V/μS for all others. AVERAGE INPUT IMPEDANCE: 2000 ohms (3-30 & 3-32 Vdc ranges), and 6000 ohms (6-30 and 6-32 Vdc ranges). ISOLATION: 10^9 ohms; dielectric strength is 2500 Vac. CERTIFICATION: All part numbers shown on this page are UL Recognized (file number E58632) and CSA Certified (file number LR 38763). MATERIALS: Cases are solvent resistant thermoplastic (UL94V-0) potted with high thermal conductive epoxy. Heat sincs are aluminum (copper for the 25A relay), tin plated. Terminal pins are brass, tin plated; tabs are brass, lead-tin plated; screws are steel, tin plated.

Available From Your Local GRAYHILL Distributor

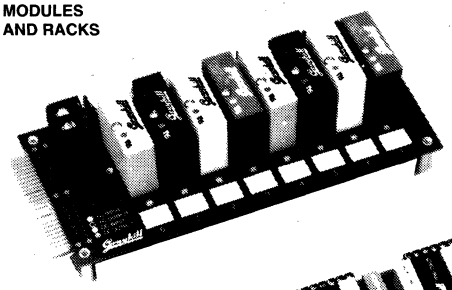
Load VAC Nominal	Load Current Max., Amps	Control Voltage Range, VDC	Part Number
STYLE V (FIGURE A)			
24	3	3-32	70S2-04-D-03-V
24	3	6-32	70S2-05-D-03-V
120	3	3-32	70S2-04-B-03-V
120	3	6-32	70S2-05-B-03-V
240	3	3-32	70S2-04-C-03-V
240	3	6-32	70S2-05-C-03-V
STYLES N & S (FIGURES B & C)			
120	6	3-30	70S2-04-B-06-N
120	6	6-30	70S2-05-B-06-N
240	6	3-30	70S2-04-C-06-N
240	6	6-30	70S2-05-C-06-N
120	12	3-30	70S2-04-B-12-N
120	12	6-30	70S2-05-B-12-N
240	12	3-30	70S2-04-C-12-N
240	12	6-30	70S2-05-C-12-N
120	6	3-30	70S2-04-B-06-S
120	6	6-30	70S2-05-B-06-S
120	12	3-30	70S2-04-B-12-S
120	12	6-30	70S2-05-B-12-S
120	25	3-30	70S2-03-B-25-S
240	6	3-30	70S2-04-C-06-S
240	6	6-30	70S2-05-C-06-S
240	12	3-30	70S2-04-C-12-S
240	12	6-30	70S2-05-C-12-S
240	25	3-30	70S2-03-C-25-S
STYLES H & F (FIGURES D & E)			
24	2.5	3-30	70S2-04-D-02-H
24	2.5	6-30	70S2-05-D-02-H
120	2.5	3-30	70S2-04-B-02-H
120	2.5	6-30	70S2-05-B-02-H
240	2.5	3-30	70S2-04-C-02-H
240	2.5	6-30	70S2-05-C-02-H
24	4	3-30	70S2-04-D-04-F
24	4	6-30	70S2-05-D-04-F
120	4	3-30	70S2-04-B-04-F
120	4	6-30	70S2-05-B-04-F
240	4	3-30	70S2-04-C-04-F
240	4	6-30	70S2-05-C-04-F

For prices, contact a Sales Office, a local Distributor, or GRAYHILL.

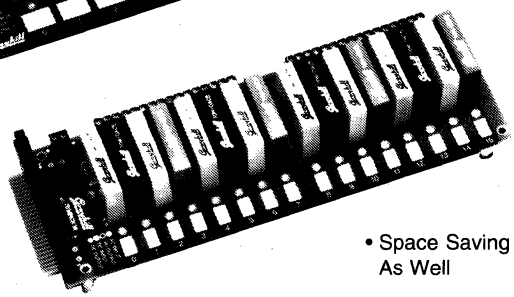
Input/Output Modules

Grayhill INC. 561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE; (708) 354-1040

STANDARD MODULES AND RACKS



- Power Saving
- Noise Immune
- Transient Protected



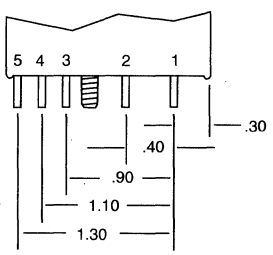
MINIATURE MODULES AND RACKS

- Space Saving As Well

DESCRIPTION - MODULES

I/O Modules provide an optically isolated interface between logic systems and external AC and DC power devices. There are 4 types: AC Output (Black Case); DC Output (Red Case); AC Input (Yellow Case); and DC Input (White Case). UL and CSA certified, all modules are logic compatible, SPST N.O. type with standard industry pinouts, and zero voltage turn-on (AC types).

Grayhill modules require 55% to 66% of the power used by other modules, saving you money on your power supply. They have superior noise immunity, and transient protection (3000 Volts per microsecond); they meet/pass the following specifications or tests: IEEE 472–1974 and ANSI C37.90 transient withstanding tests, and Electrical Noise Immunity Test per NEMA ICS 2–230. They have high blocking voltages of 400 Volts (120VAC) and 600 Volts (240 VAC). *All* modules have 4000 Volts of isolation, immunity to mechanical shock and vibration, and operate over a wide temperature range (–40° to +125°C).



Standard I/O Modules are form, fit function replacements for competitive product; output modules carry up to 3.5 Amps. Standard modules measure 1.0"L, .6"W, and 1.25" H.

Miniature I/O Modules require only .68 sq inches board area, and switch up to 3.0 Amps. Mini modules measure 1.0"L, .4"W, and 1.0"H.

TERMINAL NUMBER AND CONNECTION

	#5	#4	#3	#2	#1
OAC	N/A	DC– In	DC+ In	AC Out	AC Out
ODC	N/A	DC– In	DC+ In	DC- Out	DC+ Out
IAC	Ground	Output	+Vcc	AC In	AC In
IDC	Ground	Output	+Vcc	DC- In	DC+ In

Only input modules have terminal #5.

MOUNTING RACKS

Rack are ordered separately. All standard racks are UL Recognized and CSA certified. Mini racks 70 MRCK8-, 70MRCK16, and 70MRCK24- are CSA certified; other certification/recognition, pending. Mini modules save up to 40% board area when mounted in mini racks. Miniature rack numbers include the letter M; the Q designated types replace quad pack racks. Chose 1 of 6 connector styles: screw terminal strip (70RCK4 only); board edge connector (70RCK8, 70RCK8, 70RCK16 without suffixes, and -EC suffix types); perpendicular header with short (-HS) or long (-HL) ejector levers; right angle header with short (-RS) or long (-HL) ejector levers.

ORDERING INFORMATION – MODULES

Size and Description	Nominal Vcc Supply	Nominal External V	Part Number
AC OUTPUT MODULES — BLACK CASE			
Miniature	5 Vdc	120 Vac	**70M-OAC5**
Miniature	5 Vdc	240 Vac	**70M-OAC5A**
Miniature	15 Vdc	120 Vac	**70M-OAC15**
Miniature	15 Vdc	240 Vac	**70M-OAC15A**
Miniature	24 Vdc	120 Vac	**70M-OAC24**
Miniature	24 Vdc	240 Vac	**70M-OAC24A**
Standard	5 Vdc	120 Vac	**70-OAC5**
Standard	5 Vdc	240 Vac	**70-OAC5A**
Standard	15 Vdc	120 Vac	**70-OAC15**
Standard	15 Vdc	240 Vac	**70-OAC15A**
Standard	24 Vdc	120 Vac	**70-OAC24**
Standard	24 Vdc	240 Vac	**70-OAC24A**
DC OUTPUT MODULES — RED CASE			
Miniature	5 Vdc	60 Vdc	**70M-ODC5**
Miniature	15 Vdc	60 Vdc	**70M-ODC15**
Miniature	24 Vdc	60 Vdc	**70M-ODC24**
Standard	5 Vdc	60 Vdc	**70-ODC5**
Standard	5 Vdc	200 Vdc	**70-ODC5A**
Standard	15 Vdc	60 Vdc	**70-ODC15**
Standard	24 Vdc	60 Vdc	**70-ODC24**
AC INPUT MODULES — YELLOW CASE			
Miniature	5 Vdc	120 Vac	**70M-IAC5**
Miniature	5 Vdc	240 Vac	**70M-IAC5A**
Miniature	15 Vdc	120 Vac	**70M-IAC15**
Miniature	15 Vdc	240 Vac	**70M-IAC15A**
Miniature	24 Vdc	120 Vac	**70M-IAC24**
Miniature	24 Vdc	240 Vac	**70M-IAC24A**
Standard	5 Vdc	120 Vac	**70-IAC5**
Standard	5 Vdc	240 Vac	**70-IAC5A**
Standard	15 Vdc	120 Vac	**70-IAC15**
Standard	15 Vdc	240 Vac	**70-IAC15A**
Standard	24 Vdc	120 Vac	**70-IAC24**
Standard	24 Vdc	240 Vac	**70-IAC24A**
DC INPUT MODULES — WHITE CASE			
Miniature	5 Vdc	3-32 Vdc	**70M-IDC5**
Miniature	15 Vdc	3-32 Vdc	**70M-IDC15**
Miniature	24 Vdc	3-32 Vdc	**70M-IDC24**
Standard	5 Vdc	3-32 Vdc	**70-IDC5**
Standard, NP*	5 Vdc	3-32 Vdc	**70-IDC5NP**
Standard	15 Vdc	3-32 Vdc	**70-IDC15**
Standard, NP*	15 Vdc	3-32 Vdc	**70-IDC15NP**
Standard	24 Vdc	3-32 Vdc	**70-IDC24**
Standard, NP*	24 Vdc	3-32 Vdc	**70-IDC24NP**

*NP types have non-polarized input.

Additional types available from stock: Random crossing, Normally Closed, 9-140 Vdc Input, or 180-280 Vdc Input .

ORDERING INFORMATION — MOUNTING RACKS

Type	# Modules	Size with Modules	Part Number
Mini	8	3.5" x 6.4" x 2.2"H	**70MRCK8-****
Mini	16	3.5" x 10.4" x 2.2"H	**70MRCK16-****
Mini	24	6.0" x 8.4" x 2.2"H	**70MRCQ24-****
Mini	32	6.2" x 10.6" x 2.2"H	**70MRCQ32-****
Standard	4	3.5" x 4.5" x 2.2"H	**70RCK4**
Standard	8	3.5" x 8.4" x 2.2"H	**70RCK8**
Standard	16	3.5" x 14.5" x 2.2"H	**70RCK16**
Standard	16	3.5" x 14.5" x 2.2"H	**70RCK16-*****
Standard	24	4.5" x 18.8" x 2.2"H	**70RCK24**

** Add **-EC, -HS, -HL, -RS,** or **-RL** per paragraph at left.

*** Add **-HS** or **-HL**; 70RCK8, ...16, and ...24 have edge connectors.

For prices contact a Sales Office, a Distributor, or GRAYHILL.

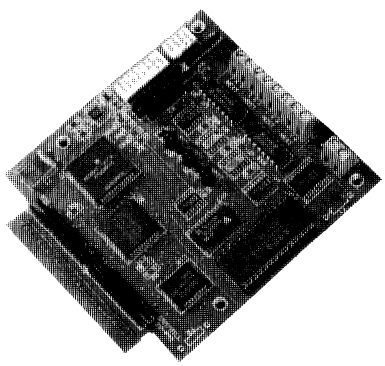
Available From Your Local GRAYHILL Distributor

Grayhill INC. Programmable Controller Board

561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE; (708) 354-1040

PROMUX® CONTROLLER BOARD

- Controls Up to 24 I/O Points Per Board, and 4,096 Points from 1 PC
- Operates as Stand Alone Or Slave to Computer
- Reduces PC Functions With User Defined Ones
- Programs In BASIC, C, Pascal, Plus 86-Ladders, and Genesis (RD1000 Ladders Also Available)
- Uses 300 to 38.4k Baud Rate
- Backed by Telephone Technical Support Hot Line



PROMUX® CONTROLLER BOARD

Programs assembly process, status, equipment, and operations, using an IBM personal computer and racks of Input/Output modules. Programming commands include the following: reading inputs, setting outputs, event timing, event counting, pulse width modulating, timed switching, delayed switching, scanning inputs. Board measures 4.0 x 4.0", plus edge connector. Supply Voltage: 4.5 to 5.5 Vdc. Supply Current (less modules): 0.1 to 0.5A. Operating Temperature Range: 0 to 70°C, 95% Humidity (non-condensing). Format operates as RS-485 or RS-422 bus for distant programming; converter for RS–232 is available. Versions for stand-alone operation or down-loaded programs have 8 kilobytes of EEPROM for user defined functions. Hardware connections are described in the User's Manual. ProMux is available with or without 8KB of EEPROM, with either header or edge card (plug) connector.

PROMUX® USER'S MANUAL

Manual with a choice of BASIC, C, or Pascal software is ordered separately. Manual without software is available for the purpose of evaluating system. Or use it for making hardware connections and determining specifications when using non-GRAYHILL software. For other real time artificial intelligent software, consult GRAYHILL.

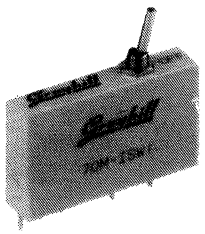
PROMUX® INFORMATION AND TECHNICAL HOTLINE

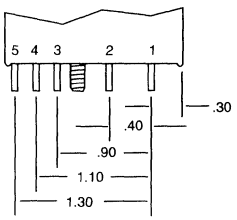
For U.S.A. inquiry: 1-800-426-4383
For Canadian Inquiry: 1-800-536-6107

ORDERING INFORMATION

Description	Part Number
ProMux Board With Plug Connector	72-PMO-1
ProMux Board With Plug and EEPROM	72-PMO-2
ProMux Board With Header Connector	72-PMO-3
ProMux Board With Header and EEPROM	72-PMO-4
ProMux Manual With No Software Included	72-UMO
ProMux Manual With Software in BASIC	72-UMO-B
ProMux Manual With Software in C	72-UMO-C
ProMux Manual With Software in Pascal	72-UMO-P

ACCESSORIES

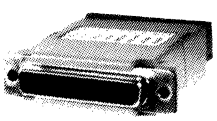


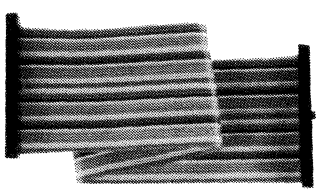


TEST MODULES

Modules fit miniature or standard module mounting racks. They measure 1.0"L, .4"W, and 1.0"H, plus .7" high toggle switch. See also Input/Output Modules page. Only input modules have terminal #5; connections are as follows:

	#5	#4	#3	#2	#1
70M-OSW1	N/A	DC– In	DC+ In	Switched Output	
70M-ISW1	Ground	Switch In	DC+ In	N/C	N/C





RS-232 TO RS-422/485 CONVERTERS

Configured for DTE operation, converters plug into any male RS-232 DB-25 connector and convert signals to RS-485 (RS-422) levels. Supply Voltage (Vps): +8 to +15 Vdc. Supply current (Ips): 62 mA plus output loads. Available with or without optical isolation.

50-PIN RIBBON CABLE ASSEMBLIES

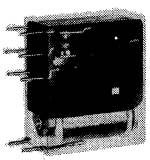
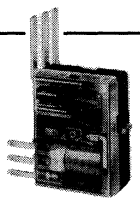
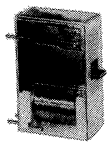
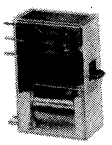
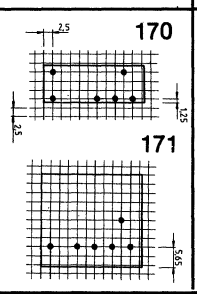
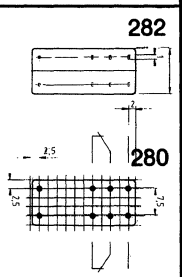
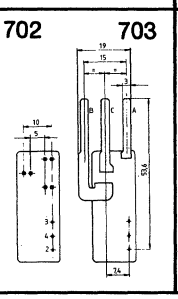
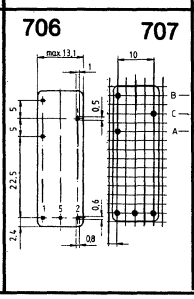
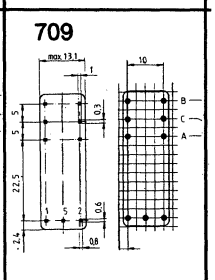
Cables in 2, 4, or 6 feet lengths for connecting the ProMux® board to I/O Module Racks. Available with header-to-header connectors or with header-to-edge-card connectors. For longer cables, contact GRAYHILL for recommendations.

ORDERING INFORMATION

Description	Part Number
Input Test Module	70M-ISW1
Output Test Module, 3A	70M-OSW1
Standard Converter	72-CNV-1
Converter With Optical Isolation	72-CNV-2
2 Ft. Header to Header Cable	72-CHH-2
4 Ft. Header to Header Cable	72-CHH-4
6 Ft. Header to Header Cable	72-CHH-6
2 Ft. Header to Edge Card Cable	72-CHE-2
4 Ft. Header to Edge Card Cable	72-CHE-4
6 Ft. Header to Edge Card Cable	72-CHE-6

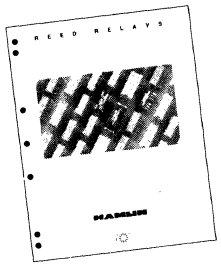
PC MOUNTABLE RELAYS by GRUNER

NEW

	POWER RELAYS		POLARIZED LATCHING RELAYS FOR COIL SENSITIVITY		
					
SERIES	**170 / 171**	**280 / 282 / 286**	**702 / 703**	**706 / 707**	**709**
DIMENSIONS (L x W x H)	**170** 1.13x0.41x1.03 **171** 1.11x1.01x0.41	1.14x0.49x1.02	1.53x0.59x1.15	1.47x0.52x0.98	1.47x0.52x0.98
FEATURES	*DC Coil *Both Slim and flat version	*DC Coil *AC Coil	*Polarized Latching *Permanent Memory *Pulse Operation	*Polarized Latching *Permanent Memory *Pulse Operation	*Polarized Latching *Permanent Memory *Pulse Operation
SEALED OPTION	*	*	N/A	N/A	N/A
LATCHING OPTION	*	*			
CONTACT DATA					
Form:	SPDT / SPST	280: DPDT / DPST 282: SPDT / SPST 286: SPDT / SPST	SPDT / SPST	SPDT / SPST	SPDT / SPST
Material:	AgCdO, AgNi	AgCdo, AgNi	AgCdo - AgNi	AgCdo - AgNi	AgCdo - AgNi
Ratings:					
250 Vac	**8 Amp.**	**280: 8 Amp. 282: 10 Amp. 286: 16 Amp.**	**702 25 Amp. 703 35 Amp.**	**706 16 Amp. 707 20 Amp.**	**10 Amp.**
Power VA:	2000	1500 / 2500 / 4000	5750 / 8000	4000	2500
Mechanical Life Expectancy	10^7	10^7	$5x10^6$	10^7	10^7
Test Voltage Contact-Coil VAC	4000	4000	4000	4000	4000
Contact Ground VAC	1000	1000	2000	2000	2000
COIL DATA					
Vdc	6 ... 60	6 ... 60	6 ... 48	6 ... 48	6 ... 48
Vac	N/A	6 ... 220	N/A	N/A	N/A
Operating Power					
VA (DC)	0.45 ... 0.6	0.5 ... 0.8			
VA (AC)		2.2 ... 2.6			
VA (Latching)	0.9 ...1.2	0.9 ...1.2	0.6 ... 2.0	0.4 ...1.5	0.4 ...1.5
Operating Time	7-10 ms	7-10 ms	20 ms	20 ms	20 ms
Release Time	2-4 ms	2-4 ms	20 ms	20 ms	20 ms
Abmient Temperature	-25 ... 70°C	-25 ... 70°C	-25 ... 70°C	-25 ... 70°C	25 ... 70°C
Conform to	VDE, UL, CSA SEV, SEMCO	VDE, UL, CSA SEV, SEMCO	VDE, UL, CSA SEV, SEMCO	VDE, UL, CSA SEV, SEMCO	VDE, UL, CSA SEV, SEMCO
BOTTOM VIEW (mm)					

ADVANCED COMPONENTS INDUSTRIES, INC.
1308 Sartori Avenue, #105 • Torrance, California 90501
(310) 328-0060 • Fax (310) 328-0062

REED RELAYS
HAMLIN
ELEC-TROL



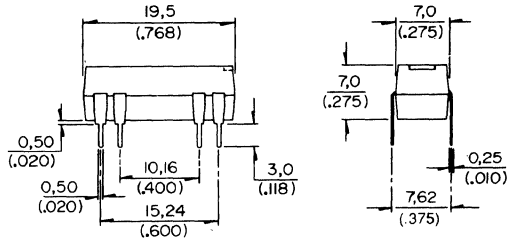
The extensive Hamlin line of standard reed relays represents the merging of the wide range of reed relay products manufactured by Hamlin Inc. and Elec-Trol. The merger provides powerful technical capability and manufacturing capacity that assures customers a reed relay supplier that is totally committed and focused. For your convenience both Hamlin and Electrol model numbers are listed. When ordering, refer to the Hamlin model number.

HAMLIN INC.
612 East Lake Street • Lake Mills, WI 53551 USA
Phone 414/648-3000 • FAX 414/648-3001

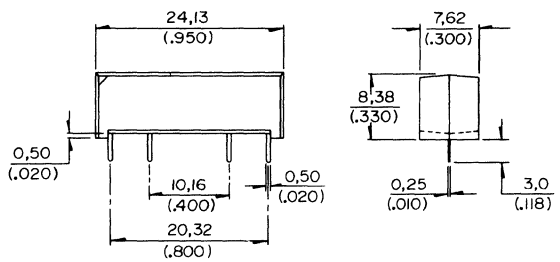
DIMENSIONS

Dimensions in Millimeters
Inches in parenthesis

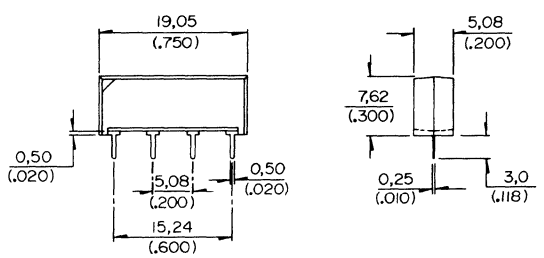
700 SERIES DIP



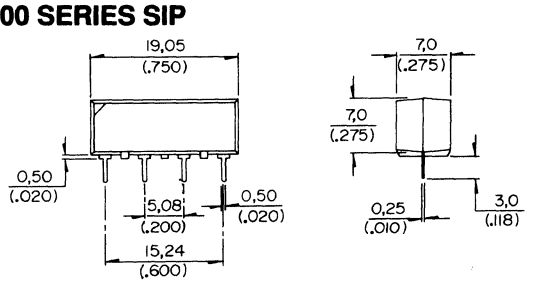
3300 SERIES SIP



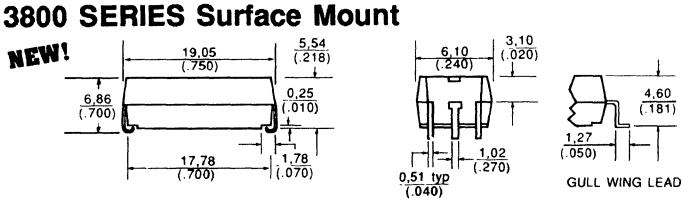
3600 SERIES SIP



3700 SERIES SIP



3800 SERIES Surface Mount



700 SERIES DIP

Contact Form	Contact Rating	HAMLIN Model Number	ELECTROL Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST - NO DRY	10W 0.5A 200V	721A0500	RA30451051	-	5	500	$3.11
		721A0510	RA30461051	Yes	5	500	3.38
		721A1200	RA30451121	-	12	1000	3.11
		721A1210	RA30461121	Yes	12	1000	3.38
		721A2400	RA30451241	-	24	2150	3.83
		721A2410	RA30461241	Yes	24	2150	4.10
1C SPST - NO DRY	3W 0.25A 175V	721C0500	RA30421051	-	5	200	5.45
		721C0510	RA30441051	Yes	5	200	5.72
		721C1200	RA30421151	-	12	500	5.72
		721C1210	RA30441151	Yes	12	200	5.99
		721C2400	RA30421241	-	24	2000	5.72
		721C2410	RA30441241	Yes	24	2000	5.99
2A DPST-NO DRY	10W 0.5A 200V	722A0500	No Equal	-	5	200	4.68
		722A0510	No Equal	Yes	5	200	4.95
		722A1200	RA30981121	-	12	500	5.18
		722A1210	RA31231121	Yes	12	500	5.45
		722A2400	RA30981241	-	24	2150	5.90
		722A2410	RA31231241	Yes	24	2150	6.17
1A SPST - NO MERCURY	50W 2.0A 500V	731A0500	RA31501051	-	5	55	7.83
		731A0510	RA31511051	Yes	5	55	8.15
		731A1200	RA31501121	-	12	300	8.10
		731A1210	RA31511121	Yes	12	300	8.37
		731A2400	RA31501241	-	24	1100	8.33
		731A2410	RA31511241	Yes	24	1100	8.60
1A SPST-NO HIGH VOLT.	10W 300V	751A0510	RA32141051	Yes	5	500	4.73
		751A1210	RA32141121	Yes	12	1000	5.18
		751A2410	RA32141241	Yes	24	2150	5.63

3300 SERIES SIP

Contact Form	Contact Rating	HAMLIN Model Number	ELECTROL Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST - NO DRY	10W 0.5A 200V	3321A0400	BBS1A05A10	-	5	500	$2.70
		3321A1200	BBS1A12A10	-	12	500	2.70
		3321A2400	BBS1A24A10	-	24	2000	3.15
1C SPDT - CO DRY	3W 0.25A 175V	3321C0500	BBS1C05A10	-	5	125	4.73
		3321C1200	BBS1C12A10	-	12	500	4.95
		3321C2400	BBS1C24A10	-	24	2000	5.40
1A SPST - NO MERCURY	50W 2A 500V	3331A0500	No Equal	-	5	125	7.20
		3331A1200	No Equal	-	12	500	7.43
		3331A2400	No Equal	-	24	2000	7.88
1A SPST-NO HIGH VOLT	10W 0.5A 300V	3351A0500	No Equal	-	5	125	3.60
		3351A1200	No Equal	-	12	500	3.60
		3351A2400	No Equal	-	24	2000	4.05

3600 SERIES SIP

Contact Form	Contact Rating	HAMLIN Model Number	ELECTROL Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST - NO DRY	10W 0.5A 200V	3621A0500	RA32041051	-	5	500	$3.38
		3621A0510	RA32051051	yes	5	500	3.65
		3621A1200	RA32041121	-	12	1000	4.73
		3621A2400	RA32041241	-	24	2150	5.18
1A SPST - NO COAX	10W 0.5A 200V	3621A0520	No Equal	-	5	200	5.63
		3621A1220	No Equal	-	12	500	6.08
		3621A2420	No Equal	-	24	1500	6.53

3700 SERIES SIP

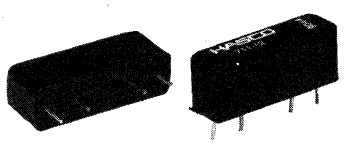
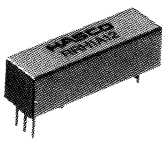
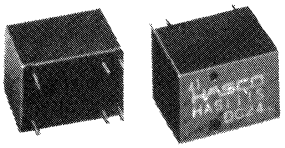
Contact Form	Contact Rating	HAMLIN Model Number	ELECTROL Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST - NO MERCURY	50W 2.0A 500V	3731A0500	No Equal	-	5	100	7.43
		3731A0510	No Equal	Yes	5	100	7.65
		3731A1200	No Equal	-	12	500	7.88
		3731A1210	No Equal	Yes	12	500	8.10
		3731A2400	No Equal	-	24	1500	8.33
		3731A2410	No Equal	Yes	24	1500	8.55
1A SPST-NO HIGH VOLTAGE	10W 0.5A 300V	3751A0500	No Equal	-	5	125	3.83
		3751A0510	No Equal	Yes	5	125	4.05
		3751A1200	No Equal	-	12	500	4.05
		3751A1210	No Equal	Yes	12	500	4.28
		3751A2400	No Equal	-	24	2000	4.50
		3751A2410	No Equal	Yes	24	2000	4.73

3800 SERIES Surface Mount

Contact Form	Contact Rating	HAMLIN Model Number	ELECTROL Model Number	Lead Type	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST-NO DRY	10W 1A 200V	3821A0500	No Equal	J	5	150	$5.40
		3821A0501	No Equal	Gull	5	150	5.40
		3821A1200	No Equal	J	12	750	5.40
		3821A1201	No Equal	Gull	12	750	5.40
		3821A2400	No Equal	J	24	1500	5.40
		3821A2401	No Equal	Gull	24	1500	5.40

HASCO COMPONENTS INT'L., CORP. SINCE 1976

RELAYS

	700 SIP	RRH SERIES	HAS-111
Hasco Relay Type			
Features	• Epoxy Molded • Low Price • Std, Heavy Duty or Hi-Voltage • FCC Available • Complete Spec Sheet Faxed in 5 Min.	• Fully Sealed • Low Price • Long Life • Complete Spec Sheet Faxed in 5 minutes	• Small Size • 2A Switching • Meets FCC Pt68 • Same Day Sample Service • Complete Spec Faxed in 5 Minutes
Form	1A, 1B	1A, 2A, 1B, 2C	1C
Contact Material	De-activated Rhodium	De-activated Rhodium	Silver-Palladium (Gold overlay)
Contact Rating	TYPE 711: 10VA DC Max, 100V DC Max, 1A 712: 70VA DC Max, 100V DC Max, 2.5A 713: 50VA DC Max, 400V DC Max, 2.5A	10VA DC Max, 100V DC Max .5A Switching, 1A Carry (Higher Voltage & Power Available)	2A 230V DC or 125A
Coil Voltages	3, 5, 6, 12, 24	3, 5, 6, 12, 24V	3, 5, 6, 9, 12, 24, 48V Standard and Sensitive
Dielectric Strength	250V-600V across contacts 1500V contacts to coil	250V-600V across contacts 1500V contacts to coil	Between open contacts: 1000VRM Contact to coil: 1500V RMS

SPECIFICATIONS

Part Number	Nominal Voltage (V)	Must Operate (V)	Must Release (V)	Coil Resistance (Ohms)
711-5	5-6	3.75	0.5	500
711-12	12	9.0	1.2	500
711-24	24	18.0	2.4	2000
HEAVY DUTY & HIGH VOLTAGE				
712-713	5-6	3.75	0.5	400
712-713	12	9.0	1.2	400
712-713	24	18.0	2.4	1600

SPECIFICATIONS COIL RATINGS

Part Number	Nominal Voltage (V)	Coil Resistance (Ω) ±10%	Rated Current (mA)	Continuous Voltage (Max V)
RRH1A05	5	500	20	10
RRH1A12	12	1000	15	20
RRH1A24	24	2200	10.90	28
RRH2A05	5	140	14	10
RRH2A12	12	500	15	20
RRH2A24	24	2150	12	28
RRH1C05	5	250	20	10
RRH1C12	12	500	15	20
RRH1C24	24	2200	10.90	28

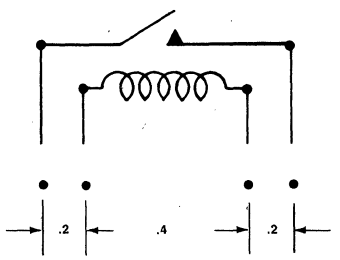
COIL RATINGS FOR STANDARD MODEL HAS 111
Nominal Power (W) Consumption Approximately 0.45

Relay Code	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*
HAS-111-3V	20	150	2.1	0.3	3.3
HAS-111-5V	56	89.3	3.5	0.5	5.5
HAS-111-6V	80	75	4.2	0.6	6.6
HAS-111-9V	180	50	6.3	0.9	9.9
HAS-111-12V	320	37.5	8.4	1.2	13.2
HAS-111-24V	1280	18.8	16.8	2.4	26.4
HAS-111-48V	5120	9.4	33.6	4.8	52.8

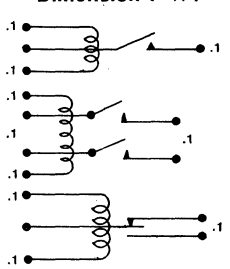
COIL RATINGS FOR SENSITIVE MODEL HS 211
Nominal Power (W) Consumption Approximately 0.20

Relay Code	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*
HS-211-3V	45	66.7	2.1	0.3	4.8
HS-211-5V	120	41.7	3.5	0.5	8.0
HS-211-6V	180	33.3	4.2	0.6	9.6
HS-211-9V	400	22.5	6.3	0.9	14.4
HS-211-12V	700	17.1	8.4	1.2	19.2
HS-211-24V	2800	8.6	16.8	2.4	38.4

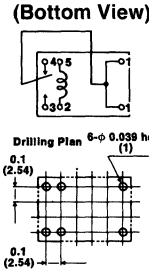
Internal Connections and Mounting Holes



Dimension 1" x 1"



Internal Connections (Bottom View)



HASCO COMPONENTS INT'L., CORP. SINCE 1976 — RELAYS

Hasco Relay Type	KSD-DPDT 3 or 5 AMP	T SERIES	HAS-124
	 *Only .62" H*	 *Through hole*  *SMT type*	 
Features	• Miniature Two Pole Relay • High Reliability • 3 and 5 Amp Switching • Fully sealed • Low Cost • Complete Spec Faxed in 5 Minutes	• Subminiature Size • Meets FCC Pt68 • Latching Available • Coil Latching available • Surface Mount Available	• Low Profile • Meets FCC • Low Cost • Same Day Samples • Complete Spec Faxed in 5 Minutes
Form	2C	2C, 2C latch	4C, 4D
Contact Material	AgCAu plated	Ac-Pd Alloy, Gold coil AgPd Alloy	Gold Coil, Ag Pd Alloy
Contact Rating	120 VAC/24 VDC–Load 250 VAC/125 VDC-Max Oper. Voltage	1A 2 30 VDC, 62.5 VAC 125 V DC/AC	2A 60 W, AC60 VA 125 VAC/DC
Coil Voltages	3, 5, 6, 9, 12, 24VDC	3, 5, 6, 9, 12 & 24V Standard and Sensitive	3, 5, 6, 12, 24, 48V
Dielectric Strength	1,500 VAC, 50/60 Hz for 1 minute between coil and contact, dissimilar pole 750 VAC, 50/60 Hz for 1 minute between non-continuous contacts of same pole	SURGE Between open contacts 1000VAC 1500V Between coil & contacts 1000VAC 1500V Between contact poles 1000VAC 1500V	SURGE Between open contacts 1000VAC 1500V Between coil & contacts 1000VAC 1500V Between contact poles 1000VAC 1500V

COIL RATING
Power Consumption Approx. 510 (mW)

Type	Item / Rated Voltage	Rated current (mA)	Coil resistance (Ω)	Must operate Voltage (% of rated voltage)	Must drop-out Voltage (% of rated voltage)	Max. Voltage (% of rated voltage)
KSD	3VDC	167	18	Max 70 at 20°C	10 min.	150 at 20°C
	5VDC	102	49	72 at 30°C		142 at 30°C
	6VDC	85.7	70	76 at 40°C		133 at 40°C
	9VDC	56.3	160	79 at 50°C		123 at 50°C
	12VDC	42.9	280	82 at 60°C		113 at 60°C
	24VDC	21.2	1130			60°C

TYPES AND COIL DATA at 20°C (68°F)

Single side stable Type of relay	Coil resistance (Ω ± 10%)	Pickup voltage V DC	Dropout voltage V DC	Nom. power consumption W DC	Max. continuous voltage V DC
T-3V	64.3	2.25	0.3	0.14	4.5
T-5V	178	3.75	0.5	0.14	7.5
T-6V	257	4.5	0.6	0.14	9.0
T-9V	579	6.75	0.9	0.14	13.5
T-12V	1028	9.0	1.2	0.14	18.0
T-24V	2880	18.0	2.4	0.2	36.0

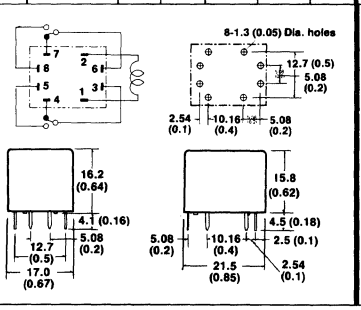
1 Coil latching Type of relay	Coil resistance (Ω ±)	Pick-up voltage	Drop-out voltage	Nom. power consumption	Max. continuous voltage
TL-3V	90	2.25	−2.25	0.1	4.5
TL-5V	250	3.75	−3.75	0.1	7.5
TL-6V	360	4.5	−4.5	0.1	9.0
TL-9V	810	6.75	−6.75	0.1	13.5
TL-12V	1440	9.0	−9.0	0.1	18.0
TL-24V	3840	18.0	18.0	0.15	36.0

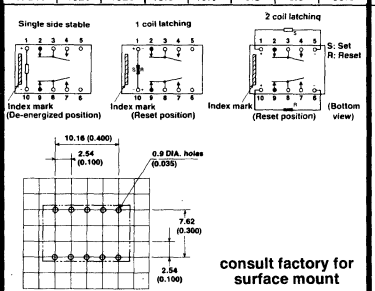
2 Coil latching Type of relay	Coil resistance (Ω ± 10%) Set coil	Coil resistance (Ω ± 10%) Reset coil	Set voltage VDC	Reset voltage VDC	Nom. power consumption W DC Set coil	Nom. power consumption W DC Reset coil	Max. continuous voltage V DC
TK-3V	45	45	2.25	2.25	0.2	0.2	4.5
TK-5V	125	125	3.75	3.75	0.2	0.2	7.5
TK-6V	180	180	4.5	4.5	0.2	0.2	9.0
TK-9V	405	405	6.75	6.75	0.2	0.2	13.5
TK-12V	720	720	9.0	9.0	0.2	0.2	18.0
TK-24V	1920	1920	18.0	18.0	0.3	0.3	36.0

COIL RATING DC Volts — **Nominal Power Consumption (W) 0.48**

Relay Code	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*
HAS-124-5V	52	96.2	3.5	0.5	7.0
HAS-124-6V	85	70.6	4.2	0.6	8.4
HAS-124-9V	170	52.9	6.3	0.9	12.6
HAS-124-12V	330	36.4	8.4	1.2	16.8
HAS-124-24V	1200	20.0	16.8	2.4	33.6
HAS-124-48V	4200	11.4	33.6	4.8	67.2

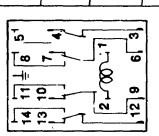
Internal Connections and Mounting Holes



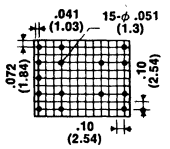


consult factory for surface mount

SCHEMATIC

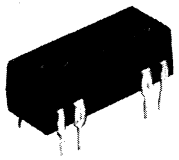


MOUNTING HOLE LAYOUT

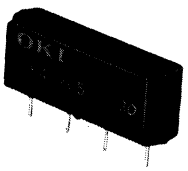


HASCO / REED RELAYS

COMPONENTS INT'L., CORP.
SINCE 1976



DIP SERIES



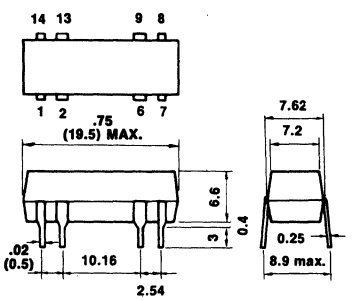
SIP SERIES

FEATURES

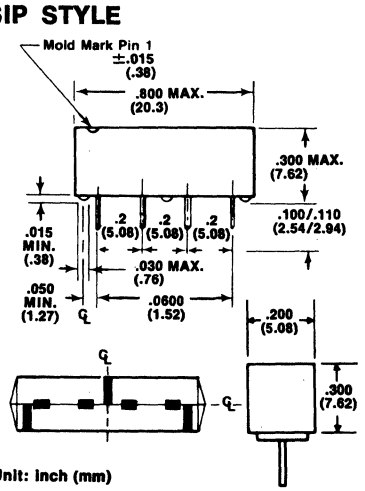
- De-activated rhodium contacts. for stable contact resistance.
- Standard TO-116 Terminal Grid fits all standard DIP sockets.
- Interface directly with RTL, DTL, TTL, HTL logic.
- Molded epoxy package for environmental immunity.
- Automatic insertion compatible.
- Relay testing services test report available.

DIMENSIONS

DIP STYLE



SIP STYLE

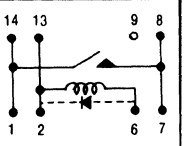
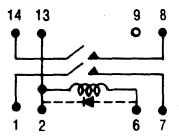
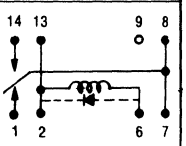


Unit: inch (mm)

DIP AND MINI SIP SERIES

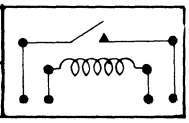
OKI electric industry company, ltd.

DIP CHARACTERISTICS

Contact Form	Part Number	Nominal Voltage (V)	Must Operate (V)	Must Release (V)	Coil Resistance (Ω)	Circuit Schematic (Top view)
1A	D51A05(D)*	5	3.75	0.5	500	
	D51A12(D)	12	9.0	1.2	800	
	D51A24 (D)	24	18.0	2.4	2000	
2A	D52A05 (D)	5	3.75	0.5	140	
	D52A12 (D)	12	9.0	1.2	400	
	D52A24 (D)	24	18.0	2.4	1300	
1C	D51C05 (D)	5	3.75	0.5	200	
	D51C12 (D)	12	9.0	1.2	500	
	D51C24 (D)	24	18.0	2.4	1500	

* (D) optional clamp diode

SIP CHARACTERISTICS

1A	F41A05	5	3.75	0.5	500	
	F41A12	12	9.0	1.2	800	

ENGINEERING DATA

	1A, 2A	1C
Operate time	0.5msec max.	0.5msec. max.
Release time	0.2msec max.	0.2msec max.
Bounce time	0.5msec max.	2.0msec max.
Contact resistance	Dip: 150mΩ max. (initial)	150mΩ max. (initial)
	Sip: 0.10Ω max.	150mΩ max. (initial)
Contact ratings	DC10VA max.	DC3VA max.
	DC100V max.	DC30V max.
	DC1.0A max. (carry only)	DC0.5A max. (carry only)
	DC0.5A max. (switched)	DC0.25A max. (switched)
Life expectancy	50 x 10^6 operations at signal level	30 x 10^6 operations at signal level
	3 x 10^6 full rated load	1 x 10^6 at full rated load
Breakdown voltage	DC250V across open contacts	DC200V across open contacts
	DC500V between coil and contact	DC500V between coil and contact
Insulation resistance	10^9Ω min.	10^9Ω min.
Vibration	20G (10 ~ 2000Hz)	20G (10 ~ 2000Hz)
Thermal shock	−55 ~ 105°C	−55 ~ 105°C
Moisture resistance	60°C-90% 240 hours	60°C-90% 240 hours
Terminal strength	225g	225g
Operating temperature	−40 ~ 85°C	−40 ~ 85°C
Storage temperature	−55 ~ 105°C	−55 ~ 105C°
Operations	200 x 10^6 low level	

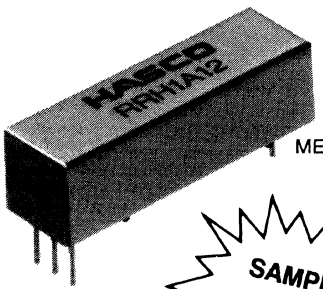
CONSULT CATALOG FOR SURFACE MOUNT SPECIFICATIONS

EXCLUSIVE AGENT FOR **OKI** REED RELAYS IN USA AND CANADA
FOR INFORMATION ON SURFACE MOUNT, CONTACT FACTORY
HASCO COMPONENTS INT'L., CORP. / 247-40 JERICHO TPKE., FLORAL PARK, NY 11001 / (516) 328-9292 FAX 516-326-9125

HASCO COMPONENTS INT'L., CORP.
SINCE 1976

REED RELAYS

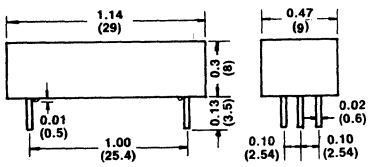
STANDARD FORM 1A 1 INCH × .1 INCH REED RELAY RRH SERIES



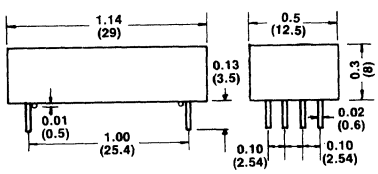
METAL COVER

SAMPLES SENT SAME DAY!

DIMENSIONS



FORM 1A, 1C



FORM 2A

SPECIFICATIONS COIL RATINGS

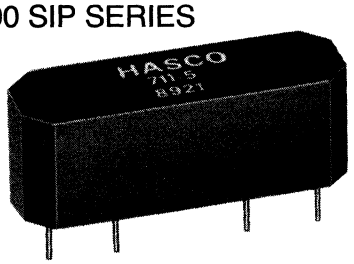
Contact Form	Part Number	Nominal Voltage (V)	Coil Resistance (Ω) ±10%	Rated Current (mA)	Continuous Voltage (Max V)	Circuit Schematic
1A	RRH1A05	5	500	20	10	
	RRH1A12	12	1000	15	20	
	RRH1A24	24	2200	10.90	28	
2A	RRH2A05	5	140	14	10	
	RRH2A12	12	500	15	20	
	RRH2A24	24	2150	12	28	
1C	RRH1C05	5	250	20	10	
	RRH1C12	12	500	15	20	
	RRH1C24	24	2200	10.90	28	

CHARACTERISTICS

Item	Contact Form	1A,2A	1C
Contact resistance		150mΩ max.	150mΩ max.
Operate time		0.5msec max.	1.0msec max.
Bounce time		0.5msec max.	2.0msec max.
Release time		0.2msec max.	0.2msec max.
Operating frequency	Mechanically	100 operations/sec.	50 operations/sec.
	Electrically	10 operations/sec (under rated load)	
Insulation resistance		100MΩ min. (at 250 VDC)	50MΩ min. (at 100 VDC)
Service life	Mechanically	100,000,000 operations min.	50,000,000 operations min.
	Electrically	10,000,000 operations min.	2,000,000 operations min.
Carry current		0.5A max.	0.25 max.
Breakdown voltage		DC 250V across open contacts	DC 200V across open contacts
		DC 500V between coil and contract	DC 500V between coil and contract
Ambient temperature		−20~60°C	
Minimum permissible load		100m VDC 10μA	

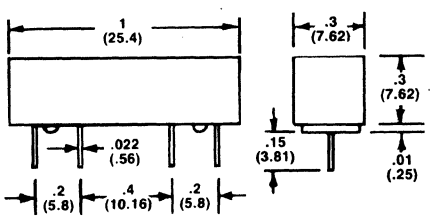
CUSTOM PACKAGING WITH SPECIAL REEDS AVAILABLE

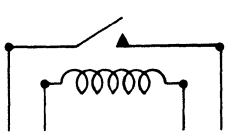
DRY CONTACT REED RELAYS 700 SIP SERIES



FEATURES

- Choice or normal
- Epoxy molded





SPECIFICATIONS

Part Number	Nominal Voltage (V)	Must Operate (V)	Must Release (V)	Coil Resistance (Ohms)	Contact Rating	Breakdown Voltage
711-5	5-6	3.75	0.5	500	10VA DC max. 100V DC max. 1.0A max. carry 0.5 max. switching	250V DC across contacts 1000V DC contacts to coil
711-12	12	9.0	1.2	500		
711-24	24	18.0	2.4	2000		
HEAVY DUTY						
712-5	5-6	3.75	0.5	400	70VA DC max. 100V DC max. 2.5A max. carry 1.0A max. switching	300V DC across contacts 1000V DC contacts to coil
712-12	12	9.0	1.2	400		
712-24	24	18.0	2.4	1600		
HIGH VOLTAGE						
713-5	5-6	3.75	0.5	400	50VA DC max. 400V DC max. 2.5A max. carry 1.0A max. switching	600V DC across contacts 1000V DC contacts to coil
713-12	12	9.0	1.2	400		
713-24	24	18.0	2.4	1600		

ENGINEERING DATA

Operate Time:	0.5 mSec max.
Release Time:	0.2 mSec max.
Bounce Time:	0.5 mSec max.
Contact Resistance:	150 mΩ max. (initial)
Life Expectancy:	50×10^6 operations at signal level 3×10^6 at full rated load
Insulation Resistance:	10^9Ω min.
Vibration:	20G (10-2000 Hz)
Thermal Shock:	−55 ~ 105°C
Moisture Resistance:	60°C-90% 240 hours
Terminal Strength:	225g
Operating Temperature:	−40 ~ 85°C
Storage Temperature:	−55 ~ 105°C

Available in non position sensitive mercury wetted contacts.

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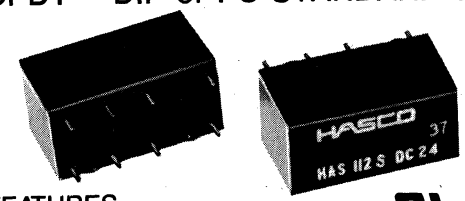
HASCO COMPONENTS INT'L., CORP. SINCE 1976 — RELAYS

DPDT — DIP or PC STANDARD or SENSITIVE HAS 112/HS 212 RELAY



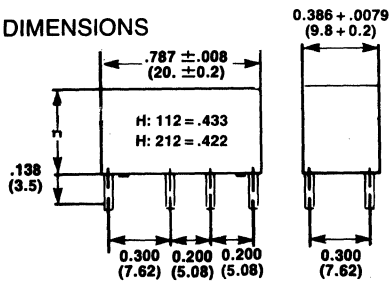
FEATURES

- FCC Pt 68.
- Sensitive available.
- Nitrogen sealing available.
- In stock!

File E75887

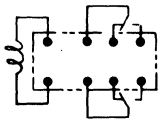
LR65354-24

DIMENSIONS

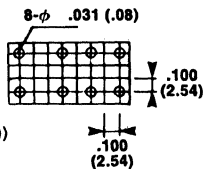


(Unit: inch (mm))

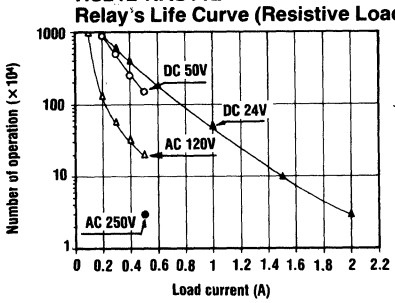
SCHEMATIC
Bottom view



MOUNTING HOLE LAYOUT

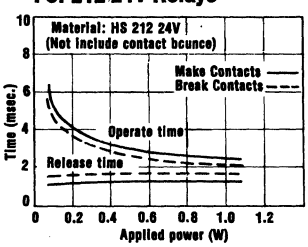


HS212-HAS112
Relay's Life Curve (Resistive Load)

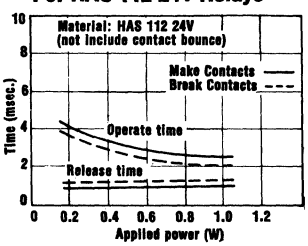


SAMPLES SENT SAME DAY!

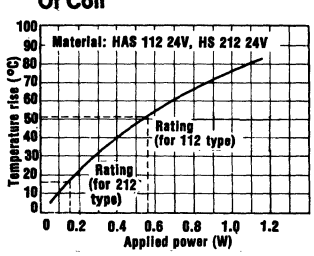
Operate and Release Time For 212 24V Relays



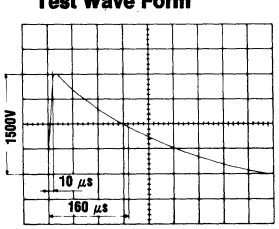
Operate and Release Time For HAS 112 24V Relays



Temperature Rise Of Coil



FCC 1500V Surge Test Wave Form



COIL RATINGS FOR **STANDARD** HAS 112

Relay Code (V)	Contact Arrangement	Nom. Volt. (VDC)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (VDC)	Drop-Out Volt. (VDC)	Max. Volt. (VDC)	Nom. Pwr (W) Cons'ption
HAS-112-5	DPDT (2 Form C)	5	45	111.0	3.5	0.5	7.0	Approx. 0.56
HAS-112-6		6	66	90.9	4.2	0.6	8.4	
HAS-112-9		9	140	64.3	6.3	0.9	12.6	
HAS-112-12		12	280	42.9	8.4	1.2	16.8	
HAS-112-24		24	1070	22.4	16.8	2.4	33.6	
HAS-112-48		48	3900	12.3	33.6	4.8	67.2	

Data Measured at 20°C.

COIL RATINGS FOR **SENSITIVE** HS 212

Relay Code (V)	Contact Arrangement	Nom. Volt. (VDC)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (VDC)	Drop-Out Volt. (VDC)	Max. Volt. (VDC)	Nom. Pwr (W) Cons'ption
HS-212-5	DPDT (2 Form C)	5	167	29.9	3.5	—	12.5	0.15
HS-212-6		6	240	25.0	4.2	—	15.0	0.15
HS-212-9		9	540	16.7	6.3	—	22.5	0.15
HS-212-12		12	960	12.5	8.4	—	30.0	0.15
HS-212-24		24	2,880	8.3	16.8	—	51.6	0.2
HS-212-48		48	7,680	6.3	32.6	—	84.0	0.3
HS-212A-48		48	9,600	5.0	33.0	—	96.0	0.3
HS-212B-48		48	11,500	4.2	33.6	—	117.5	0.2
HS-212C-48		48	5,760	8.3	33.6	—	83.1	0.4

As for the resistance value, pull-in voltage and drop-out voltage, they show the value at ambient temperature, 20°C, and the tolerance is ±10%.

RATING PERFORMANCE

Specifications			Note
Coil	Nominal Voltage	5, 6, 9, 12, 24, 48 VDC	
	Nominal Power Consumption	0.56W	
	Pick-up Voltage	70% of nominal voltage	
	Drop-out Voltage	10% of nominal voltage	
Contact	Contact Arrangement	DPDT, 2 Form C	
	Contact Material	Gold-clad, Ag-Pd alloy	
	Contact Resistance	100 mΩ	at initial value
	Max. Switching Power	DC 30W/AC 60 VA	
	Max. Switching Voltage	125 VDC/AC	at resistive load
	Max. Switching Current	1.25 ADC/AC 2.5A @12V	Available in 2 amp single contact rating
Time	Operate Time	Approx. 3 mS	at nominal
	Release Time	Approx. 2 mS	voltage
	Bounce Time (Operating)	0.5 to 2.0 mS	no bounce in break contact
	Bounce Time (Releasing)	1.5 to 3.5 mS	no bounce in make contcat
Insulation Resistance		1000 MΩ	at 500 VAC, 25°C, 50% relative humidity
Dielectric Strength	1000AC Between coil and contacts Between open contacts		1 minute is at 25°C, 50% relative humidity
FCC Surge Strength	1500V Between coil and contacts Between Adjacent contacts		
Vibration Resistance		1.55 mm DA, 10 ~ 55 Hz	
Temperature		−40°C ~ +90°C −40°C ~ +80°C −40°C ~ +65°C	HS212-5-24V HS212-48 HS212
Life	Mechanical Life	10 x 10^6 times	
	Electrical Life	5 x 10^5 times	at 24 VDC, 1A, resistive load
Weight		5 g	

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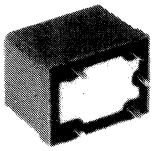
HASCO RELAYS

COMPONENTS INT'L., CORP.
SINCE 1976

KLT MINIATURE POWER RELAYS SPDT 3, 6 & 12 AMP



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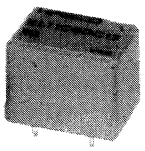
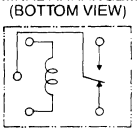
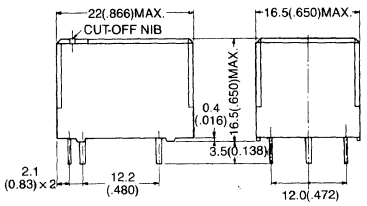


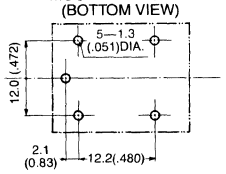
TERMINAL ARRANGEMENT (BOTTOM VIEW)



DIMENSIONS/UNIT mm (inch)



MOUNTING HOLES (BOTTOM VIEW)



SPECIFICATIONS

CONTACT DATA

Arrangement: 1 Form C (SPDT), 1 Form A (SPST-NO), 1 Form B (SPST-NC)
Material & Rating: Silver: 3A at 28 VDC or 120V AC, 1.5A at 240V AC, resistive
Silver Cadmium oxide: 6A at 28VDC or 120V AC, 3A at 240V AC, resistive
Special alloy: 12A at 28VDC or 120V AC, 6A at 240VDC, resistive
Pilot duty: 40 amp in-rush, 4 amp steady state @ 120 VAC
Max. operating Voltage: 250V AC & 125VDC
Min. permissible load (reference value): Silver contact: 5VDC, 1mA
Other contact: 5VDC, 100mA
Life: Mechanical: 10 million operations/
Electrical: 100,000 operations min.

GENERAL DATA

Contact resistance: 50m Ω Max.
Operate time: 8 ms Max. (at nominal voltage)
Operate bounce time: 3 ms Max.
Release time: 5 ms Max./Release bounce time: 8 ms Max.
Insulation resistance: More than 100M Ω at DC 500V
Dielectric strength: 750V AC (50/60 Hz), between open contact; 1500V AC (50/60 Hz), between coil & contact
Vibration: 1.5mm double amplitude, 10 to 50 Hz
Shock: 100m/sec² (approx. 10 G's)
Operation frequency: Mechanical: 18,000 operations/hour
Electrical: 1,800 operations/hour (under rated load)
Temperature range: – 30°C to 70°C
Temperature rise: Less than 35 degrees/Humidity: 45%-85% RH
NOTE: The data shown above are of initial value.

ELECTRICAL RATINGS:

- Models KLT 1A, 1B or 1C, followed by 6: 6A, 120 V ac, 28 V dc: 3 A, 240 V ac general purpose, per pole. Models KLT 1A, 1B, or 1C, followed by 12: 12A, 120 V ac, 28 V dc: 12 A, 240 V ac general purpose, per pole.
- 4 A steady state, 40 A inrush, 125 V ac pilot duty.

N.O. *Only,* Single Pole:
10 A at 12 V dc, Tungsten; 10 A at 125 V ac, General Purpose;
1500 W at 277 V ac, Ballast, 200 W at 120 V ac Tungsten.

COIL RATINGS

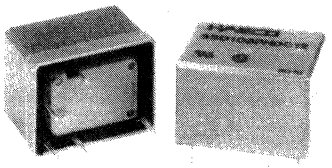
Nominal Coil Voltage	Coil Resistance in Ohms, ± 10% at 20°C	Must Operate Voltage at 20°C	Must Release Voltage at 20°C	Maximum Voltage
3VDC	25	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
5VDC	70			
6VDC	100			
9VDC	225			
12VDC	400			
18VDC	900			
24VDC	1600			
48VDC	5120			

ORDERING INFORMATION

KLT-1C-12-DC12

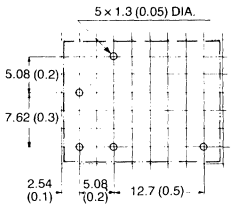
Model No.
Contact Arrangement:
A = 1 Form A B = 1 Form B C = 1 Form C
Contact Material & Rating:
= Silver, gold flash, 3A = Silver Cadmium oxide, 6A
= Special alloy, 12A
Nominal Voltage:
3 = 3VDC; 5 = 5VDC;
6 = 6VDC; 9 = 9VDC;
12 = 12VDC; 24 = 24VDC;
48 = VL

SSD SERIES/6 or 10 AMP SPDT RELAY

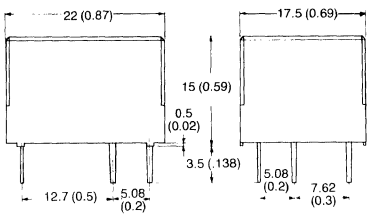


LR49291
File E75887

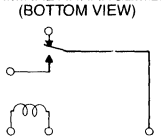
MOUNTING HOLES (BOTTOM VIEW)



DIMENSIONS/UNIT mm (inch)



TERMINAL ARRANGEMENT (BOTTOM VIEW)



SPECIFICATIONS

CONTACT DATA

Arrangement: 1 Form C (SPDT), 1 Form A (SPST-NO), 1 Form B (SPST-NC)
Material & Rating: Silver, gold flash: 3A at 24 VDC or 120V AC, 1.5A at 240V AC, resistive
Silver Cadmium oxide: 6A at 24VDC or 120VDC, 3A at 240V AC, resistive
Special alloy: 10A at 24VDC or 120V AC, 5A at 240VDC, resistive
Max. operating Voltage: 250V AC & 125VDC
Min. permissible load (reference value): Silver contact: 5VDC, 1mA
Other contact: 5VDC, 100mA
Life: Mechanical: 20 million operations/
Electrical: 100,000 operations min.

GENERAL DATA

Contact resistance: 50m Ω Max.
Operate time: Approx. 6ms (at nominal voltage)
Operate bounce time: Approx. 2ms
Release time: Approx. 2ms/Release bounce time: Approx. 4ms
Insulation resistance: More than 100M Ω at DC 500V
Dielectric strength: 750V AC (50/60 Hz), between open contact; 2000V AC (50/60 Hz), between coil & contact
Vibration: 1.5mm double amplitude, 10 to 50 Hz
Shock: 100m/sec² (approx. 10G's)
Operation frequency: Mechanical: 18,000 operations/hour
Electrical: 1,800 operations/hour (under rated load)
Temperature range: – 30°C to 70°C
Temperature rise: Less than 35 degrees/Humidity: 45%-85% RH
NOTE: The data shown above are of initial value.

COIL RATINGS

Nominal Coil Voltage	Coil Resistance in Ohms, ± 10% at 20°C	Must Operate Voltage at 20°C	Must Release Voltage at 20°C	Maximum Voltage
3VDC	20	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
5VDC	56			
6VDC	80			
9VDC	180			
12VDC	320			
24VDC	1150			

Power (at 20°C): Nominal: 0.45 watt. Available in 48 volts.

ORDERING INFORMATION

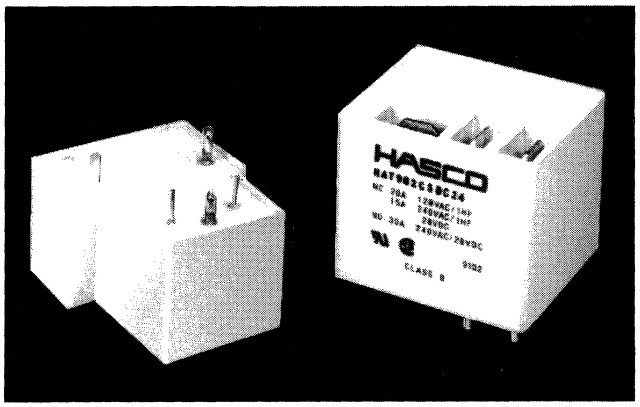
SSD 106PH DC12

Model No.
Contact Material & Rating:
= Silver, gold flash, 3A
= Silver Cadmium oxide, 6A = Special alloy, 10A
Nominal Voltage:
3V, 5V, 6V, 9V,
12V, 24V, 48V

HASCO RELAYS

COMPONENTS INT'L., CORP.
SINCE 1976

HAT-901 SERIES HEAVY DUTY



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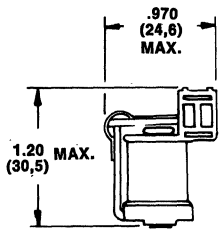
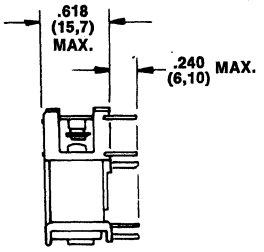
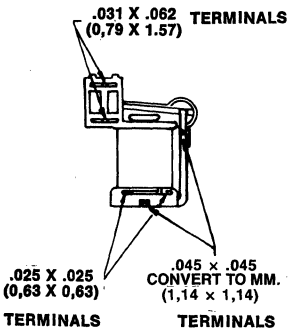
MECHANICAL SPECIFICATIONS

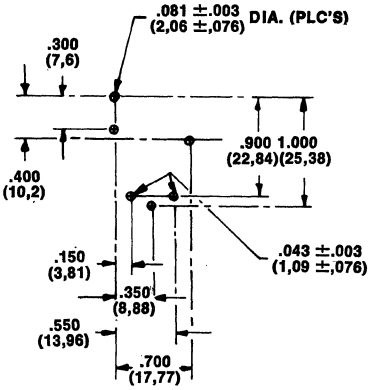


CLASS B INSULATION



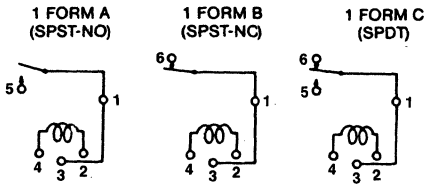
PC BOARD LAYOUT
VIEWED TOWARD TERMINALS





WIRING DIAGRAMS

PIN VIEW



NOTE: PIN 3 IS OMITTED FOR -1

GENERAL SPECIFICATIONS

Max. continuous rated voltage: 110% of nominal voltage.
Pull-In voltage: 75% of nominal voltage. Max @ 25°C.
Drop-Out voltage: 10% of nominal voltage. Min @ 25°C.
Contact Resistance: 20 mΩ max. (Initial value)
Operating Temp: −55°C to +85°C.
Insulation Resist: DC 500V 10 MΩ min.
Dielectric Strength: AC 2500V between contact and coil, frame and contact, coil and frame one minute. AC 2500V between contacts one minute.
Operate Time: approx 15 ms.
Release Time: approx. 10 ms.
Electrical Life: 10×10^4 operation min.
Mechanical Life: 10×10^6 operation min.

QUICK CONNECT VERSION AVAILABLE

COIL SPECIFICATIONS

Nominal Voltage (VDC)	Resistance 10% @ 25°C (Ohms)	Coil Power 10% @ 25°C (Watts)
5	27	.93
6	40	.90
9	97	.84
12	155	.93
15	256	.88
18	380	.85
24	660	.87
48	2560	.88
110	13400	.90

MAXIMUM LOAD SPECIFICATIONS

Voltage	Load Type	SPNC	SPDT	SPNO
AC	Resistive Motor	20A 120 VAC 15A 240 VAC 2HP 120/240 VAC		30A 240 VAC
DC	Resistive	15A 28 VDC		30A 28 VDC

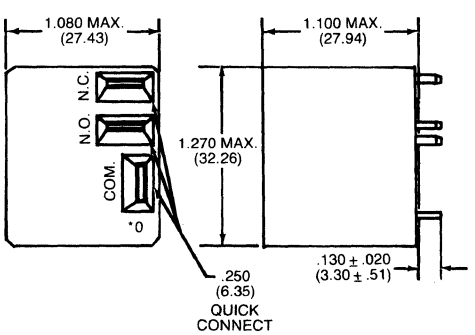
ORDERING INFORMATION

Part Number	Form	Style	DC
HAT 901	**A**	Sealed Type = S	Coil Voltage
	B	Cover Only = C	
	C	Open Style is Standard	

(I.e.: HAT-901C-S 12
is an SPDT fully
sealed version with 12V coil.)

QUICK CONNECT SPECIFICATIONS

PART NUMBER HAT-902



HASCO COMPONENTS INT'L., CORP. / 247-40 JERICHO TPKE., FLORAL PARK, NY 11001 / (516) 328-9292 FAX 516-326-9125

"HOLD-HEET®" PRODUCTS

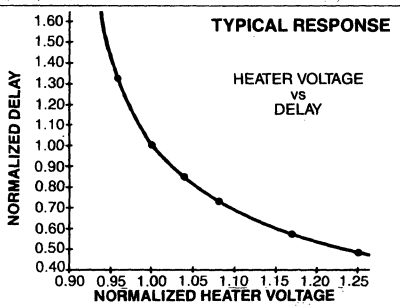


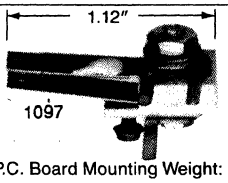
BIMETAL WARP SWITCHES
CUSTOM ENGINEERED • HIGH QUALITY
LOW COST • PRODUCTION QUANTITIES

5011 N. RAVENSWOOD AVENUE
CHICAGO, ILLINOIS 60640
312/728-4454 FAX 312/728-2016
BUSINESS HOURS: 8am-3:30pm
CENTRAL TIME

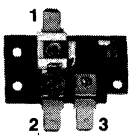
These time delay relays are actuated by heated bi-metallic blade, and thus are
- Immune to transients.
- Independent of wave form.
- Exceptionally low-cost (some models as low as $1.30 in volume).

By using a bi-metallic mating blade, temperature compensation up to −20°F to +150°F can be achieved. All models available with contacts N.O. or N.C. Heater coil can be isolated from contacts, or made common with one contact for greater economy.



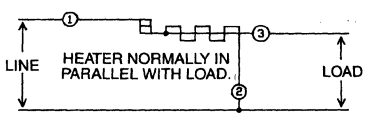


P.C. Board Mounting Weight: 1/5 oz.

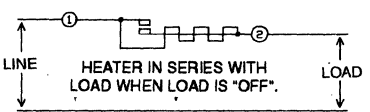


Alternative Package: 1/4" Push-on Tabs

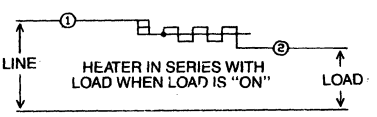
Heater Coil: 4v to 115v AC or DC. 1 1/4 w. continuous to 5 watts momentary
Contacts: (Non-inductive Loads) AC: 6 to 115v, 35 to 350 ma, 2 to 25 w — DC: 6 to 12v, 35 to 350 ma, 2 to 4 w
Delay: 4 to 90 sec., opening or closing
Alternative Arrangements for use as a Flasher:



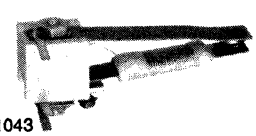
FLASHER OPERATES INDEPENDENT OF LOAD. LOAD IS FULLY "ON" OR "OFF".



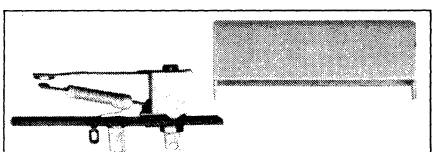
FLASHER IS DEPENDENT ON LOAD. LOAD IS "ON" OR PARTIALLY "OFF".



FLASHEH IS DEPENDENT ON LOAD AND MUST BE MATCHED TO IT. LOAD IS "OFF" OR PARTIALLY "ON"

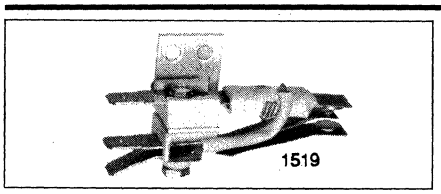


PC Board Mounting

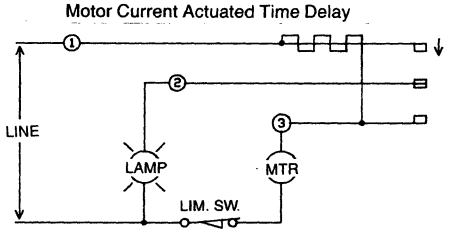


Alternative Package: Protective Can

Heater Coil: 6.3 to 28v AC or DC; 1.5w to 2.25 w. continuous.
Contacts: (Non-inductive Loads) AC: 6 to 115v, 35 to 350 ma, 2 to 40 w — DC: 6 to 12v, 35 to 350 ma, 2 to 4 w
Delay: 20 to 150 seconds, opening or closing



Motor Current Actuated Time Delay



Automatic light time delay switch for use in electric door opener circuits and similar applications. Features include:
- light goes on in a few seconds
- light maintained for 1 1/2 to 2 1/2 minutes
- all 3 blades are same bi-metallic material for good temperature compensation
- shorting blade prevents heater burn-out in case of motor or door malfunction

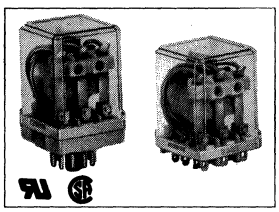
"Hold-Heet" switches provide service in many applications. Any number of recombinations are possible with component elements. This great versatility can result in tremendous savings over magnetic relays or timing motors. Please direct your technical questions to Gifford Neill, Chief Engineer, at 708/837-7709.

idec CORPORATION

IDEC Relay Selection Guide

IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211
Catalog Requests: 800-262-IDEC
Telephone: Corporate Office: (408) 747-0550; Fax: (408) 744-9055
Regional Offices: Schaumburg, IL: (708) 706-3880; Fort Pierce, FL: (407) 461-4994

RR Series



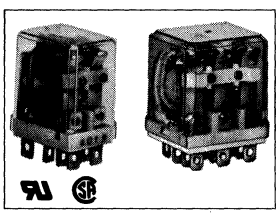
Contacts
Form: 1C, 2C, 3C
Current: 10A
Rating: 10A 240VAC (Resist.)
1/3 HP 240V
1/4 HP 120V
10A 30VDC (Resist.)
Material: Silver
Resistance: 30mΩ max.

Nominal Operating Voltages And DC Coil Resistance (Ω)

6VAC: 4.6	6VDC: 25
12VAC: 20	12VDC: 100
24VAC: 80	24VDC: 400
120VAC: 2,200	48VDC: 1,600
240VAC: 8,930	110VDC: 8,450
Power Consumption: 2.5VA	Power Consumption: 1.5W

Operating Temperature
−22°F to +158°F
Life Expectancy
Mechanical: 10,000,000
Electrical: 500,000
Terminals
Pin/Plug-In
Blade/Plug-In

RH Series



Contacts
Form: 1C, 2C, 3C, 4C
Current: 10A
Rating: 10A 240VAC (Resist.)
⅓ HP @ 240VAC
⅙ HP @ 120VAC
10A 30VDC (Resist.)
Material: Silver Cadmium Oxide
Resistance: 50mΩ max.

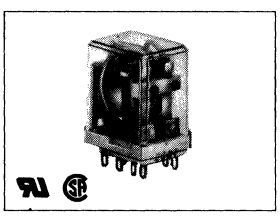
***Nominal Operating Voltages And DC Coil Resistance (Ω)**

6VAC: 9.6	6VDC: 40
12VAC: 40.5	12VDC: 160
24VAC: 156.7	24VDC: 650
120VAC: 4,280	48VDC: 2,600
240VAC: 15,720	110VDC: 12,100
Power Consumption: 1.2VA	Power Consumption: 0.9W

**Specifications for 2C version.*

Operating Temperature
−22°F to +158°F
Life Expectancy
Mechanical: 50,000,000
Electrical: 500,000
Terminals
Blade/Plug-In
P.C. Mount

RM Series



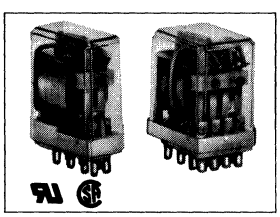
Contacts
Form: 2C
Current: 5A
Ratings: 5A 240VAC (Resist.)
5A 30VDC (Resist.)
Material: Fine Silver
Resistance: 30mΩ max.

Nominal Operating Voltages And DC Coil Resistance (Ω)

6VAC: 9.6	6VDC: 40
12VAC: 40.5	12VDC: 160
24VAC: 156.7	24VDC: 650
120VAC: 4,280	48VDC: 2,600
240VAC: 15,720	110VDC: 12,100
Power Consumption: 1.2VA	Power Consumption: 0.9W

Operating Temperature
−22°F to +158°F
Life Expectancy
Mechanical: 50,000,000
Electrical: 500,000
Terminals
Solder/Plug-In
P.C. Mount

RY Series



Contacts
Form: 2C, 4C
Current: 3A
Rating: 3A 240VAC (Resist.)
3A 30VDC (Resist.)
Material: Silver (Gold-Plated)
Resistance: 50mΩ max.

****Nominal Operating Voltages And DC Coil Resistance (Ω)**

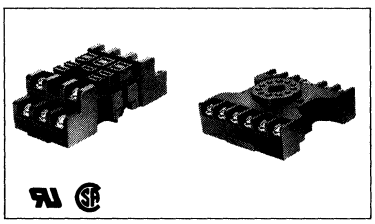
6VAC: 9.6	6VDC: 40
12VAC: 40.5	12VDC: 160
24VAC: 156.7	24VDC: 650
120VAC: 4,280	48VDC: 2,600
240VAC: 15,720	110VDC: 12,100
Power Consumption: 1.2VA	Power Consumption: 0.9W

***Specifications for 4C version.*

Operating Temperature
−22°F to +158°F
Life Expectancy
Mechanical: 50,000,000
Electrical: 200,000
Terminals
Solder/Plug-In
P.C. Mount

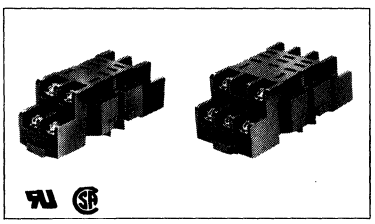
IDEC Selection Guide To Quality "Snap-Mount" Sockets

SR Series



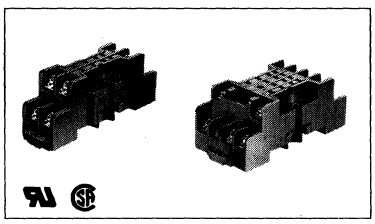
Type: 2-Pole, 8-Pin/Plug-in
3-Pole, 11-Pin/Plug-in
1-3-Pole, 11-Blade/Plug-in
Ratings: 10A 300V-Blade Type
10A 300V-Pin Type
Mounting: DIN Rail, Surface
Compatible IDEC Relay: RR Series

SH Series



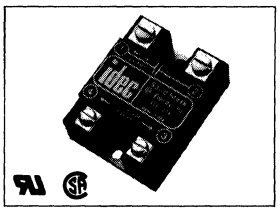
Type: 1-4 Pole, Blade/Plug-in
Ratings: 10A 300V
Mounting: DIN Rail, Surface
Compatible IDEC Relay: RH Series
RH2L Series

SY Series



Type: 2, 4-Pole, Solder/Plug-in
Ratings: 7A 300V
Mounting: DIN Rail, Surface
Compatible IDEC Relay: RM Series
RY Series
RY2L Series

RSS Series Solid State Relays



Input (DC)
Voltage Range: 3–32V DC
Isolation Voltage: 4000V AC (Input to Output)
Output

Current Ratings:	10A	25A	40A
1 Cycle Surge Peak:	100A	250A	650A

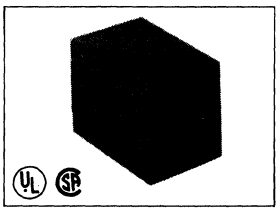
Voltage Range: 24–330V AC

Input (AC)
Voltage Range: 90–280V AC
Isolation Voltage: 4000V AC (Input to Output)
Output

Current Ratings:	10A	25A	40A
1 Cycle Surge Peak:	100A	250A	650A

Voltage Range: 24–330V AC

RTE Series Multi-Function/Range Time Delay Relay

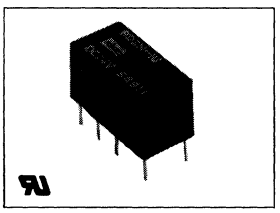


Contacts
Form: 2 Form C, DPDT
Current: 10A
Rating: 10A 240VAC (Res.)
10A, 30VDC
1/6HP 120VAC
1/3HP 240VAC
Operating Voltages
Input: 120VAC
12, 24V AC/DC
Power Consumption: 2.2VA

Timing/Operation
Mode of
Operation: Delay-On-Make/Interval
Delay-On-Break/Single-Shot
Time Range: 1 Sec. to 10 Hrs.
Repeat Accuracy: ±0.25%, 10ms
Reset Time: 100ms or less
Type of Control: Programmable DIP switch and adjustable potentiometer

Operating Temperature
–20°C to +65°C
Mounting
Plug-In
8-Pin, 11-Pin/Blade

RD Series

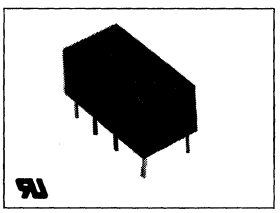


Contacts
Form: 2 Form C
Current: 1.25A, max.
Material: Silver (Gold-Clad)
Resistance: 100mΩ max.
Surge Withstand Voltage: 1500V (FCC)

Nominal Operating Voltages And DC Coil Resistance (Ω)
3VDC: 22.5
5VDC: 62.5
6VDC: 90
12VDC: 360
24VDC: 1440
48VDC: 5760
Power Consumption: 400mW

Operating Temperature
–30°C to +70°C
Life Expectancy
Mechanical: 50,000,000
Electrical: 500,000
Terminals
P.C. Mount

RW Series

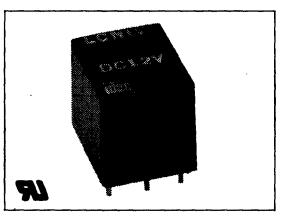


Contacts
Form: 2 Form C
Current: 2A
Rating: 0.5A, 110VAC
2A, 30VDC
Material: Silver (Gold-Clad)
Resistance: 50mΩ max.
Surge Withstand Voltage: 1,500V (FCC)

Nominal Operating Voltages And DC Coil Resistance (Ω)
1.5VDC: 11.3
3VDC: 45
5VDC: 125
6VDC: 180
12VDC: 720
24VDC: 2880
48VDC: 5760
Power Consumption: 200mW
400mW (48VDC)

Operating Temperature
–40°C to +70°C
Life Expectancy
Mechanical: 10,000,000
Electrical: 50,000
Terminals
P.C. Mount

LCN Series

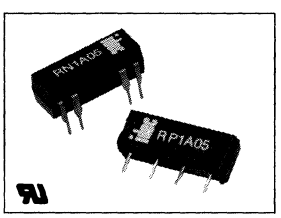


Contacts
Form: 1C
Current: 5A
Ratings: 5A 120VAC (Resist.)
5A 30VDC (Resist.)
Material: Silver Alloy
Resistance: 100mΩ max.

Nominal Operating Voltages And DC Coil Resistance (Ω)
5VDC: 70
6VDC: 100
12VDC: 400
24VDC: 1,600
48VDC: 4,500
Power Consumption: 0.36W

Operating Temperature
–22°F to +158°F
Life Expectancy
Mechanical: 10,000,000
Electrical: 100,000
Terminals
P.C. Mount

RN/RP Series/Dry Reed Relay



Contacts
Form: 1A, 2A, 1B, 1C (DIP)
1A (SIP)
Current: (1A, 1B, 2A) 0.50A
(1C) 0.25A
Ratings: 0.50A, 100V AC/DC
0.25A, 100V AC/DC
Material: Ruthenium
Resistance: 200mΩ max.

Nominal Operating Voltages And DC Coil Resistance (Ω)
(1 Form C)
5VDC: 200
12VDC: 500
24VDC: 2150
Power Consumption: 125-268mW

Life Expectancy
Electrical: 20,000,000
Terminals
P.C. Mount

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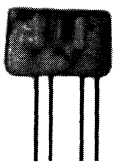
SOLID STATE DELAY TIMERS

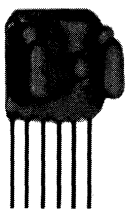
KH Series **Timing Module**/PC Mount

Thick Film Hybrid Circuit, Miniature Size, Thick Conformal Coating,Printed Circuit Mounting, Time Ranges from .1 to 300 sec*, External Adjustable or Fixed Times.

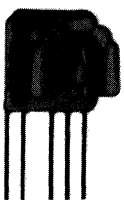
KH 1



KH 2



KH 3



OUTPUT CURRENT RATING: Action 1:10 ma. min,100 max. Actions 2&3:10 ma. min. 500 ma .max.
REPEAT ACCURACY: Fixed conditions = ± 3 %, OVERALL ±10 %. over -10° to 70° C.
SIZE: Action 1 = 1.25"L x .6"W x .3" Thick. Action 2 & 3 = 1.25"L x 1.0" W x .5" Thick.

Ordering Code: KH ___ ___ ___

Timing Actions:

ON Delay	(1).
OFF Delay	(2).
INTERVAL Delay	(3)
N/A in all voltages.	

Timing Ranges:

Standard:		Non-standard:	
.1 to 1 sec.	(1).	1 to 10 sec.	(5).
.5 to 5 sec.	(2).	5 to 50 sec.	(3).
3 to 30 sec.	(7).	6 to 60 sec.	(8).
30 to 300 sec.	(4).	12 to 120 sec.	(6).
		*Special time.	(0).

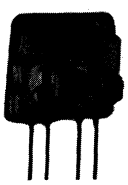
Input Voltages:

Standard:		Non-standard:	
24 VAC	(2).	12 VAC	(7).
120 VAC	(1).	240 VAC	(5).
12 VDC	(8).	48 VDC	(6).
24 VDC	(4).	110 VDC	(3).

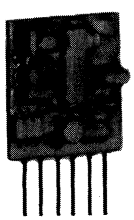
KD Series **Digital Countdown Timer**/PC Mount

Digital Countdown Circuit, Miniature PC Board, Thick Conformal Coating, Printed Circuit Mounting, Time Ranges from .1 sec. to 10 hr.*, External Adjustable or Fixed Times.

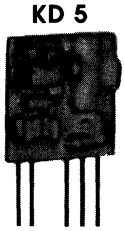
KD 1



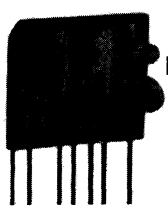
KD 2



KD 3
KD 5



KD 6



OUTPUT CURRENT RATING: 20 ma. min, 500 max.
REPEAT ACCURACY: Fixed conditions = ± .5 %, OVERALL ± 3 %. over -10° to 70° C.
SIZE: Action 1 = 1.25" L x 1.0" W x .5" Thick Action 2, 3, 5 = 1.38" sq. x .5" Thick.
Action 6 = 2.0" L x 1.38" W x .5" Thick.

Ordering Code: KD ___ ___ ___ **Action 6 "ON" time is inserted here.**

Timing Actions:

ON Delay	(1).
OFF Delay	(2).
INTERVAL Delay	(3).
RECYCLE Timer	(5)
(OFF & ON times are equal; single adjustment).	
RECYCLE Timer	(6) (OFF & ON times independently adjustable).

Timing Ranges:

Standard:		Non-standard:	
.1 to 10 sec.	(1).	10 - 600 min.	(3).
1 to 60 sec.	(4).	*Special time	(0).
10 to 600 sec.	(2).		
1 to 60 min.	(5).		

Input Voltages:

Standard:		Non standard:	
24 VAC	(2).	12 VAC	(7).
120 VAC	(1).	240 VAC	(5).
12 VDC	(8).	48 VDC	(6).
24 VDC	(4).	110 VDC	(3).

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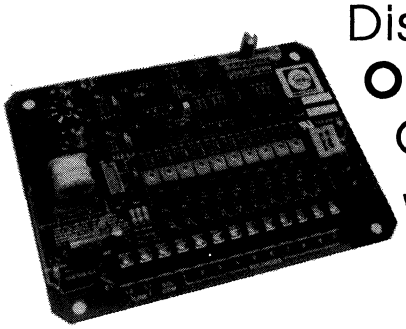

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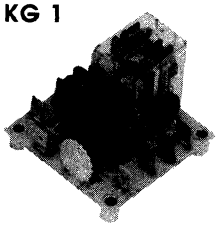
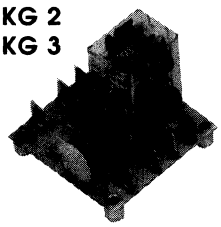
TIME DELAY RELAYS

KG Series **Time Delay Relay**/Chassis Mount

KG 1



KG 2
KG 3



Thick Film Hybrid Timing Element, Heavy Duty Long Life Relay, Stand off for Chassis Mounting, 1/4" Quick Connect Terminals, Time Ranges from .1 to 300 sec*, On Board Time Adjustment Pot.

OUTPUT RELAY RATING: 10 Amps resistive or 1/3 HP @ 120 VAC.
REPEAT ACCURACY: Fixed conditions = ± 3 %, OVERALL ±10%. over -10° to 70° C.
SIZE: 2.1" sq. x 1.8" high, 1/4" Q.C. terminals.

Ordering Code: KG ___ ___ ___

Timing Actions:

ON Delay	(1).
OFF Delay	(2).
INTERVAL Delay	(3)
N/A in all voltages.	

Timing Ranges:

Standard:		Non-standard:	
.1 to 1 sec.	(1).	1 to 10 sec.	(5).
.5 to 5 sec.	(2).	5 to 50 sec.	(3).
3 to 30 sec.	(7).	6 to 60 sec.	(8).
30 to 300 sec.	(4).	12 to 120 sec.	(6).
		*Special time.	(0).

Input Voltages:

Standard:		Non-standard:	
24 VAC	(2).	12 VAC	(7).
120 VAC	(1).	240 VAC	(5).
12 VDC	(8).	48 VDC	(6).
24 VDC	(4).	110 VDC	(3).

OP4 Series **Time Delay Relay/** Plug In

OP41
OP43



Thick Film Hybrid Timing Element, Heavy Duty Long Life Relay, Enclosed Octal Plug In Base, LED Operation Indicator, Time Ranges from .1 to 300 sec*, Built in Time Adjustment Pot with Knob.

OUTPUT RELAY RATING: 10 Amps resistive or 1/3 HP @ 120 VAC.
REPEAT ACCURACY: Fixed conditions = ± 3 %, OVERALL ±10 %. over -10° to 70° C.
SIZE: 2.0 " sq. x 4.0" high, Action 1 & 3= 8 pin octal base. Action 2 = 11 pin round base.

OP42



Ordering Code: OP4 ___ ___ N ___

Timing Actions:

ON Delay	(1).
OFF Delay	(2).
INTERVAL Delay	(3)
N/A in all voltages.	

Timing Ranges:

Standard:		Non-standard:	
.1 to 1 sec.	(1).	1 to 10 sec.	(5).
.5 to 5 sec.	(2).	5 to 50 sec.	(3).
3 to 30 sec.	(7).	6 to 60 sec.	(8).
30 to 300 sec.	(4).	12 to 120 sec.	(6).
		*Special time.	(0).

Input Voltages:

Standard:		Non-standard:	
24 VAC	(2).	12 VAC	(7).
120 VAC	(1).	240 VAC	(5).
12 VDC	(8).	48 VDC	(6).
24 VDC	(4).	110 VDC	(3).

OP4 Series **Recycle Timer/** Plug In

OP45



Digital Countdown Timing Module, Heavy Duty Long Life Relay, Enclosed Octal Plug In Base, LED Operation Indicator, Time Ranges from .1 to 10 hrs*, Built in Time Adjustment Pot with Knob.

OUTPUT RELAY RATING: 10 Amps resistive or 1/3 HP @ 120 VAC.
REPEAT ACCURACY: Fixed conditions = ± .5 %, OVERALL ± 3 %. over -10° to 70° C.
SIZE : Action 5 = 2.0" sq. x 4.0" high, Action 6 = 1.8" W x 2.4" L x 3.6" H, 8 pin octal base.

OP46



Ordering Code: OP4 ___ ___ ___ ___ **For action 5, insert "N" here. For action 6, insert time range here.**

Timing Actions:

RECYCLE Timer	(5)
(OFF & ON times are equal, single adjustment).	
RECYCLE Timer	(6)
(OFF & ON times independently adjustable).	

Timing Ranges:

Standard:		Non-standard:	
.1 to 10 sec.	(A).	10 - 600 min.	(C).
1 to 60 sec.	(D).	*Special time	(0).
10 to 600 sec.	(B).		
1 to 60 min.	(E).		

Input Voltages:

Standard:		Non standard:	
24 VAC	(2).	12 VAC	(7).
120 VAC	(1).	240 VAC	(5).
12 VDC	(8).	48 VDC	(6).
24 VDC	(4).	110 VDC	(3).

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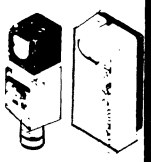
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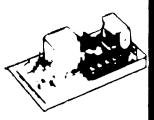
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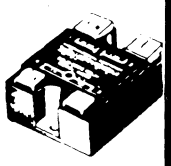
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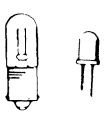
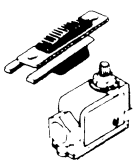

LAMPS & LEDS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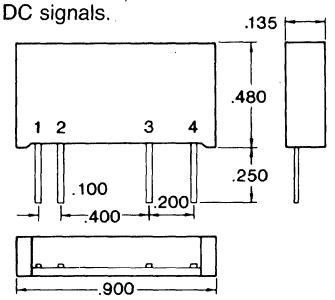

Figure 1 ChipSwitch SP

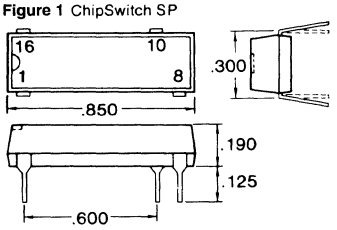

Figure 2 ChipSwitch DP

SERIES	PART NUMBER	Operating Voltage Range V(RMS)	Max. Load Current @40°C A(RMS)	Trans. Over-Volt V(Pk)	Turn-On Signal (DC)	Outline Drawing	Tech. Bulletin No.
SP  1 FORM A	SP1110	20-140	1.0 Free Standing	300	5mA	Figure 1	MPIC-4
	SP1210	20-140		300	10mA		
	SP2110	20-280		450	5mA		
	SP2210	20-280		450	10mA		
	SP6110	20-280	3.0 With Heat Sink	600	5mA		
	SP6210	20-280		600	10mA		
DP  1 FORM A	DP1110	20-140	1.0	300	5mA	Figure 2	MPIC-4
	DP1210	20-140		300	10mA		
	DP1610	20-140		300	3.5V		
	DP2110	20-280		450	5mA		
	DP2210	20-280		450	10mA		
	DP2610	20-280		450	3.5V		
	DP6110	20-280		600	5mA		
	DP6210	20-280		600	10mA		
	DP6610	20-280		600	3.5V		
CS  1 FORM A	CS5005	20-280	0.3	500	5mA	Figure 3	MPIC-4
	CS5010	20-280		500	10mA		
	CS6005	20-280		600	5mA		
	CS6010	20-280		600	10mA		

GENERAL CHARACTERISTICS	SP	DP	CS	UNITS
Dielectric Strength Input/Output	4000			VRMS
Min. off state dv/dt @ rated V 25°C	600		1200	V/μ sec
Max. off state leakage	10			μ A
Power factor range	0.5 to 1	0.2 to 1		—
Ambient operating temperature	−30 to +85			°C

BOSFET® PhotoVoltaic Relay

International Rectifier Photo-Voltaic Relays utilize a unique power integrated circuit termed a BOSFET to form a solid state replacement for signal level electromechanical relays. They feature high speed, zero offset voltage, low pick-up power, miniaturization, and are widely applied in instrumentation, multiplexing, automatic test equipment, thermocouple switching and telecommunications for general purpose switching of AC/DC analog and digital signals. The PVI isolators provide a DC output with a 2500VAC isolation level for driving MOSFETs, IGBTs and serving as an isolated DC bias.

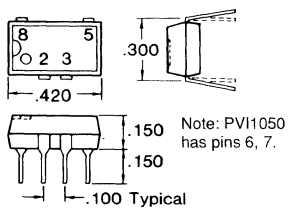

Figure 3 ChipSwitch CS, BOSFET PVD, PVA & PVI

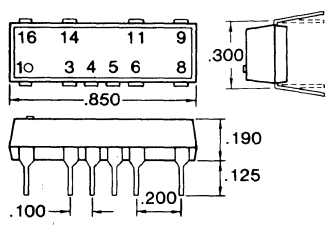

Figure 4 BOSFET PVR

SERIES	PART NUMBER	Operating Voltage Range V(Pk)	Max. On-State Res. @25°C Ohms AC	Max. On-State Res. @25°C Ohms DC	Max. Load Current @40°C (DC) mA	Nom. Control Current (DC) mA	Min. Off-State Res. Ohms	Outline Drawing	Tech. Bulletin No.
PVR  2 FORM A	PVR1300	±100	5.0	1.5	700	10	10^8	Figure 4	MPIC-4
	PVR1301	±100	5.0	1.5	700		10^{10}		
	PVR2300	±200	24	6.0	260		10^8		
	PVR3300	±300	24	6.0	260		10^8		
	PVR3301	±300	24	6.0	260		10^{10}		
PVA  1 FORM A	PVA1052	±100	35	35	70	5.0	10^8	Figure 3	MPIC-4
	PVA1054	±100	35	35	70	5.0	10^{10}		
	PVA1352	±100	5.0	5.0	315	5.0	10^8		
	PVA1354	±100	5.0	5.0	315	5.0	10^{10}		
	PVA2352	±200	24	24	130	5.0	10^8		
	PVA3054	±300	160	160	40	5.0	10^{10}		
	PVA3055	±300	160	160	40	5.0	10^{11}		
	PVA3324	±300	24	24	130	2.0	10^{10}		
	PVA3354	±300	24	24	130	5.0	10^{10}		
	PVAZ172	±60	0.5	0.5	1000	10	10^8		
PVD  1 FORM A	PVD1052	+100		8.0	160	5.0	10^8	Figure 3	MPIC-4
	PVD1054	+100		8.0	160	5.0	10^{10}		
	PVD1352	+100		1.5	500	5.0	10^8		
	PVD1354	+100		1.5	500	5.0	10^{10}		
	PVD2352	+200		6.0	220	5.0	10^8		
	PVD3354	+300		6.9	220	5.0	10^{10}		
	PVDZ172	+60		0.25	1400	10	10^8		
PVI 	PHOTOVOLTAIC ISOLATOR								
	PVI1050	2	5.0/10		10/5.0	10	—	Figure 3	MPIC-4
	PVI5100	1	5.0		10.0				

GENERAL CHARACTERISTICS	PVR	PVA	PVD	PVI	UNITS
Isolation Input/Output	1500	1500 and 2500		2500	VRMS
Min. off state dv/dt @ 25°C	1000			—	V/μ sec
Max. thermal offset voltage	0.2			—	μV
Output	AC or DC		DC		—
Ambient operating temp.	−40 to +85				°C

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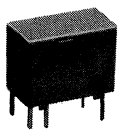
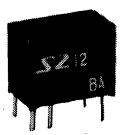
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

SY/SZ RELAYS

1 Amp SPDT
L — 0.492″,
W — 0.291″,
H — 0.374″





CONTACT DATA

Arrangement — 1 Form C

Material — Gold overlay silver-palladium

Resistance — Max. 100 mΩ (initial value)

Ratings — 0.5A, 120V AC or 1A, 24V DC (resistive) switched
2.0A carrying curent

Life Expectancy — Mechanical: Min. 5 million operations
Electrical: SZ Min. 200,000 operations at rated load
SY Min. 150,000 operations at rated load

COIL DATA

Voltages — 1.5 to 24V DC

Power (at 20°C) —
SZ Operate — 0.15 watt (0.16 watt for 18V coil, 0.18 watt for 24V coil)
Nominal — 0.3 watt (0.32 watt for 18V coil, 0.36 watt for 24V coil)
SY Operate — 0.075 watt
Nominal — 0.15 watt

Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 100 MΩ minimum at 500V DC

Dielectric Strength — 500V AC (50, 60 Hz), between open contacts
1000V AC between contacts and coil

Temperature Range — SZ −40°C to +70°C (18V coil: −30°C to +65°C,
25V coil; −30°C to +60°C) (at nominal voltage)
SY −40°C to +90°C

Time Values (approx.) — Operate 1.5 mS, Release 1 mS (at nominal voltage)

Vibration Resistance — 20G (10 ~ 300 Hz) amplitude 3 mm

Shock Resistance — 50G

Mounting — For direct printed circuit mounting on grid spacing
of 2.54 mm (0.1 in.)

Approximate Weight — 1.7 gr (0.06 oz.)

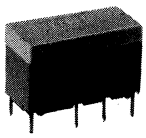
Enclosure — Polybutylene terephthalate (PBT)

Surge Strength — 1000V

Nominal Coil Voltage	Coil Resistance	Operate Voltage	Type No.	List Price
3	30	2.1	SZ-3W	$2.66
5	**83**	**3.5**	**SZ-5W**	**$2.66**
6	100	3.9	SZ-6W	$2.66
9	270	6.3	SZ-9W	$2.66
12	**480**	**8.4**	**SZ-12W**	**$2.66**
18	1000	12.6	SZ-18W	$2.66
24	**1600**	**16.8**	**SZ-24W**	**$2.66**
5	**167**	**3.5**	**SY-5**	**$2.93**
6	240	4.2	SY-6	$2.93
9	540	6.3	SY-9	$2.93
12	**960**	**8.4**	**SY-12**	**$2.93**
24	3290	16.8	SY-24	$2.93

RY RELAY

1 Amp DPDT
L — 0.795″,
W — 0.386″,
H — 0.472″



CONTACT DATA

Arrangement — 2 Form C, 2 Form D

Material — Gold overlay silver-palladium

Resistance — Max. 100 mΩ (initial)

Ratings — 0.5A 120V AC or 1A 24V DC (resistive)

Life Expectancy — Mechanical: Min. 20 million operations
Electrical: Min. 500,000 operations at 1A 24V DC
Min. 200,000 operations at 0.5A 120V AC

COIL DATA

Voltages — 4.5 to 48V DC

Power (at 20°C) —
Operate — 0.075 watt (0.098 watt for 18V, 24V coil, 0.138 watt
for 48V coil)
Nominal — 0.15 watt (0.2 watt for 18V, 24V coil, 0.3 watt for 48V coil)

Operate (at 20°C) — 68 ~ 71% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 1000 MΩ min. at 500V DC

Dielectric Strength — 500V AC between open contact
1000V AC between all other conductors

Temperature Range — −40°C ~ +85° at nominal voltage

Surge Strength — 1500V between all conductors

Time Values (max.) — Operate 6 ms, Release 3 ms at nominal voltage

Vibration Resistance — 10G (10 ~ 55 Hz)

Shock Resistance — 10G 11 ±1 ms) — Unerror, 100G (6 ±1 ms) —
Destruction

Enclosure — Polybutylene terephthalate (PBT)

Standard Coil and Contact Combination (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
B-M (2 form C) Sensitive Type					
5	**3.6**	**12.5**	**167**	**RY-5W**	**$3.37**
6	4.3	15.0	240	RY-6W	$3.37
9	6.4	22.5	540	RY-9W	$3.37
12	**8.5**	**30.0**	**960**	**RY-12W**	**$3.37**
24	**16.8**	**51.6**	**2880**	**RY-24W**	**$3.37**
48	32.6	84.0	7680	RY-48W	$4.26
M-B (2 form D)					
5	**3.3**	**7.1**	**55**	**RY-5D**	**$3.82**
6	4.0	8.5	80	RY-6D	$3.82
9	5.9	12.8	180	RY-9D	$3.82
12	7.9	17.0	320	RY-12D	$3.82
24	15.8	34.1	1280	RY-24D	$3.82
48	31.8	65.8	4800	RY-48D	$4.71
B-M (2 form C) Standard Type					
5	**2.5**	**7.0**	**45**	**RY-5WZ-K**	**$3.20**
6	**3.0**	**8.4**	**66**	**RY-6WZ-K**	**$3.20**
9	4.5	12.6	140	RY-9WZ-K	$3.20
12	**6.0**	**16.8**	**280**	**RY-12WZ-K**	**$3.20**
24	**12.0**	**33.6**	**1070**	**RY-24WZ-K**	**$3.20**
48	**24.0**	**67.2**	**4000**	**RY-48WZ-K**	**$4.08**

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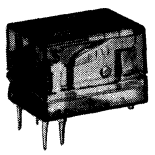
TAKAMISAWA ELECTRIC CO. LTD.

Sub Miniature Printed Circuit Board Relays

MZ RELAY



2 Amp SPDT
L — 0.606″,
W — 0.449,
H — 0.433″

CONTACT DATA

Arrangement — 1 Form C
Material — Gold overlay silver-palladium alloy
Resistance — 100 milliohms maximum (initial value)
Ratings — 50μ amps to 1 amp at 30V DC or 120V AC, resistive
2A maximum carrying current
Life Expectancy — Mechanical: 20 million operations
Electrical: 500,000 operations minimum at 1 amp 24V DC resistive load
200,000 operations minimum at 0.5 amps 120V AC resistive load

COIL DATA

Voltages — 1.5 to 24 volts DC
Power (at 20°C) —
Standard type: Operate—0.22 watt, Nominal—0.45 watt, Maximum—1 watt
High sensitive type: Operate—0.1 watt, Nominal—0.2 watt, Maximum—1 watt
Operate (at 20°C) — 70% of nominal voltage
Duty — Continuous

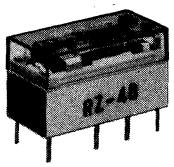
GENERAL DATA

Insulation Resistance — 100 megohms minimum at 500V DC
Dielectric Strength — 500V AC (50/60 Hz), between all insulated elements
Temperature Range — Standard type: −40°C to +55°C
(at nominal voltage) High sensitive type: −30°C to +75°C
Time Values — Operate <3 ms standard, <6 ms sensitive; release <1 ms
Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.) up to board thickness of 2.5 mm (0.98 in.)
Approximate Weight — 3.5 gr. (0.12 oz.)
Enclosure — Standard — polycarbonate
Washable or sealed — PBT

Standard Coil and Contact Combination (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Standard Types – 1A					
1.5	1.05	2.0	5	MZ-1.5HG	$2.44
3	2.1	4.1	20	MZ-3HG	$2.44
5	**3.5**	**6.8**	**56**	**MZ-5HG**	**$2.44**
6	4.2	8.1	80	MZ-6HG	$2.44
9	6.3	12.2	180	MZ-9HG	$2.44
12	**8.4**	**16.2**	**320**	**MZ-12HG**	**$2.44**
24	**16.8**	**32.4**	**1280**	**MZ-24HG**	**$2.44**
High Sensitive Types – 1A					
1.5	1.05	3.0	12	MZ-1.5HS	$2.62
3	2.1	6.0	45	MZ-3HS	$2.62
5	**3.5**	**10.0**	**120**	**MZ-5HS**	**$2.62**
6	**4.2**	**12.0**	**180**	**MZ-6HS**	**$2.62**
9	6.3	18.0	400	MZ-9HS	$2.62
12	**8.4**	**24.0**	**700**	**MZ-12HS**	**$2.62**
24	**16.8**	**48.0**	**2800**	**MZ-24HS**	**$2.62**
Standard Types – 2A					
3	2.1	4.1	28	MZD-3	$2.53
5	3.5	6.8	56	MZD-5	$2.53
6	4.2	8.1	80	MZD-6	$2.53
9	6.3	12.2	180	MZD-9	$2.53
12	**8.4**	**16.2**	**320**	**MZD-12**	**$2.53**
24	16.8	32.4	720	MZD-24	$2.53

RZ RELAYS



2 Amp DPDT
L — 0.795″,
W — 0.386″,
H — 0.457″

CONTACT DATA

Arrangement — DPDT (B-M) — RZ, RZ( )W Type
Material — Gold overlaid silver-palladium alloy
Max. Switching Power —
30W/60VA — Single Contact
30W/50VA — Bifurcated contact at resistive load
Max. Switching Current —
2A AC or DC — Single Contact
1A AC or DC — Bifurcated contact at resistive load
Max. Switching Voltage —
150V DC/125V AC — Single Contact
100V DC/90V AC — Bifurcated contact at resistive load
Contact Resistance (Pin-pin) — 100mΩ Max.
Capacitance — 1.5PF max. between open contact
0.5PF max. between adjacent change-over contact
Life Expectancy —
Mechanical: 20 million operations — Single Contact
15 million operations — Bifurcated contact
Electrical: 0.5 million operations at 1.25A 24V DC or 0.4A 125V AC at resistive load — Single contact
0.5 million operations at 0.7A 24V DC or 0.25A 125V AC at resistive load — Bifurcated contact

COIL DATA

Nominal Voltage — 3 to 48 V DC — RZ, RZ( )W Type,
3 to 24V DC — RZ1, RZ1( )W Type
Power (at 20°C) — Nominal: 515 ~ 560 mW — RZ, RZ( )W Type,
Operate: 200 ~ 324 mW — RZ, RZ( )W Type
Max: 1050 mV
Temperature Range — −40°C ~ +65°C — RZ RZ( )W Type
(at nominal voltage) −40°C ~ +75°C — RZ1 RZ1( ) Type

GENERAL DATA

Dielectric Strength — 500V AC (50/60 Hz) between open contacts, 1000V AC contact-coil
Insulation Resistance — 1000 MΩ min. at 500V DC
Timing — Operate <4 ms, release <2
Bounce Time — Approx. 1 ms on operate
Approx. 4 ms on release
Vibration Resistance — 10 to 60 Hz amplitude 1.5 mm (10G)
Shock Resistance — Destruction shock: 100G (11 ms ±1 ms)
Unerror shock: 10G (11 ms ± 1 ms)
Surge Strength — 1500V AC between all conductors

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Single Contact					
5	**3.2**	**7.0**	**45**	**RZ-5**	**$3.20**
6	**3.8**	**8.4**	**66**	**RZ-6**	**$3.20**
9	5.1	12.6	140	RZ-9	$3.20
12	**7.6**	**16.8**	**280**	**RZ-12**	**$3.20**
24	**15.2**	**33.6**	**1070**	**RZ-24**	**$3.20**
48	**36.0**	**67.2**	**4000**	**RZ-48**	**$4.08**
Bifurcated Contact					
5	3.2	7.0	45	RZW-5	$3.29
6	3.8	8.4	66	RZW-6	$3.29
9	5.7	12.6	140	RZW-9	$3.29
12	**7.6**	**16.8**	**280**	**RZW-12**	**$3.29**
24	15.2	33.6	1070	RZW-24	$3.29
48	36.0	67.2	4000	RZW-48	$4.17

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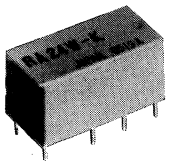
Sub Miniature Printed Circuit Board Relays

RA RELAY



1 Amp DPDT Relay
L — 0.795″
W — 0.394″
H — 0.394″

CONTACT DATA

Arrangement — 2 Form C (DPDT)
Material — Gold overlaid silver palladium alloy vs silver palladium alloy
Resistance — Max. 100 mΩ (Initial)
Rating — 24V DC 1A, or 120V AC 0.5A
Life Expectancy — Mechanical: Min. 20 million operations
Electrical: Min. 500,000 operations at 24V DC 1A
Min. 200,000 operations at 120V AC 0.5A
Max. Carrying Current — 2A

COIL DATA

Voltages — 1.5 to 48V DC
Power (at 20°C) — Operate: Standard 100—200 mW
Single winding latching 35~100 mW
Double winding latching 75~180 mW
Nominal: Standard 200~400 mW
Single winding latching 75~200 mW
Double winding latching 150~360 mW
Operate (at 20°C) — Less than 70% of nominal voltage
Duty — Continuous

GENERAL DATA

Insulation Resistance — 1000 MΩ at 500V DC
(Expect between P & S coil)
Dielectric Strength — 1000V AC between open contact
1500V AC between all other conductors
(Expect between P & S coil)
Temperature Range — −40°C~+80°C (RA-W, RA-WN, RAL-W, RAL-DW, RAL-WP, RAL-DWP)
−40°C~+70°C (RA-WM, RAL-DWM), at nominal voltage, Non carring Contact
Surge Strength — 1500V between coil and contact, adjacent contacts
Time Value (Max.) — Operate: (RA-WM, RAL-DWM) 4 mS
(RA-W, RA-WN, RAL-W, RAL-DWN, RAL-WP, RAL-DWP) 6 mS
Release: (RA-WM) 3 mS
(RA-W, RA-WN, RAL-DWM) 4 mS
(RAL-W, RAL-DWN, RAL-WP, RAL-DWP) 6 mS, at nominal voltage
Vibration Resistance — 30G (10~55 Hz) Unerror
30G (10~55 Hz) Destruction
Shock Resistance — 50G (11 ±1 mS) Unerror
100G (11 ±1 mS) Destruction
Enclosure — Polybutylene terephthalate (PBT)

Ordering Code		Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RA( )W-K TYPE						
Non-Latching						
RA	1.5W-K	1.5	15	+1.0	+0.15	$4.00
RA	3W-K	3	60	+2.0	+0.3	$4.00
RA	4.5W-K	4.5	135	+3.1	+0.45	$4.00
RA	**5W-K**	**5**	**167**	**+3.4**	**+0.5**	**$4.00**
RA	6W-K	6	240	+4.0	+0.6	$4.00
RA	9W-K	9	540	+6.1	+0.9	$4.00
RA	**12W-K**	**12**	**900**	**+8.1**	**+1.2**	**$4.00**
RA	18W-K	18	2160	+12.3	+1.8	$4.00
RA	**24W-K**	**24**	**2880**	**+16.1**	**+2.4**	**$4.00**
RA	**48W-K**	**48**	**11520**	**+32.2**	**+4.8**	**$4.88**

Ordering Code		Nominal Coil Voltage (VDC)		Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RA( )W-K TYPE) (Continued)							
Single Winding Latching							
RAL	1.5W-K	1.5		30	+1.0	−1.0	$4.44
RAL	3W-K	3		120	+2.1	−2.1	$4.44
RAL	4.5W-K	4.5		270	+3.1	−3.1	$4.44
RAL	5W-K	5		335	+3.4	−3.4	$4.44
RA	6W-K	6		480	+4.1	−4.1	$4.44
RAL	9W-K	9		1080	+6.3	−6.3	$4.44
RAL	**12W-K**	**12**		**1920**	**+8.3**	**−8.3**	**$4.44**
RAL	18W-K	18		4320	+12.5	−12.5	$4.44
RAL	24W-K	24		5760	+16.6	−16.6	$4.44
RAL	48W-K	48		11520	+21.0	−21.0	$5.33
Double Winding Latching							
RAL	D1.5W-K	1.5	P/S	15	+1.0*	+1.0*	$4.66
RAL	D3W-K	3	P/S	60	+2.0*	+2.0**	$4.66
RAL	D4.5W-K	4.5	P/S	135	+3.1*	+3.1**	$4.66
RAL	**D5W-K**	**5**	**P/S**	**167**	**+3.4***	**+3.4****	**$4.66**
RAL	D6W-K	6	P/S	240	+4.0*	+4.0**	$4.66
RAL	D9W-K	9	P/S	540	+6.1*	+6.1*	$4.66
RAL	**D12W-K**	**12**	**P/S**	**960**	**+8.1***	**+8.1****	**$4.66**
RAL	18W-K	18	P/S	2160	+12.3*	+12.3*	$4.66
RAL	**D24W-K**	**24**	**P/S**	**2880**	**+16.1***	**+16.1****	**$4.66**
RAL	D48W-K	48	P/S	11520	+32.2*	+32.2*	$7.37
RA( )WN-K TYPE							
Non-Latching							
RA	1.5WN-K	1.5		11.3	+1.0	+0.15	$3.92
RA	3WN-K	3		45	+2.0	+0.3	$3.92
RA	4.5WN-K	4.5		100	+3.1	+0.45	$3.92
RA	5WN-K	5		125	+3.4	+0.5	$3.92
RA	6WN-K	6		180	+4.0	+0.6	$3.92
RA	9WN-K	9		405	+6.1	+0.9	$3.92
RA	12WN-K	12		720	+8.1	+1.2	$3.92
RA	18WN-K	18		1620	+12.3	+1.8	$3.92
Double Winding Latching							
RAL	D1.5WN-K	1.5	P/S	12.5	+1.0*	+1.0**	$4.57
RAL	D3WN-K	3	P/S	50	+2.0*	+2.0**	$4.57
RAL	D4.5WN-K	4.5	P/S	113	+3.1*	+3.1**	$4.57
RAL	D5WN-K	5	P/S	139	+3.4*	+3.4**	$4.57
RAL	D6WN-K	6	P/S	200	+4.0*	+4.0**	$4.57
RAL	D9WN-K	9	P/S	450	+6.1*	+6.1**	$4.57
RAL	D12WN-K	12	P/S	800	+8.1*	+8.1**	$4.57
RAL	D18WN-K	18	P/S	1800	+12.3*	+12.3**	$4.57
RA( )WM-K TYPE							
Non-Latching							
RA	1.5WM-K	1.5		5.63	+0.9	+0.15	$3.82
RA	3WM-K	3		22.5	+1.9	+0.3	$3.82
RA	4.5WM-K	4.5		50.6	+2.9	+0.45	$3.82
RA	**5WM-K**	**5**		**62.5**	**+3.3**	**+0.5**	**$3.82**
RA4	6WM-K	6		90.0	+3.9	+0.6	$3.82
RA4	9WM-K	9		203.0	+5.9	+0.9	$3.82
RA	**12WM-K**	**12**		**360.0**	**+7.9**	**+1.2**	**$3.82**
RA	18WM-K	18		810.0	+11.8	+1.8	$3.82
RA	**24WM-K**	**24**		**1440**	**+15.8**	**+2.4**	**$3.82**
RA	**48WM-K**	**48**		**5760**	**+31.6**	**+4.8**	**$4.71**
Double Winding Latching							
RAL	1.5WM-K	1.5	P/S	6.2	+1.0*	+1.0**	$4.48
RAL	D3WM-K	3	P/S	25	+2.0*	+2.0**	$4.48
RAL	D4.5WM-K	4.5	P/S	56	+3.0*	+3.0**	$4.48
RAL	**D5WM-K**	**5**	**P/S**	**69**	**+3.3***	**+3.3****	**$4.48**
RAL	D6WM-K	6	P/S	100	+4.0*	+4.0**	$4.48
RAL	D9WM-K	9	P/S	225	+6.0*	+6.0*	$4.48
RAL	**D12WM-K**	**12**	**P/S**	**400**	**+8.0***	**+8.0****	**$4.48**
RAL	18WM-K	18	P/S	900	+12.0*	+12.0**	$4.48
RAL	**D24WM-K**	**24**	**P/S**	**1600**	**+16.0***	**+16.0****	**$4.48**
RAL	D48WM-K	48	P/S	6400	+32.1*	+32.1*	$7.10

Notes: • If correct polarity is not applied to the coil terminals, relay does not operate properly.
• To release latched contact, polarity to be applied to coil terminals should be reversed.

* P only. ** S only.

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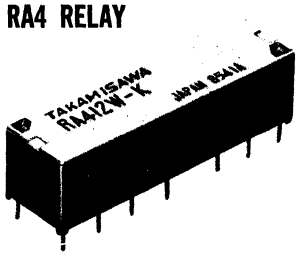
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

RA4 RELAY



1 Amp 4PDT
L — 1.387″,
W — 0.390″,
H — 0.433″

CONTACT DATA

Arrangement — 4 Form C (4PDT)

Material — Gold overlaid silver palladium alloy vs silver palladium alloy

Resistance — Max. 100 mΩ

Ratings — 120V AC 0.5A, 24V DC 1A (Resistive)

Max. Current — 2A

Life Expectancy Mechanical — Min. 20 million operations

Electrical — Min. 500,000 operations at 24V DC
Min. 200,000 operations at 120V AC 0.5A

COIL DATA

Voltages — 1.5 to 48V DC Power (at 20°C)

Type	RA4, RA4L		RA4-M, RA4L-M	
	Operate	Nominal	Operate	Nominal
Single Winding Non Latching	0.1W	0.2W	0.2W	0.4W
Single Winding Latching	0.045W	0.09W		
Double Winding Latching	0.09W	0.18W	0.18W	0.36W

Operate (at 20°C) 70% of nominal voltage
Pulse Length—20ms min.

GENERAL DATA

Insulation Resistance — 1000 mΩ min. at 500V DC

Dielectric Strength — 1000V AC between open contacts
1500V AC btween all other conductors

Temperature Range — −40°C ~ +80°C (RA4, RA4L),
−40°C ~ +70°C (RA4-M, RA4L-M)

Surge Strength — 1500V between coil and contact, adjacent contacts

Time Value — Operate: 6 msec max.
Release: 4 msec max.

Vibration Resistance — 30G (10 ~ 55 Hz) Destructive
20G (10 ~ 55 Hz) Unerring
} reference value

Shock Resistance — 100G (6 ±1 msec) Destructive
30G (11 ±1 msec) Unerring
} reference value

Enclosure — PBT

ORDERING INFORMATION

RA4 L D 12 W M —K

- —K: Enclosure K: Washable
- M: Coil Sensitivity Nill: HighSensitive Power, M: Standard
- W: Contact W: Bifurcated
- 12: Nominal Coil Voltage
- D: Coil Winding Nill: Single Winding, D: Double Windings
- L: Type of Relays Nill: Non Latching Type, L: Latching Type
- RA4: Type

Ordering Code		Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
Standard						
RA4	1.5W-K	1.5	11	+1.0	0.15	$ 9.10
RA4	3W-K	3	45	+2.1	0.3	$ 9.10
RA4	4.5W-K	4.5	101	+3.1	0.45	$ 9.10
RA4	**5W-K**	**5**	**125**	**+3.5**	**0.5**	**$ 9.10**
RA4	6W-K	6	180	+4.2	0.6	$ 9.10
RA4	9W-K	9	405	+6.3	0.9	$ 9.10
RA4	**12W-K**	**12**	**720**	**+8.4**	**1.2**	**$ 9.10**
RA4	18W-K	18	1620	+12.6	1.8	$ 9.10
RA4	**24W-K**	**24**	**2880**	**+16.8**	**2.4**	**$ 9.10**
RA4	**48W-K**	**48**	**11520**	**+33.6**	**4.8**	**$11.06**
RA4	1.5WM-K	1.5	5.63	+1.0	0.15	$ 8.66
RA4	3WM-K	3	22.5	+2.1	0.3	$ 8.66
RA4	4.5WM-K	4.5	50.6	+3.1	0.45	$ 8.66
RA4	**5WM-K**	**5**	**62.5**	**+3.5**	**0.5**	**$ 8.66**
RA4	6WM-K	6	90	+4.2	0.6	$ 8.66
RA4	9WM-K	9	203	+6.3	0.9	$ 8.66
RA4	**12WM-K**	**12**	**360**	**+8.4**	**1.2**	**$ 8.66**
RA4	18WM-K	18	810	+12.6	1.8	$ 8.66
RA4	**24WM-K**	**24**	**1440**	**+16.8**	**2.4**	**$ 8.66**
RA4	**48WM-K**	**48**	**5760**	**+33.6**	**4.8**	**$10.52**
Single winding latching						
RA4L	1.5W-K	1.5	25	+1.0	−1.0	$ 9.50
RA4L	3W-K	3	100	+2.1	−2.1	$ 9.50
RA4L	4.5W-K	4.5	225	+3.1	−3.1	$ 9.50
RA4L	5W-K	5	278	+3.5	−3.5	$ 9.50
RA4L	6W-K	6	400	+4.2	−4.2	$ 9.50
RA4L	9W-K	9	900	+6.3	−6.3	$ 9.50
RA4L	**12W-K**	**12**	**1600**	**+8.4**	**−8.4**	**$ 9.50**
RA4L	18W-K	18	3600	+12.6	−12.6	$ 9.50
RA4L	24W-K	24	6400	+16.8	−16.8	$ 9.50
RA4L	48W-K	48	25600	+33.6	−33.6	$11.46
Double winding latching						
RA4L	D1.5W-K	1.5	P/S	12.5	+1.0	+1.0	$ 9.63
RA4L	D3W-K	3	P/S	50	+2.1	+2.1	$ 9.63
RA4L	D4.5W-K	4.5	P/S	113	+3.1	+3.1	$ 9.63
RA4L	**D5W-K**	**5**	**P/S**	**139**	**+3.5**	**+3.5**	**$ 9.63**
RA4L	D6W-K	6	P/S	200	+4.2	+4.2	$ 9.63
RA4L	D9W-K	9	P/S	450	+6.3	+6.3	$ 9.63
RA4L	**D12W-K**	**12**	**P/S**	**800**	**+8.4**	**+8.4**	**$ 9.63**
RA4L	D18W-K	18	P/S	1800	+12.6	+12.6	$ 9.63
RA4L	**D24W-K**	**24**	**P/S**	**3200**	**+16.8**	**+16.8**	**$ 9.63**
RA4L	**D48W-K**	**48**	**P/S**	**12800**	**+33.6**	**+33.6**	**$11.59**
RA4L	D1.5WM-K	1.5	P/S	6.3	+1.0	+1.0	$ 9.19
RA4L	D3WM-K	3	P/S	25	+2.1	+2.1	$ 9.19
RA4L	D4.5WM-K	4.5	P/S	56	+3.1	+3.1	$ 9.19
RA4L	**D5WM-K**	**5**	**P/S**	**69**	**+3.5**	**+3.5**	**$ 9.19**
RA4L	D6WM-K	6	P/S	100	+4.2	+4.2	$ 9.19
RA4L	D9WM-K	9	P/S	225	+6.3	+6.3	$ 9.19
RA4L	**D12WM-K**	**12**	**P/S**	**400**	**+8.4**	**+8.4**	**$ 9.19**
RA4L	D18WM-K	18	P/S	900	+12.6	+12.6	$ 9.19
RA4L	**D24WM-K**	**24**	**P/S**	**1600**	**+16.8**	**+16.8**	**$ 9.19**
RA4L	**D48WM-K**	**48**	**P/S**	**6400**	**+33.6**	**+33.6**	**$11.06**

Notes

- As to the positive (+) symbol of each value, such as working voltage, positive working voltage, open voltage and reverse working voltage, positive (+) electrode of power source should be connected to the positive (+) terminal of pin arrangements.
- Reverse working voltage for wirewound latch type.
  As to the negative (−) symbol, positive (+) electrode of power source should be connected to negative (−) terminal of pin arrangements.

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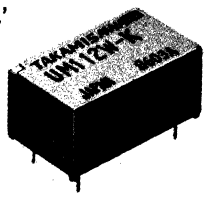
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature RF Printed Circuit Board Relays

UM RELAY

0.1 Amp SPDT W — 0.449", L —0.787", H — 0.394"



CONTACT DATA
Arrangement — 1 form C (SPDT bifurcated)
Ratings — 24V DC 10 mA, 1W at 900 MHz
Resistance — 100 mΩ max. (initial value)
Max. Current — 100 mA DC
Max. Voltage — 30V DC
Max. Power — 1W DC, 10W at 900 MHz
Life Expectancy — Mechanical: 1,000,000 operations min.
Electrical: 300,000 operating min. at rated load

COIL DATA
Voltage — 1.5 to 48V DC
Power — (at 20°C)

Type	Operate	Nominal
Single Winding Non Latching	0.1W (0.11W for 48V coil)	0.2W (0.22W for 48V coil)
Single Winding Latching	0.1W	0.2W
Double Winding Latching	0.2W	0.4W

Operate wattage less than 70% of nominal voltage

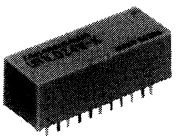
GENERAL DATA
Insulation Resistance — 1000 MΩ min. at 500V DC (UMIL-D, except between P.S. Coil)
Dielectric Strength — 500V AC between open contacts, between contacts and earth
1000V AC between coil and other terminals
Temperature Range — −30°C ~ +80°C at nominal voltage
Time Value — 6 msec max. at nominal voltage (UMI Release Time 5 ms)
Vibration Resistance — 30G (10 ~ 55 Hz) Destructive
20G (10 ~ 55 Hz) Unerring } reference value
Shock Resistance — 100G (6 msec) Destructive
50G (11 msec) Unerring } reference value

HIGH FREQUENCY CHARACTERISTICS
Isolation — 60 dB min. at 900 MHz
Insertion Loss — 1 dB max. at 900 MHz
V.S.W.R. — 1.2 max. at 900 MHZ
(Impedance of the measuring devices is 75Ω)

Ordering Code		Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
Standard						
UM1	3W-K	3	45	+2.1	+0.3	$5.77
UM1	**5W-K**	**5**	**125**	**+2.1**	**+0.3**	**$5.77**
UM1	6W-K	6	180	+4.2	+0.6	$5.77
UM1	9W-K	9	405	+6.3	+0.9	$5.77
UM1	**12W-K**	**12**	**720**	**+8.4**	**+1.2**	**$5.77**
UM1	18W-K	18	1620	+12.6	+1.8	$5.77
UM1	**24W-K**	**24**	**2880**	**+16.8**	**+2.4**	**$5.77**
UM1	48W-K	48	10472	+33.6	+4.8	$7.37
Single Winding Latching						
UM1L	3W-K	3	45	+2.1	−2.1	$6.35
UM1L	5W-K	5	125	+3.5	−3.5	$6.35
UM1L	6W-K	6	180	+4.2	−4.2	$6.35
UM1L	9W-K	9	405	+6.3	−6.3	$6.35
UM1L	**12W-K**	**12**	**720**	**+8.4**	**−8.4**	**$6.35**
UM1	18W-K	18	1620	+12.6	−12.6	$6.35
UM1L	24W-K	24	2880	+16.8	−16.8	$6.35
UM1L	48W-K	48	11520	+33.6	−33.6	$7.95
Double Winding Latching						
UM1L	3W-K	3	22.5	+2.1	−2.1	$6.84
UM1L	5W-K	5	62.5	+3.5	−3.5	$6.84
UM1L	6W-K	6	90	+4.2	−4.2	$6.84
UM1L	9W-K	9	202.5	+6.3	−6.3	$6.84
UM1L	**12W-K**	**12**	**360**	**+8.4**	**−8.4**	**$6.84**
UM1	18W-K	18	910	+12.6	−12.6	$6.84
UM1L	24W-K	24	1440	+16.8	−16.8	$6.84
UM1L	48W-K	48	5760	+33.6	−33.6	$8.44

Notes
- As to the positive (+) symbol of each value, such as working voltage, positive working voltage, open voltage and reverse working voltage, positive (+) electrode of power source should be connected to the positive (+) terminal of pin arrangements.
- Reverse working voltage for wirewound latch type.
As to the negative (−) symbol, positive (+) electrode of power source should be connected to negative (−) terminal of pin arrangements.

UR RELAY



L-1.291"
W-0.504"
H-0.425"

CONTACT DATA
Arrangement—2 Form C (DPDT bifurcated contact)
Ratings—24VDC 10mA, 1W at 900 MHz
Resistance—100 mΩ max. (Initial value)
Max. Current—100 mA DC
Max. Voltage—30 VDC
Max. Power—1WDC, 10W at 900 MHz
Life Expectancy—Mechanical: 1,000,000 operations min.
Electrical: 300,000 operations min.

COIL DATA
Voltage—1.5 to 48 VDC **Power**—(at 20°C)

Type	Operate	Nominal
Single winding non latching	0.18W (0.2W for 48V coil)	0.36W (0.39W for 48V coil)
Single winding latching	0.125W	0.25W
Double winding latching	0.25W (0.28W for 48V coil)	0.5W (0.55W for 48V coil)

GENERAL DATA
Insulation Resistance—1000MΩ min. at 500 VDC (Except between P & S Coil)
Dielectric Strength—500VAC between open contact, between contact & Shield terminals 1000VAC between coil & other terminals
Temperature Range—−30°C ~+80°C at nominal voltage
Time Value—approx. 6 ms at nominal voltage
Vibration Resistance—30G (10~ 55Hz)...Destructive
20G (10~ 55Hz)...Unerring
Shock Resistance—100G (6ms)...Destructive
50G (11ms)...Unerring
Reference value

TABLE-1 Non Latching type

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ± 10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
UR1—1.5W-K	1.5	5.3	+1.05	+0.08	10.92
UR1—3W-K	3	25	+2.1	+0.15	10.92
UR1—4.5W-K	4.5	56.3	+3.15	+0.23	10.92
UR1—5W-K	**5**	**69.5**	**+3.5**	**+0.25**	**10.92**
UR1—6W-K	6	100	+4.2	+0.3	10.92
UR1—9W-K	9	225	+6.3	+0.45	10.92
UR1—12W-K	**12**	**400**	**+8.4**	**+0.6**	**10.92**
UR1—18W-K	18	900	+12.6	+0.9	10.92
UR1—24W-K	**24**	**1600**	**+16.8**	**+1.2**	**10.92**
UR1—48W-K	48	5900	+33.6	+2.4	12.52

TABLE-2 Single winding latching type

UR1L—1.5W-K	1.5	9	+1.05	−1.05	11.06
UR1L—3W-K	3	36	+2.1	−2.1	11.06
UR1L—4.5W-K	4.5	81	+3.15	−3.15	11.06
UR1L—5W-K	5	100	+3.5	−3.5	11.06
UR1L—6W-K	6	144	+4.2	−4.2	11.06
UR1L—9W-K	9	324	+6.3	−6.3	11.06
UR1L—12W-K	**12**	**576**	**+8.4**	**−8.4**	**11.06**
UR1L—18W-K	18	1296	+12.6	−12.6	11.06
UR1L—24W-K	24	2304	+16.8	−16.8	11.06
UR1L—48W-K	48	9216	+33.6	−33.6	12.65

TABLE-3 Double winding latching type

UR1L—D1.5W-K	1.5	P S	4.5 4.5	+1.05	+1.05	11.59
UR1L—D3W-K	3	P S	18 18	+2.1	+2.1	11.59
UR1L—D4.5W-K	4.5	P S	40.5 40.5	+3.15	+3.15	11.59
UR1L—D5W-K	5	P S	50 50	+3.5	+3.5	11.59
UR1L—D6W-K	6	P S	72 72	+4.2	+4.2	11.59
UR1L—D9W-K	9	P S	162 162	+6.3	+6.3	11.59
UR1L—D12W-K	**12**	**P** **S**	**288** **288**	**+8.4**	**+8.4**	11.59
UR1L—D18W-K	18	P S	648 648	+12.6	+12.6	11.59
UR1L—D24W-K	24	P S	1152 1152	+16.8	+16.8	11.59
UR1L—D48W-K	48	P S	4189 4189	+33.6	+33.6	13.19

Notes • If correct polarity is not applied to the coil terminals, relay does not operate properly. • To release latched contact, polarity to be applied to coil terminals should be reversed. • Since this is the polarized relay, Confirm the relays performance in the actual circuit, prior to use. When relays are expected to be mounted very closely together or to be used under strong magnetic fields.

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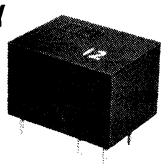
TAKAMISAWA ELECTRIC CO., LTD.

Miniature General Purpose Relays

LZ RELAY



5 Amp SPDT
L — 0.843″
W — 0.646″
H — 0.583″

CONTACT DATA

Arrangement — 1 Form C

Material — 5A type: Gold overlay silver-nickel alloy (single)
3A type: Gold overlay silver (single)
1A type: Gold overlay silver-palladium alloy (bifurcated)

Load — 5A type: 5A @ 30V DC or 120V AC, 4A @ 240V AC resistive, ⅛ HP
3A type: 3A @ 30V DC or 120V AC, 2.5A @ 240V AC resistive, 1/10 HP
1A type: 1A @ 30V DC or 120V AC, resistive

Life — Mechanical: 20 million operations minimum
Electrical: 0.1 x 10^6 operations minimum at rated load

Timing — Operate: < 5 ms (standard type), < 6 ms (high sensitive type)
Release: < 2 ms

COIL DATA (@ 20°C)

Operate Power — 210 mW (standard type), 150 mW (high sensitive type)

Nominal Power — 450 mW (standard type), 330 mW (high sensitive type)

Maximum Power — 1.4W

GENERAL DATA

Insulation Resistance — 250 MΩ at 500V DC

Dielectric Strength — 750V AC between open contacts
2000V AC between all other points

Temperature Range — standard type −40°C to +70°C
sensitive type −40°C to +80°C

Vibration Resistance — 15G (10-55 Hz)

Shock Resistance — 15G (11 ms ±1 ms)

Approximate Weight — 8 gr (0.28 oz.)

Enclosure — Standard — polycarbonate
Washable or sealed — PBT

Surge Strength — 3000V

Standard Coil and Contact Combinations (20°C)

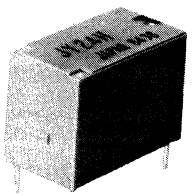
Nominal Voltage	Pull-In Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code 5A*	Ordering Code 3A	Ordering Code List Price
Standard types						
5	**3.25**	**8.3**	**56**	**LZ-5H**	**LZ-5**	**$2.62**
6	3.90	9.9	80	LZ-6H	LZ-6	$2.62
9	5.85	14.9	180	LZ-9H	LZ-9	$2.62
12	**7.80**	**19.8**	**320**	**LZ-12H**	**LZ-12**	**$2.62**
24	**15.6**	**39.6**	**1280**	**LZ-24H**	**LZ-24**	**$2.62**
48	28.8	79.2	3800	LZ-48H	LZ-48	$3.02
High sensitive types						
5	**3.25**	**9.8**	**80**	**LZ-5HS**	**LZ-5S**	**$2.71**
6	3.90	11.7	110	LZ-6HS	LZ-6S	$2.71
9	5.85	17.6	250	LZ-9HS	LZ-9S	$2.71
12	**7.80**	**23.4**	**440**	**LZ-12HS**	**LZ-12S**	**$2.71**
24	**15.6**	**45.6**	**1780**	**LZ-24HS**	**LZ-24S**	**$2.71**

*Add 5% to List Price

S PST-NO 10A type

5	**3.25**	**NA**	**56**	**ZLVM-5**	**$2.89**
6	3.9	NA	80	LZVM-6	$2.89
9	5.85	NA	180	LZVM-9	$2.89
12	**7.8**	**NA**	**320**	**LZVM-12**	**$2.89**
24	15.6	NA	1280	LZVM-24	$2.89
48	28.8	NA	3800	LZVM-48	$3.29

JY RELAYS



5 Amp SPST-NO
L —0.795″
W—0.394″
H —0.504″

CONTACT DATA

Arrangement — 1 Form A (SPST-N.O.)

Material & Rating —
JY-( )H, JY-( ) — Gold plated silver cadmium oxide alloy
JY-( )H — 5A, 30V DC or 250V AC resistive
JY-( ) — 3A, 30V DC or 250V AC resistive

Life Expectancy — Mechanical — 20 million operations
Electrical — 100,000 operations at rated load

COIL DATA

Voltage — JY- 4.5 to 24V DC

Power (at 20°C) — JY- Nominal 0.2W
JY- Operate 0.098W

Max. Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — Min. 1000MΩ at 500V DC

Dielectric Strength — JY- 750V AC (50/60 Hz) between open contacts

Surge Strength — 6000V (1 x 40μs)

Temperature Range (at Nominal Voltage) —
JY- −40°C to +80°C — Non-carrying condition of contacts

Time Value — Operate Max. 10ms
Release Max. 10ms

Weight — 5gr (Approx.)

Enclosure — PBT

Standard Coil and Contact Combinations

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance	Ordering Code	List Price
5	**3.5**	**11.5**	**125**	**JY-5-H-K**	**$3.73**
6	4.2	13.8	180	JY-6-H-K	$3.73
9	6.3	20.7	405	JY-9-H-K	$3.73
12	**8.4**	**27.6**	**720**	**JY-12-H-K**	**$3.73**
18	**12.6**	**41.4**	**1620**	**JY-18-H-K**	**$3.73**
24	**16.8**	**55.2**	**2880**	**JY-24-H-K**	**$3.73**
JY Socket				JK-4N	$1.41

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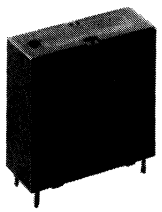
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature General Purpose Relays

VE RELAY



CONTACT DATA

Arrangement—1 Form A (SPST-NO)
or 1 Form C (SPDT)

Material & Rating

Type	Material	Contact Rating*	
		N.O.	N.C.
VE-( )H	Gold overlay silver-nickel alloy	5A	3A
VE-( )HE	Silver-nickel alloy		
VE-( )H5	Silver-cadmium oxide alloy	5A	5A

*250 VAC resistive

Resistance (Initial)— 70 mΩ.....VVE-( ) H
100 mΩ (6VDC.1A).....VVE-( ) HE
200 mΩ (6VDC.1A).....VVE-( ) H5

Life Expectancy—Mechanical: 10 million operations
Electrical: 100,000 operations

COIL DATA

Voltage—5 to 48 VDC

Power (at 20°C)—

	Standard	High Sensitive
Nominal Operate	0.36 W 0.18 W	0.25 W 0.13 W

Operate (at 20°C)—70% of nominal voltage

GENERAL DATA

Insulation Resistance—1000 MΩ min, at 500 VDC

Dielectric Strength—750 VAC (50/60 Hz) between open contact (N.C.),
1000 VAC (50/60 Hz) between open contact (N,O)
2000 VAC (50/60 Hz) between all other conductor

Surge Strength—4000 V or 6000 V

Temperature Range—Standard type −40°C ~ +85°C
High sensitive type −40°C ~ +90°C
} Non-carring condition of contacts

Time Value (at nominal voltage)—Operate Max. 10 ms
Release Max. 5 ms

Weight—Approx. 8 gr

Vibration Resistance*—10 ~ 55 Hz (Double amplitude of 3.3mm)
.....Destructive, Unerring

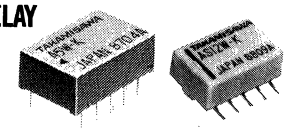
Shock Resistance*—50 G (11±1 ms).....Destructive
(*Reference Value) 10 G (11±1 ms).....Unerring

Enclosure - PBT

Ordering Code	Nominal Voltage V DC	Coil Resistance Ω±10%	Must Operate Voltage VDC	List Price 3A	List Price 5A
Standard types					
VE-( ) H E-K VE-( ) H 5-K	5	69	Nominal Voltage ×70%	2.31	2.40
	6	100		2.31	2.40
	9	225		2.31	2.40
	12	400		2.31	2.40
	14	544		2.31	2.40
	18	900		2.31	2.40
	24	1600		2.31	2.40
	48	6400		2.66	2.75
High Sensitive types					
VE-( ) H SE-K VE-( ) H S5-K	5	100	Nominal Voltage ×70%	2.40	2.49
	6	145		2.40	2.49
	9	325		2.40	2.49
	12	575		2.40	2.49
	14	790		2.40	2.49
	18	1300		2.40	2.49
	24	2310		2.40	2.49
	48	9220		2.75	2.93

A/AS RELAY

L—0.551″,
W—0.354″,
H—0.197″



CONTACT DATA

Arrangement—2FormC (DPDT)
Material—Stationary...Gold overlaid silver palladium
Movable...Silver palladium
Resistance—Max. 100mΩ (Initial)
Rating—1A 30V DC or 0.5A 125V AC (Resistive)
Life expectancy—Mechanical: Min 100 million operations
Electrical: Min 500,000 operations at 1A 30V DC
: Min 200,000 operations at 0.5A 125V AC

COIL DATA

Voltages—4.5 to 48V DC
Power (at 20°C)—Operate 0.07W (0.11W for 24V coil)
Nominal 0.14W (0.2W for 24V coil)
Operate (at 20°C)—70% of nominal voltage
Duty—Continuous.

GENERAL DATA

Insulation resistance—Min. 1000MΩ at 500V DC
Dielectric strength—1000V AC between open contact, coil-contact, adjacent contact
Surge strength—1500V
Temperature range—−40°C ~ +85°C at nominal voltage
Time Value (at nominal voltage)—Operate Max. 6mS Release Max. 4mS
Vibration Resistance—10 to 55Hz amplitude 3mm...Unerring
10 to 55Hz amplitude 5mm...Destructive
} Reference Value
Shock Resistance—50G (11 mS)...Unerring
100G (6mS)...Destructive

Enclosure—PBT

Notes:
- Since this is the polarized relay, confirm the relays performance in the actual circuit, prior to use. When relays are expected to be mounted very closely together or to be used under strong magnetic fields.

Single Winding Non-Latching — **Substitute AS Prefix for SMD Type**

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ± 10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
A—3W-K	3	64.3	+2.1	+0.3	4.44
A—4.5W-K	**4.5**	**145**	**+3.15**	**+0.45**	**4.44**
A—5W-K	**5**	**178**	**+3.5**	**+0.5**	**4.44**
A—6W-K	6	257	+4.2	+0.6	4.44
A—9W-K	9	579	+6.3	+0.9	4.44
A—12W-K	**12**	**1028**	**+8.4**	**+1.2**	**4.44**
A—18W-K	18	1620	+12.6	+1.8	4.44
A—24W-K	**24**	**2880**	**+16.8**	**+2.4**	**4.44**
A—48W-K	**48**	**7680**	**+33.6**	**+4.8**	**4.80**

Single Winding Latching

AL—3W-K	3	90	+2.1	−2.1	4.80
AL—4.5W-K	4.5	203	+3.15	−3.15	4.80
AL—5W-K	5	250	+3.5	−3.5	4.80
AL—6W-K	6	360	+4.2	−4.2	4.80
AL—9W-K	9	810	+6.3	−6.3	4.80
AL—12W-K	**12**	**1440**	**+8.4**	**−8.4**	**4.80**
AL—18W-K	18	2160	+12.6	−12.6	4.80
AL—24W-K	24	3840	+16.8	−16.8	4.80

Double Winding Latching

AL—D3W-K	3	P S	45 45	+2.1	+2.1	5.15
AL—D4.5W-K	4.5	P S	101 101	+3.15	+3.15	5.15
AL—D5W-K	**5**	**P** **S**	**125** **125**	**+3.5**	**+3.5**	**5.15**
AL—D6W-K	6	P S	180 180	+4.2	+4.2	5.15
AL—D9W-K	9	P S	405 405	+6.3	+6.3	5.15
AL—D12W-K	**12**	**P** **S**	**720** **720**	**+8.4**	**+8.4**	**5.15**
AL—D18W-K	18	P S	1080 1080	+12.6	+12.6	5.15
AL—D24W-K	**24**	**P** **S**	**1920** **1920**	**+16.8**	**+16.8**	**5.15**

P: Single Winding Coil, S: Double Winding Coil

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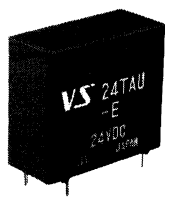
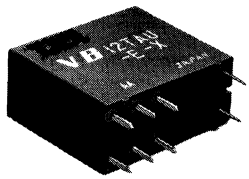
TAKAMISAWA ELECTRIC CO., LTD.

Miniature Power Relays

VB/VS RELAY





L — 1.150″
W — 0.508″
H — 0.996″

CONTACT DATA

Arrangement—1 Form A or C 15/10 Amp (VS)
2 Form C 5 Amp (VB)

Material—Silver Nickel (Standard), silver tin oxide (15A)

Rating—5 10/15 Amp at 24V DC or 240V AC
1/6 or 1/3 HP 120V AC motor load

Inrush Current — 51 or 78A at 120 V AC

Max. Carrying Current — SPDT 14A, DPDT 7A

Life Expectancy — Mechanical 5 million operations
Electrical: 100,000 operations at 5 or 10A 24V DC or 240V AC
200,000 operations at 5 or 10A 120V AC resistive
3.5 or 7A 24V DC or 240V AC
30,000 operations at 1/6 or 1/3 120V AC motor load

COIL DATA

Nominal Voltage — 3 to 60V DC

Power (at 20°C) — Nominal: 0.72W Standard Type
0.53W High Sensitive Type
Operate: 0.35W Standard Type
0.26W High Sensitive Type
Maximum: 1.4W

GENERAL

Dielectric Strength — Min. 1000V AC between open contact
Min. 5000V AC between all other conductors

Insulation Resistance — Min. 1000MΩ at 500V DC between conductors

Surge Strength — 10,000V.

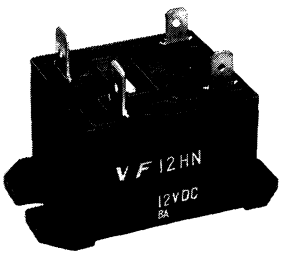
Temperature Range — (TV types) −40°C to +50°C
Standard types) −40°C to +65°C
(Sensitive types) −40°C to +75°C

Enclosure Standard — Polycarbonate
— Washable — PBT

Standard Coil and Contact Combinations

Type	Nominal Voltage DC (V)	Coil Resistance —10% at 20°C (V)	Must Operate Voltage at 20°C (V)	Ordering Code	List Price
Standard types					
SPDT 16A	5	36	3.5	VSB- 5TB	$3.69
	6	50	4.2	VSB- 6TB	$3.69
	12	200	8.4	VSB-12TB	$3.69
	24	820	16.8	VSB-24TB	$3.69
SPDT 10A	5	36	3.5	VS- 5TBU-E	$3.33
	6	50	4.2	VS- 6TBU-E	$3.33
	12	200	8.4	VS-12TBU-E	$3.33
	24	820	16.8	VS-24TBU-E	$3.33
DPDT 5A	5	36	3.5	VB- 5TBU-E	$3.82
	6	50	4.2	VB- 6TBU-E	$3.82
	12	200	8.4	VB-12TBU-E	$3.82
	24	820	16.8	VB-24TBU-E	$3.82
High Sensitive Types					
SPDT 16A	5	47	3.5	VSB- 5STB	$3.77
	6	68	4.2	VSB- 6STB	$3.77
	12	270	8.4	VSB-12STB	$3.77
	24	1100	16.8	VSB-24STB	$3.77
SPDT 10A	5	47	3.5	VS- 5STBU-E	$3.53
	6	68	4.2	VS- 6STBU-E	$3.53
	12	270	8.4	VS-12STBU-E	$3.53
	24	1100	16.8	VS-24STBU-E	$3.53
DPDT 5A	5	47	3.5	VB- 5STBU-E	$4.04
	6	68	4.2	VB- 6STBU-E	$4.04
	12	270	8.4	VB-12STBU-E	$4.04
	24	1100	16.8	VB-24STBU-E	$4.04

VF RELAY



L — 1.968″
W — 1.268″
H — 0.949″

CONTACT DATA

Arrangement — 1 Form A

Material — Silver Alloy

Rating: See Table

Classification	Rating		Maximum Inrush Current
	Resistive	Motor Load	
H	30A 250V AC	2HP 25A 250V AC	70A 200V AC
M	25A 250V AC	1.5HP 20A 250V AC	60A 200V AC
L	20A 250V AC	1HP 15A 250V AC	55A 100V AC

Maximum Carry Current — 30A

Life Expectancy — Mechanical: 5 million operations
Electrical: 200,000 operations at motor load
100,000 operations at resistive load

COIL DATA

Nominal Voltage — 3 to 60V DC

Power (at 20°C) — Nominal: 1.2W
Operate: 0.59W
Maximum: 3.0W

GENERAL DATA

Dielectric Strength — 1200V AC between open contacts
4000V AC between all other conductors

Insulation Resistance — 1000MΩ (min.) at 500V DC

Surge Voltage — 10,000V

Timing (approx.) — Operate: 15ms at nominal
Release: 3ms at nominal

Temperature Range — −40°C to +70°C

Weight — 55 gr

Vibration — 10 - 55Hz

Shock — 20G

Enclosure Cover — Cover — Polycarbonate (PC)
— Base — Polyetherimide (PEI)

Standard Coil and Contact Combinations

Coil Data at 20°C			Ordering Code		
Nominal Coil Voltage	Coil Resistance in Ohms ±10%	Must Operate Voltage	Quick Connect Terminals	PCB Coil Terminals	List Price
6	30	4.2	VF- 6HU	VFB- 6HU	$8.88
12	120	8.4	VF-12HU	VFB-12HU	$8.88
24	480	16.8	VF-24HU	VFB-24HU	$8.88
48	1920	33.6	VF-48HU	VFB-48HU	$8.88
6	30	4.2	VF- 6MU	VFB- 6MU	$8.17
12	120	8.4	VF-12MU	VFB-12MU	$8.17
24	480	16.8	VF-24MU	VFB-24MU	$8.17
48	1920	33.6	VF-48MU	VFB-48MU	$8.17
6	30	4.2	VF- 6LU	VFB- 6LU	$7.55
12	120	8.4	VF-12LU	VFB-12LU	$7.55
24	480	16.8	VF-24LU	VFB-24LU	$7.55
48	1920	33.6	VF-48LU	VFB-48LU	$7.55

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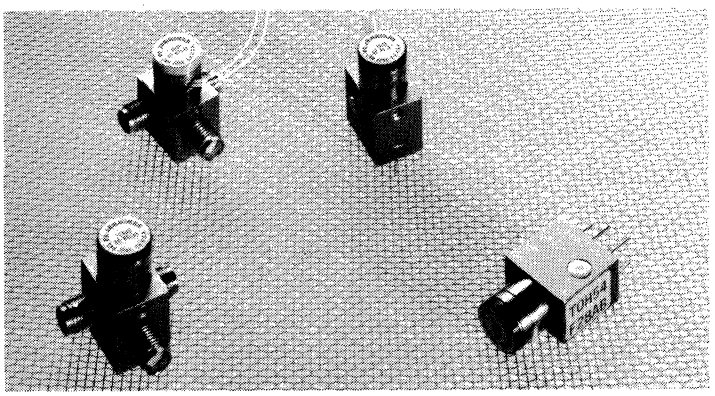
JENNINGS MINIATURE MICROWAVE RELAYS

The FL Jennings TOH Series microwave relays are designed to operate from DC to 2.5 GHz and higher. They are used in coaxial transmission lines to open, close, and divert signal paths. Applications where stringent impedance matching and isolation are required include antenna switching, radar, communications, radio telephones, and cable TV systems. Our technology represents the latest developments in materials, performance and flexibility. The TOH series microwave relays are available in coil terminal, PCB terminal, flying lead, and solder lug configurations. Operating voltages of 6, 12, 24, and 28 VDC can be specified.

The TOH Series are built using a new patented method that offers efficiency in manufacture. The result provides reliable, proven relays at lower cost.



TYPICAL RF CHARACTERISTICS

MICROWAVE DATA TOH 55 SMA CONNECTOR VERSION

FREQUENCY RANGE (GHz)	DC-200 MHz	200-500 MHz	500-1 GHz	1-1.5 GHz	1.5-2.5 GHz*
VSWR (MAX.)	1.05:1	1.08:1	1.09:1	1.10:1	1.20:1
INSERTION LOSS (MAX. dB)	0.05 dB	0.05 dB	0.08 dB	0.1 dB	0.15 dB
ISOLATION (MIN. dB)	60 dB	55 dB	48 dB	45 dB	40 dB
IMPEDANCE	50 OHMS NOMINAL				

MICROWAVE DATA TOH 54 PC BOARD VERSION

FREQUENCY RANGE (GHz)	DC-200 MHz	200-500 MHz	500-1 GHz	1-1.5 GHz	1.5-2.5 GHz*
VSWR (MAX.)	1.05:1	1.1:1	1.17:1	1.22:1	1.3:1
INSERTION LOSS (MAX. dB)	0.05 dB	0.07 dB	0.11 dB	0.15 dB	0.24 dB
ISOLATION (MIN. dB)	60 dB	55 dB	48 dB	45 dB	40 dB
IMPEDANCE	50 OHMS NOMINAL				

*Frequency Range to 12 GHz Available on Special Order

ACTUATION DATA

COIL VOLTAGE (VDC)	6	12	24	28
RESISTANCE (OHMS ± 10%)	15	60	240	330
CURRENT (MA MAX @ 20° C)	445	230	115	95
SWITCHING TIME	20 MS (MAX)			

POWER HANDLING 50 WATTS CW @ 1 GH_z

MECHANICAL **SWITCHING SEQUENCE BREAK BEFORE MAKE**
OPERATING MODE: FAILSAFE

TEMPERATURE RANGE **OPERATING AMBIENT:** −55°C TO +85°C

LIFE **OPERATING LIFE:** 2.5 MILLION CYCLES

COAXIAL CONNECTORS MADE PER MIL-C-39012

MATERIALS AND FINISHES
RF BODY, AL. ALLOY PER QQ-A-250/11 COND. T6 NICKEL PLATED PER MIL-C26074, CL4.
CONNECTOR SHELL, CRES OCMP. 303 Se, PER ASTM-A-582, COND A, PASSIVATED PER QQ-P-35
CONNECTOR DIELECTRIC, VIRGIN TEFLON PER MIL-P-19468, GROUP A.
CONNECTOR CONTACT, BERYLLIUM COPPER PER QQ-C-530, GOLD PLATED PER MIL-G-45204.
SOLENOID HOUSING, CARBON STEEL LEADED PER QQ-S-637, NICKEL PLATED PER MIL-C-26074, CL2.

PATENT PENDING.

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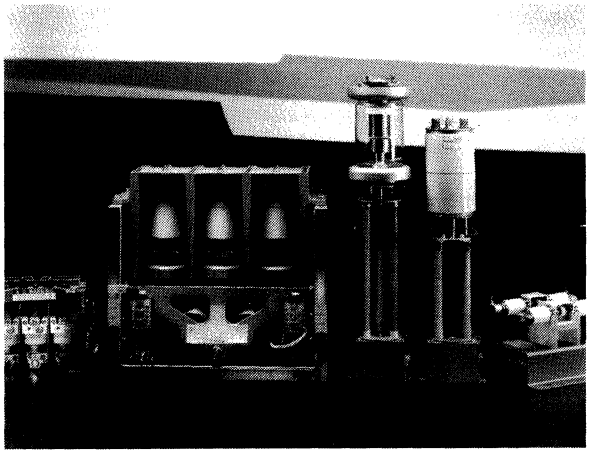
(408) 292-4025

JENNINGS VACUUM CONTACTORS

Vacuum Contactors are used to control large amounts of DC power and RF currents with ratings up to 50 kv and currents up to 600 Amperes continuous. These contactors are recommended wherever high voltage capability, small size, and high speed operation with a long and low maintenance life are important. Applications include primary control of power supplies, industrial motors, and induction heating equipment, RF system tap changing, and fault protection of high power transmitters. The 18 page catalog provides complete specifications with a variety of specific applications for 3-pole, high voltage AC and DC, RF contactors and overcurrent relays actuated by solenoid, air or motor drives.



GENERAL PURPOSE

Model Number	Operate Voltage (Pk KV)	Continuous Current (Amps)	Max. Interrupt AC Current (Amps RMS)	Capacitor Discharge Decaying to 0 in 200 μS (KAmps Pk)	Contact Arrangement	Actuator Voltage (Volts)	Time to Close (Ms)	Break Time (Ms)	Weight (Lbs.)
RP101F4903D21B20 RP101F4904D21B20	30	200 DC	N/A	50	N/O N/C	115 60 Hz	60	50	15
RP101F4304D26B20 RP103F4304D26B20	30	200 DC 200 RMS	N/A 2000	50	N/C	100 DC	55	42	10
RP103F4903D21B20 RP103F4904D21B20	30	200 RMS	2000	50	N/O N/C	115 60 Hz	60 30	50 60	10
RP901K4903D21B30 RP901K4904D21B30	50	400 DC	N/A	100	N/O N/C	115 60 Hz	60 30	50 60	20
RP900K4601D26B30 RP900K4602D26B30	50	400 DC	4000	100	N/O N/C	100 DC	34 27	11 17	15
RP900K4903D21B30 RP900K4904D21B30	50	400 RMS	4000 at 13 KV RMS	100	N/O N/C	115 60 Hz	60 50	50 60	20
RT1G4201C22A10 RT1G4202C21A10	20	100	500	1	N/O N/C	230 AC 115 VAC 50/60	60 60	25 30	4
RT5C4202A21A10	15	30	100	0.5	N/C	115 AC	60	30	3

RF

Unit	Pk Operate Voltage 32 MHz	Contact Current 32 MHz RMS	Contact Resistance Ohms Max.	Contact Capacitance pF	Contact Inductance Nh	Contact Arrangement	Open Time	Close Time	Pull-in Current RMS	Hold Current RMS	Hold Power Watts	Actuating Voltage or Air Pressure	Approx. Weight	Life	Auxiliary Contacts Ratings Volt RMS Current RMS
RT224070A31NB (Solenoid Operated)	5*	25	.0005	2.5	n/a	Latching	< 300 Ms.	< 300 Ms.	.3	n/a	n/a	230 VAC	12 lbs.	2.5×10^5	Form C 230/15
RP233D1585 (Air Operated)	25	35	.0005	2	25	N/O	< 200 Ms.	< 200 Ms.	n/a	n/a	n/a	40 ± 5 psig	13 oz.	1×10^5	n/a
RF22-D2488 (Air Operated)	20	45	.00075	3	25	N/O	50 Ms.	100 Ms.	n/a	n/a	n/a	20 ± 10 psig	15 oz.	10×10^6	n/a
RF20B1586 (Air Operated)	20	100	.0004	10	2.5	N/O	< 200 Ms.	< 200 Ms.	n/a	n/a	n/a	35 ± 5 psig	2 lbs. 12 oz.	1×10^6	n/a

*Higher voltage ratings available at lower frequencies.

3-PHASE

Model Number	Operate Voltage V (RMS)	Continuous Current 60 Hz	Interrupt Current Amps RMS	Mechanical Life (Min.)	Actuator Voltage	Approx. Pull-in Current Amps Max.	Approx. Hold Current Amps Max.	Interrupt Time	Auxiliary Contacts	Approx. Weight
RP151B4541X44R20 RP151B4541X46R20	600	250	2000	2.5×10^5	26.5 VDC 100 VDC	4.6 1.7	.5 .07	Less than 2 Cycles	DPDT 115/230 VAC	16 lbs.
RP173-2310-00	7200	450	6000	1×10^6	115 VAC 50/60 110 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2 N/C	67 lbs.
RP173-2311-00	7200	450	6000	1×10^6	230 VAC 220 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2N/C	67 lbs.
RP133-2332-00	1500	450	4500	1×10^6	115 VAC 50/60, 110 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2 N/C	30 lbs.

JENNINGS 970 McLaughlin Ave., San Jose, CA 95122
(408) 292-4025

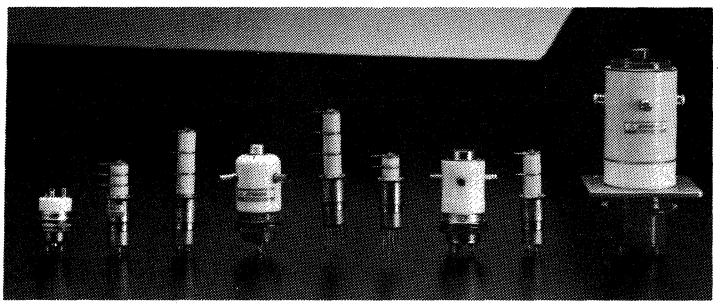
JENNINGS VACUUM/GAS RELAYS

Relay Testing

Jennings operates test facilities to provide all environmental, high voltage, and radio frequency (RF) test parameters. All relays are individually tested prior to shipment for pull-in voltage, timing characteristics, contact resistance, and dielectric strength.

Vibration, shock, humidity, salt spray, temperature effects, current load and reliability tests are regularly performed on a sampling basis.

Mechanical life reliability tests are performed on a sample basis with equipment that only passes relays which cycle with proper sequences of contact operation. Some relay types have been checked to more than 10^8 operations.



Peak Test Voltage (kV)	Model Number	Peak Working Voltage (kV) DC/60 Hz	Continuous Current Amps (RMS) DC/60 Hz	Maximum Capacitance Between Open Contacts or Contacts to Ground	Contact Configuration	Contact Resistance (ohms)	Operate Time (ms, Max)	Release Time (ms, Max)	Coil Resistance*	Expected Mech Life × 10⁶	Connector Type	Weight Ozs. (Nom.)
SPST/VACUUM												
4	RF40(1)	3.6	12	1.6	Latch	.020	10	N/A	47	1	Sol.	1
4	RF41, RF42	3.6	12	1.6	N/C	.020	10	10	290	1	Sol.	1
4	RF44	3.6	12	1.6	Latch	.012	4	N/A	80	1	Sol.	1
8	RF5A	7.5	12	1.6	N/C	.050	12	12	920	1	Sol.	1
8	RF6A	7.5	12	1.6	N/O	.050	12	12	920	1	Sol.	1
9	RF43(1)	7.0	12	1.6	Latch	.020	10	N/A	47	1		
10	RF47	8.0	35	1.6	Latch	.004	4	N/A	80	1	Sol.	1
10	RF4A, RF4B(1)	8.0	30	4.0	N/C	.015	18	18	156	1	Sol.	2
12	RF50, RF51	10.0	12	1.6	N/C	.020	15	15	290	1	Sol.	1
12	RJ5	12.0	15	1.0	N/C	.030	10	10	180	1	S, N300, N400	3
15	RD5A, RF5B	12.0	15	1.0	N/O	.010	18	8	265	1	N300, N400	3
15	RD6A, RD6B	12.0	15	1.0	N/C	.010	18	8	265	1	N300, N400	3
30	RS8, RS10	28.0	75	1.5	N/O	.003	30	10	120	1	T	7
33	RJ8A	28.0	110	1.3	N/O	.003	18	8	120	2	T	10
33	RJ10	28.0	110	1.3	N/C	.003	18	8	120	2	T	10
SPDT/VACUUM												
4	RF1D, RF1E	2.0	8	2.0	SPDT	.050	10	10	920	2	Sol.	1
4	RF60(1), RF61	3.6	12	2.0	Latch	.020	10	N/A	47	1	Sol.	1
5	RJ1A	3.5	18	2.5	SPDT	.010	8	8	335	2	Sol.	1
5	RJ1H	2.5 Hot Switch	3	N/A	SPDT	.030	6	6	335	1	Sol.	1
9	RF62, RF63(1)	7.0	12	1.6	SPDT	.020	10	10	290	1	Sol.	1
9	RF63A	7.0	12	1.6	Latch	.020	10	N/A	47	1	Sol.	1
10	RF3A, RF3C(1)	8.0	30	4.0	SPDT	.015	18	18	156	1	Sol.	2
10	RF3D	8.0 Hot Switch	30	4.0	SPDT	.015	18	18	156	1	Sol.	2
15	RB1H, RB1J	12.0	15	1.0	SPDT	.012	18	9	265	1	S, N300, N400	3
15	RJ2B, RJ2C	12.0	50	1.0	SPDT	.012	18	9	270	.5	S, N300, N400	3
15	RJ4	12.0	50	1.0	SPDT	.012	18	9	270	1	S, N300, N400	3
18	RB1D, RB1E	12.0	15	1.0	SPDT	.012	18	8	265	1	S, N300, N400	3
20	RF10B	15.0	75	1.8	SPDT	.012	30	10	225	.1	Sol.	16
30	RE6B	25.0	25	2.5	SPDT	.012	25	10	120	.5	S, N300, N400	7
DPDT/VACUUM												
9	RB7A, RB7B	7.0	14	2.0	DPDT	.020	15	5	270	1	S, N300, N400	2
15/8(2)	RB3	12/6(2)	30	2.5	DPDT	.010	20	8	120	.5	S, N300, N400	6
22	RB2A	20.0	20	2.5	DPDT	.010	20	10	225	.5	S, N300, N400	8
4PDT/VACUUM												
17	RB4	15.0	20	2.5	4PDT	.010	45	10	131	.1	S, N300, N400	16
SPST/GAS FILLED												
70	RGH3	70.0	15	N/A	N/C	1.000	N/A	15	24	5	Solder/ Screw	16
DPDT/GAS FILLED												
14	RGD6	7.5	30	N/A	DPDT	.100	20	N/A	18(3)	.01(4)	Flex	11
20	RGD1	18.0	30	N/A	DPDT	.100	25	N/A	52	.01(4)	Sol.	16

* 26.5 VDC operate at 25°C (other coil voltages available)

S = Standard Nickel Tabs
N300 = Copper
N400 = Heavy duty copper Bolt
Flex = Flying leads
Sol. = Solder terminals
T = Threaded mount

1 Latching Model
2 Lower Contacts
3 12 volt DC Coil
4 Rated Load Life

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JENNINGS VACUUM/COAXIAL RELAYS

Applications for these units include high speed switching from omnidirectional to directional antennas, transmit-receive switching, and switching between transmitters for standby control.

Other applications include crossbar matrices and switching trees, CCTV, CATV, and microwave telemetry and data acquisition links, as well as general coaxial instrumentation.

Jennings vacuum coaxial relays have a recorded history of dependable, maintenance free operation. Because of this, they were chosen for ground and airborne applications for the tracking network of the Apollo program and the Atlantic Missile Range Communications.



Model Number	Power Rating (CW in KW)	Frequency Range† (MHz)	VSWR†	Crosstalk† (db Isolation)	Actuating Voltage	Insertion Loss† (Max)	Coil Resistance (Ohms ± 10•)	Contact Configuration	Connector size	Position Indicators Auxiliary Contacts	Operate Time†† (Max)	Weight Lbs. (Nom.)
GENERAL TRANSMITTER/RECEIVER SWITCH												
RC41E6000K440	3 @ 30 MHz	0-500	1.1:1 Max to 300 MHz	30 @ 300 MHz	26.5 VDC	0.1 dB	265	SPDT	C	None	25 ms	0.9
RC43E6050N440	5 @ 30 MHz	0-500	1.1:1 Max to 300 MHz	30 @ 300 MHz	26.5 VDC	0.1 dB	265	SPDT	LC	None	25 ms	3.3
CROSS OVER TYPE/4-PORT: 2 INPUT, 2 OUTPUT												
RC53A6300K24B	2.25 @ 30 MHz (connector limited)	0-600	1.1:1 Max to 300 MHz	75 @ 30 MHz	26.5 VDC	0.1 dB	19**	Transfer	N	DPDT	30 ms	2.8
RC54A6325H24B	7.5 @ 30 MHz	0-400	1.1:1 Max to 300 MHz	53 @ 500 MHz	26.5 VDC	0.1 dB	19**	Transfer	LC	DPDT	30 ms	6.4
1 5/8" LINE SIZE												
RC5A5101A24B	25 @ 30 MHz	0-100	1.05:1 Max to 60 MHz	70 @ 30 MHz	26.5 VDC	0.02 dB	Opening 19.9 Closing 18.7	SPST	1 5/8"	DPDT	30 ms	1.8
RC6A5126F14B	25 @ 30 MHz	0-400	1.1:1 Max to 150 MHz	65 @ 30 MHz	26.5 VDC Latching	0.01 dB	15.4	SPDT	1 5/8"	DPDT	50 ms	8.0
3 1/8" LINE SIZE												
RC10C5227A24B	90 @ 30 MHz	0-100	1.05:1 Max to 60 MHz	65 @ 30 MHz	26.5 VDC	0.02 dB	Opening 20.3 Closing 18.7	SPST	3 1/8"	DPDT	30 ms	3.8
RC21A5500F14B	90 @ 30 MHz	0-500	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	4.8	SPDT	3 1/8"	DPDT	40 ms	14.0
SWITCH ASSEMBLY												
RC265552G24F	90 @ 30 MHz 2 MW Peak* Spec. Order	0-600	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	19	SPDT	3 1/8"	DPDT	50 ms	14.0
ATTENUATOR												
RC275576G24F	90 @ 30 MHz 2 MW Peak* Spec. Order	0-600	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	19	SPST	3 1/8"	DPDT	50 ms	13.0

* Power rating applies when connecting line pressurized 45 PSIA Dry Air or 31 PSIA Dry Nitrogen.
** ± 15%
† All measurements with a characteristic impedance of 50 ohms.
†† faster operate times can be obtained on most units by coil pulse circuits. Information available from factory.

NOTE: This power ratings is for the frequency at which the relay is most commonly used.
The power rating for any point in the frequency range of the unit other than that shown may be obtained by consulting factory.

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(408) 292-4025

High Voltage Relays

THE EXPERTS IN HIGH VOLTAGE RELAYS AND DC POWER SWITCHING DEVICES.

THE WORLD'S LEADING SUPPLIER OF HIGH VOLTAGE SWITCHING DEVICES

For over a quarter century, Kilovac has been dedicated to the design and manufacture of high voltage relays, contactors, and power control devices.

Today, Kilovac is recognized as the world's leading supplier of high voltage switching devices for a broad range of critical applications. Kilovac relays are used in medical and scientific instruments, aircraft power distribution, and sophisticated test equipment. Kilovac relays have been to the moon in the Lunar Rover Vehicle and to the depths of the sea on nuclear submarines.

KILOVAC CAN QUICKLY MEET YOUR REQUIREMENTS

Kilovac can respond quickly to customer requirements by developing special relays or modifications to existing relays or by delivering our standard products quickly.

Call Kilovac's new Application Hot Line at 1-800-253-4560 to discuss your application with one of our Sales Engineers.

Kilovac's extensive manufacturing capability allows us to respond to your needs with a wide variety of special modifications and special relays.

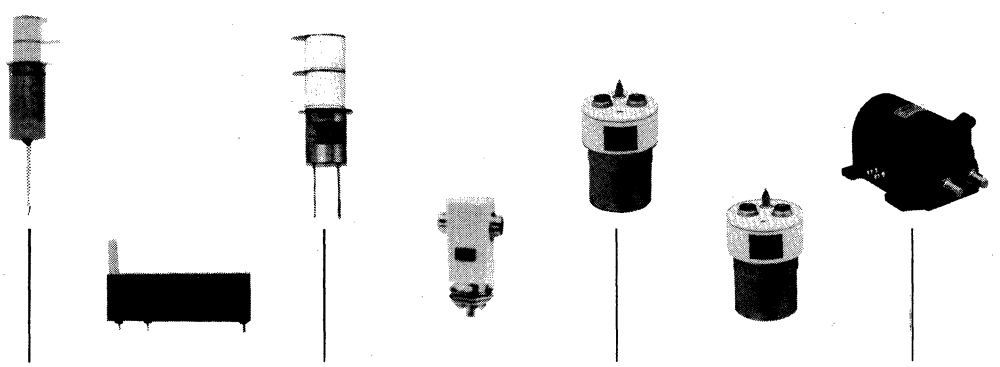
YOU CAN RELY ON KILOVAC

High voltage circuits are often difficult to design and debug. Let us work with you to solve your high voltage isolation and switching problems. We can often supply engineering samples for test and evaluation in your circuit or we can conduct special tests for you in our well-equipped test lab.

Don't experiment with high voltage... rely on the proven experience of Kilovac Corporation.

Call Kilovac's Application Hot Line at 1-800-253-4560.

VOLTAGE: ——— 270Vdc ———→



Kilovac Part Number	AP41[5]	AP81[5]	AP44[5]	AP22[5]	AP75X[5]	AP150[5]	AP250X[5]
Contact Arrangement	SPST-NO, SPST-NC, SPDT, LATCH	SPST-NO, SPST-NC, SPDT	SPST-NO, SPST-NC, LATCH	SPST-NO	SPST-NO	SPST-NO, LATCH	SPST-NO
Rated Operating Voltage	270 Vdc	270 Vdc	270 Vdc	270 Vdc	270 Vdc	270 Vdc	270 Vdc
Test Voltage	1500 Vac	1500 Vac	1500 Vac	1500 Vac	1500 Vac	1500 Vac	1500 Vac
Continuous Carry Current contacts closed, max. (amps DC or 60 Hz peak)	15	10	45	65	75	150	250
Power Switching	5 Amps	5 Amps	15 Amps	50 Amps	75 Amps	150 Amps	250 Amps
Contact Resistance max. (ohms)	.010	.010	.010	.002	.0025	.001	.001
Operate Time, max (ms)	10	10	10	25	25	20	25
Coil Resistance (ohms ±10% @ 20°C)	290	290	180	48	56	42	18
Coil Voltage [4] (Vdc, nominal)	28	28	28	28	28	28	28
Nominal Dimensions (inches)	.65 D x 1.7 H	2.25 L x .75 H	.75 D x 2.5 H	2.3 D X 4.0 H	1.5 D x 2.75 H	2.25 D x 3.5 H	2.25 D x 5.8 H
Nominal Weight (oz.)	1	3	2	10	14	24	36
Mounting Style	Flange	Printed Circuit Board	Flange	Flange	Flange	Flange	Flange

(1) Suitable for power switching. Contact factory for details.
(2) Gas-filled for power switching on the "make".
(3) Contact resistance in gas-filled relays is tested at 28 Vdc and 1 amp.
(4) 12 Vdc and 115 Vdc coils available on request.
(5) All 270 Vdc products available as a power controller. Contact factory for details.

Send for Kilovac catalog

Kilovac Corporation
P.O. Box 4422EM, Santa Barbara, CA 93140 USA
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Kilovac® Corporation

High Voltage Relays

THE EXPERTS IN HIGH VOLTAGE RELAYS AND DC POWER SWITCHING DEVICES.

POWER SWITCHING

For proper relay performance in hot switching applications, the consequences of the circuit conditions must be assessed for each unique application. It is therefore essential that Kilovac be as fully informed as possible when recommending relays for hot switching applications. To select the proper relay, the following information should be supplied to the Kilovac Sales Engineer:

a. Type of Load.

b. Current and voltage values to be switched. If capacitative discharge, peak current and RC time constant values are needed.

c. Repetition rate or frequency of operation desired.

d. Expected life span.

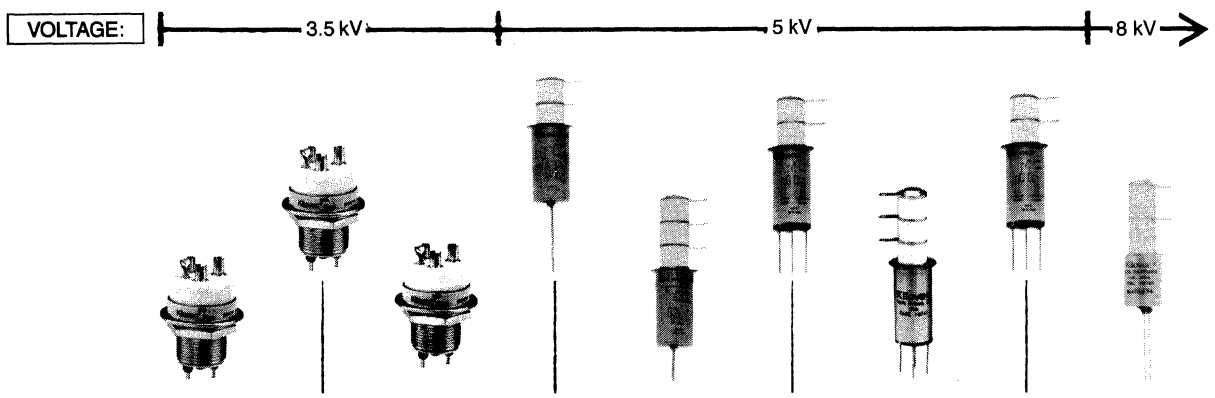
Frequently, the only way to determine whether a relay will survive a particular power switching application is to test it in the circuit. These tests ideally can be performed in the customer's circuit or, if that is not possible, in Kilovac's well-equipped test lab.

270 VDC APPLICATIONS

A new generation of 270 Vdc power systems are now being developed for aerospace and commercial applications. These systems offer improvements in reliability, maintenance costs, fuel consumption, weight, and life-cycle costs over the conventional 28 Vdc and 115 Vac power systems.

Conventional switching devices cannot reliably switch 270 Vdc loads. Kilovac has developed a broad line of products that capitalize on the ability of vacuum switches to interrupt high voltage, direct current loads. Kilovac's 270 Vdc relays, contactors, and power controllers offer substantial improvements in weight, size, performance, and reliability over other switching products.

All Kilovac's 270 Vdc products are also available as power controllers with electronic sensing and control to provide short circuit protection. Whether you need to switch 2 amps or 250 amps at 270 Vdc, Kilovac has the products you need. Call us at 805-684-4560 and request our extensive literature package on 270 Vdc products.



Kilovac Part Number	HC-1	HC-3	HC-5[2]	K41A, B	K41C	K41P	K41R	K40P	K47A, B
Contact Arrangement	SPDT	SPDT	SPDT	SPST-NO, SPST-NC,	SPDT	LATCH	LATCHING SPDT	LATCH	SPST-NO, SPST-NC
Rated Operating Voltage	3.5 KVdc	3.5 KVdc	3.5 KVdc	5.0 KVdc	5.0 KVdc	5.0 KVdc	4.0 KVdc	5.0 KVdc	8.0 KVdc
Test Voltage	5.0 KVdc	5.0 KVdc	5.0 KVdc	6.0 KVdc	6.0 KVdc	6.0 KVdc	5.0 KVdc	5.0 KVdc	9.0 KVdc
Continuous carry current contacts closed, max (amps dc or 60 Hz peak)	25	18	8	15	15	15	15	35	12
Power Switching?	N	Y[1]	Y[1]	Y[1]	Y[1]	N	N	N	Y[1]
Contact Resistance max (ohms)	.010	.020	.5[3]	.020	.020	.020	.020	.020	.030
Operate Time, max (ms)	6	6	6	10	10	6	6	1	10
Coil Resistance (ohms ±10% @ 20°C)	335	335	335	290	290	80	80	80	920
Coil Voltage[4] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	.75D x 1.5H	.75D x 1.5H	.75D x 1.5H	.65D x 1.7H	.65D x 2.1H	.65D x 1.7H	.65D x 2.1H	.65D x 1.7H	.65D x 1.82H
Nominal Weight (oz)	1	1	1	1	1	1	1	1	.6
Mounting Style	Threaded Base	Threaded Base	Threaded Base	Flange	Flange	Flange	Flange	Flange	Flange

(1) Suitable for power switching. Contact factory for details.
(2) Gas-filled for power switching on the "make".
(3) Contact resistance in gas-filled relays is tested at 28 Vdc and 1 amp.
(4) 12 Vdc and 115 Vdc coils available on request.

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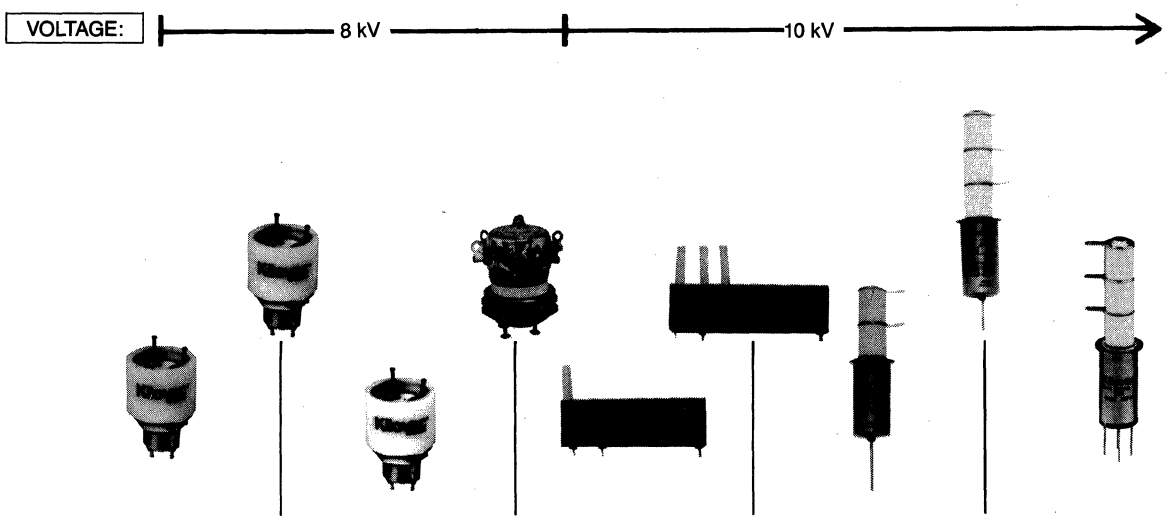
THE EXPERTS IN HIGH VOLTAGE RELAYS AND DC POWER SWITCHING DEVICES.

FEATURES OF VACUUM AND GAS-FILLED RELAYS

- Smaller size for a given voltage/ current rating
- Extremely low and stable contact resistance in vacuum relays
- No contact oxidation due to arcing
- Faster operate times
- High resistance to thermal and mechanical shock
- Capable of switching high inrush currents using gas-filled relays
- Safe use in explosive or corrosive atmospheres
- No contact maintenance
- Usable at frequencies above 30 MHz
- Rapid arc extinguishment for power switching in vacuum relays
- Can be mounted in any orientation



Kilovac Part Number	HC-2	HC-4	HC-6	H-18	K81A, B	K81C	K43A, B	K43C	K43R
Contact Arrangement	SPDT	SPDT	SPDT	DPDT	SPST-NO, SPST-NC	SPDT	SPST-NO, SPST-NC	SPDT	LATCHING SPDT
Rated Operating Voltage	8.0 KVdc	8.0 KVdc	8.0 KVdc	8.0 KVdc	10.0 KVdc	10.0 KVdc	10.0 KVdc	10.0 KVdc	10.0 KVdc
Test Voltage	10.0 KVdc	10.0 KVdc	10.0 KVdc	10.0 KVdc	11.0 KVdc	11.0 KVdc	11.0 KVdc	11.0 KVdc	11.0 KVdc
Continuous carry current contacts closed, max (amps dc or 60 Hz peak)	25	15	8	10	10	10	15	15	15
Power Switching?	N	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	N
Contact Resistance max (ohms)	.010	.020	.050[3]	.020	.050	.050	.020	.020	.020
Operate Time, max (ms)	6	6	6	15	10	10	10	10	6
Coil Resistance (ohms ±10% @ 20°C)	335	335	335	250	290	290	290	290	80
Coil Voltage[4] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	1.13Dx1.88H	1.13Dx1.88H	1.13Dx1.88H	1.5Dx1.97H	2.25Lx.75H	2.5Lx.75H	.65Dx2.18H	.65Dx2.62H	.65Dx2.62H
Nominal Weight (oz)	1.25	1.25	1.25	4	1.5	2	1	1	1
Mounting Style	Threaded Base	Threaded Base	Threaded Body	Threaded Base	Printed Circuit Board	PC	Flange	Flange	Flange

(1) Suitable for power switching. Contact factory for details.
(2) Gas-filled for power switching on the "make".
(3) Contact resistance in gas-filled relays is tested at 28 Vdc and 1 amp.
(4) 12 Vdc and 115 Vdc coils available on request.

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High Voltage Relays

THE EXPERTS IN HIGH VOLTAGE RELAYS AND DC POWER SWITCHING DEVICES.

TYPICAL APPLICATIONS

Typical high voltage relay applications are listed below:

COMMUNICATIONS–H.F. SSB radio, digital antenna couplers and tuners, transmit/receive switching.

TEST EQUIPMENT–Electrostatic discharge testing, dielectric testing, cable and harness testing.

AEROSPACE POWER SWITCHING–Aircraft, space systems, submarine, and ground equipment where 48 Vdc, 155 Vdc, 270 Vdc, and 20 KHz switching and control is required.

RADAR–Pulse forming networks, modulators/transmitters, TWT and klystron switching.

GENERAL–Safety interlock applications, high voltage power supplies, polarity reversal, nuclear instrumentation, switching in explosive or corrosive atmospheres.

LASERS–Pulse forming network discharge, safety interlock, simmer circuit isolation, Pockels cell isolation.

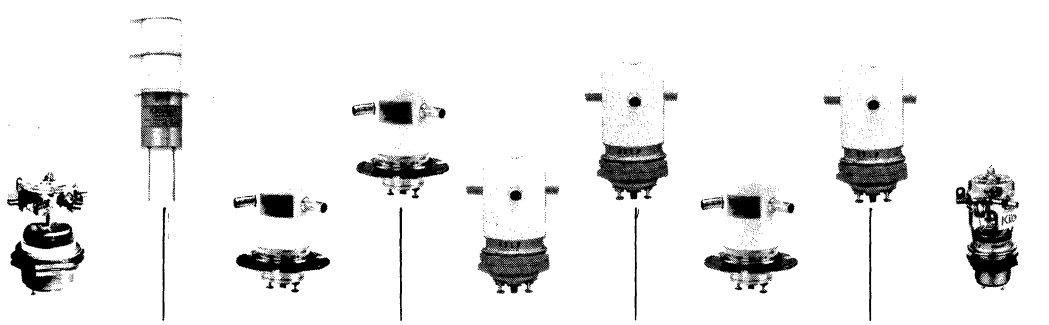
SEMICONDUCTOR PROCESSING

PLASMA ETCHING–Multiple target switching.

HIGH INTENSITY LIGHTING SYSTEMS

MEDICAL INSTRUMENTS–Heart defibrillators, surgical lasers, magnetic resonance imaging (MRI), Electrophoresis.

VOLTAGE: 12 kV — 15 kV



Kilovac Part Number	H-14	K46A, B	KC-2	KC-8	KC-11	KC-12	KC-15[2]	KC-16[2]	H-8
Contact Arrangement	DPDT	SPST-NO, SPST-NC	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT
Rated Operating Voltage	12.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc
Test Voltage	15.0 KVdc	17.0 KVdc	17.0 KVdc	17.0 KVdc	17.0 KVdc	17.0 KVdc	17.0 KVdc	17.0 KVdc	20.0 KVdc
Continuous carry current contacts closed, max (amps dc or 60 Hz peak)	30	45	50	30	50	30	12	12	15
Power Switching?	Y[1]	N	N	Y[1]	N	Y[1]	Y[1]	Y[1]	Y[1]
Contact Resistance max (ohms)	.015	.010	.012	.025	.012	.025	1.0[3]	1.0[3]	.015
Operate Time, max (ms)	20	10	15	15	15	15	15	15	15
Coil Resistance (ohms ± 10% @ 20°C)	120	290	250	180	250	180	180	180	265
Coil Voltage[4] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	1.8Dx2.77H	.75Dx2.5H	1.37Dx2.26H	1.37Dx2.26H	1.37Dx2.26H	1.37Dx2.26H	1.37Dx2.26H	1.37Dx2.26H	1Dx3H
Nominal Weight (oz)	8	1.8	3	3	3	3	3	3	3
Mounting Style	Threaded Base	Flange	Flange	Flange	Threaded Base	Threaded Base	Flange	Threaded Base	Threaded Base

(1) Suitable for power switching. Contact factory for details.
(2) Gas-filled for power switching on the "make".
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All Kilovac relays have either a vacuum or gas dielectric. Both have the obvious benefit of providing high voltage isolation in a small package, but each has unique characteristics which should be considered.

VACUUM AS A DIELECTRIC

A vacuum is, in many ways, the ideal dielectric. Since most high voltage arcs are initiated by the ionization of the insulating medium, absence of any such media (i.e., a hard vacuum) produces the greatest possible isolation between contact electrodes. In a vacuum of 10^{-6} mm of mercury, dielectric strengths can be achieved on the order of 2000 V/mil. A vacuum dielectric has the additional advantage of providing an inert, non-oxidizing atmosphere in which high voltage contacts operate.

The chief advantage in using a vacuum relay is that it has low and stable contact resistance over the life of the relay.

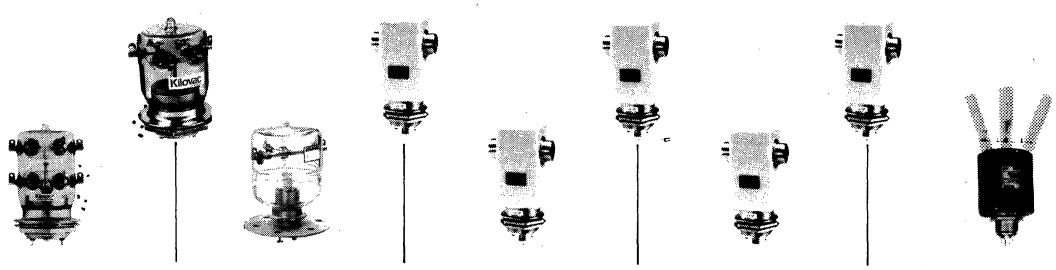
Vacuum relays are typically recommended whenever low and stable contact resistance is needed or when power switching that requires load interruption is called for.

GAS AS A DIELECTRIC

Because of the arc suppression characteristics of electronegative gas, gas-filled relays are generally more suitable for power-switching on the "make" or N.O. contacts, as used in the capacitive discharge of heart defibrillator circuits or pulsed lasers.

When the relay is switched, ionization of the gas causes electrical continuity to occur before mechanical continuity is achieved. Thus, contact bounce may occur without interruption of the circuit if circuit voltage is above 3500 volts. This phenomenon contributes to the long life gas-filled relays demonstrate in capacitive discharge circuits.

VOLTAGE: 15 kV — 20 kV — 25 kV



Kilovac Part Number	H-26	H-19	H-17	KC-22	KC-32	KC-28[2]	KC-38[2]	KC-30	K62.
Contact Arrangement	4PDT	DPDT	SPDT	SPST-NO	SPST-NC	SPST-NO	SPST-NC	SPST-NO	SPST-NO, SPST-NC, SPDT
Rated Operating Voltage	15.0 KVdc	20.0 KVdc	25.0 KVdc	25.0 KVdc	25.0 KVdc	25.0 KVdc	25.0 KVdc	25.0 KVdc	25.0 KVdc
Test Voltage	17.0 KVdc	25.0 KVdc	30.0 KVdc	28.0 KVdc	28.0 KVdc	28.0 KVdc	28.0 KVdc	28.0 KVdc	30.0 KVdc
Continuous Carry Current contacts closed, max. (amps DC or 60 Hz peak)	30	30	30	65	45	30	15	55	18
Power Switching	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	N	Y[1]
Contact Resistance max. (ohms)	.020	.015	.015	.005	.010	1.0[3]	1.0[3]	.010	.025
Operate Time, max. (ms)	30	30	25	18	18	18	18	18	15
Coil Resistance (ohms ± 10% @ 20°C)	130	225	120	120	120	120	120	120	125
Coil Voltage[4] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	2.3Dx3.92H	2.28Dx3.25H	2.38Dx3.57H	1.31Sqx4.0H	1.31Sqx4.0H	1.31Sqx4.0H	1.31Sqx4.0H	1.31Sqx4.0H	1.98Sqx2.8H
Nominal Weight (oz.)	16	7	5	10	10	10	10	10	12
Mounting Style	Threaded Base	Threaded Base	Flange	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base

(1) Suitable for power switching. Contact factory for details.
(2) Gas-filled for power switching on the "make".
(3) Contact resistance in gas-filled relays is tested at 28 Vdc and 1 amp.
(4) 12 Vdc and 115 Vdc cells available on request.

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LOW LEAKAGE, HIGH VOLTAGE RELAYS

Kilovac has specialized relays for test equipment and instrument applications which require very low leakage currents and/or very high insulation resistance. We can provide you with standard relays or special relays built for your application with leakage currents in the picoamp range and insulation resistance of 10^{13} or 10^{14} ohms. Call our Application Hot Line at 1-800-253-4560 for more information.

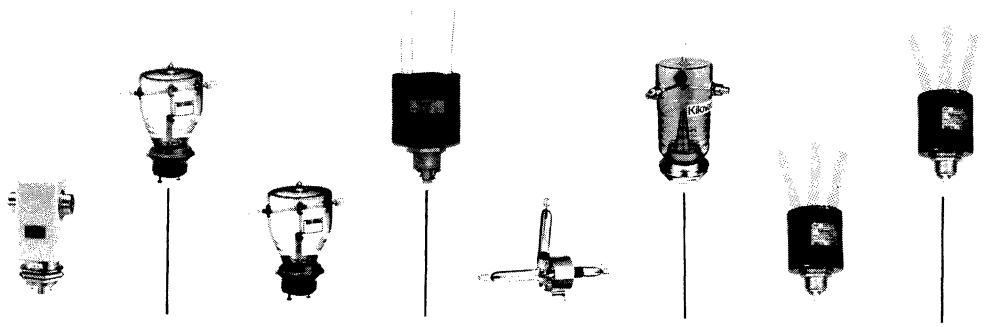
KILOVAC MEDICAL RELAYS

Kilovac has supplied high voltage relays for a number of medical applications ranging from portable heart defibrillators to magnetic resonance imaging equipment. Kilovac relays are used as polarity reversal switches in electrophoresis equipment to analyze DNA and in kidney stone lithotrypters to discharge energy stored in high voltage capacitors which crushes kidney stones with powerful sound waves.

The small size and high reliability of Kilovac relays make them ideally suited for portable, battery operated equipment. Kilovac maintains an on-going reliability test program to ensure that all relays continue to perform reliably time after time. In addition, since medical relays are often considered a "Critical Component" by the FDA, Kilovac maintains the required quality control and configuration control systems necessary to meet these strict standards.

Call our Application Hot Line at 1-800-253-4560 for help with your medical relay application.

VOLTAGE: 28 kV — 30 kV — 35 kV — 50 kV — 65 kV →



Kilovac Part Number	KC-20	H-23	H-24	K-61[2]	H-35	H-25	K64C[2]	K65C[2]
Contact Arrangement	SPST-NO	SPST-NC	SPST-NO	SPST-NO, SPST-NC, SPDT	SPDT	SPDT	SPDT	SPDT
Rated Operating Voltage	28.0 KVdc	30.0 KVdc	30.0 KVdc	35.0 KVdc	35.0 KVdc	50.0 KVdc	50.0 KVdc	65.0 KVdc
Test Voltage	30.0 KVdc	35.0 KVdc	35.0 KVdc	40.0 KVdc	40.0 KVdc	60.0 KVdc	60.0 KVdc	75.0 KVdc
Continuous Carry Current contacts closed, max. (amps DC or 60 Hz peak)	110	30	30	14	10	30	14	TBD
Power Switching	N	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]
Contact Resistance max. (ohms)	.005	.015	.015	.5[3]	.015	.015	.5[3]	1[3]
Operate Time, max. (ms)	18	30	30	15	30	60	15	25
Coil Resistance (ohms ± 10% @ 20°C)	120	120	120	125	50	120	80	80
Coil Voltage[4] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	1.31 Sq x 4.0 H	2 D x 3.62 H	2 D x 3.62 H	1.98 D x 2.8 H	8.4 L x 6.03 H	2 D x 7.5 H	1.98 D x 2.8 H	1.98 D x 4.25 H
Nominal Weight (oz.)	10	7	7	12	15	30	12	14
Mounting Style	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base

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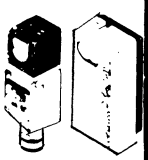
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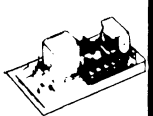
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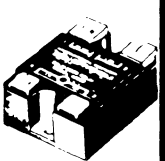
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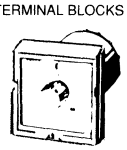
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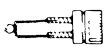
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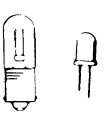
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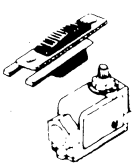
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6900 Orangethorpe Ave.
Buena Park, CA 90622-5032
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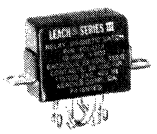

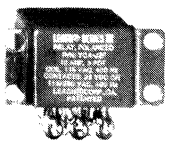

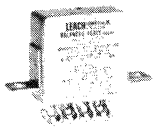

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DESIGNED TO: APPLICABLE MS NUMBER(S):	MIL-R-6106 M6106/21, 27, 38, 54	MIL-R-6106 M6106/22, 28, 39, 55	MIL-R-6106 N/A	MIL-R-6106 M6106/24, 29, 40	MIL-R-6106 Non-Latch: MS27401 Latch: M6106/50
ELECTRICAL DATA					
Contact Rating (Amps): 28 VDC: Resistive Inductive Motor Lamp	 5 3 2 1	 5 3 2 1	 10 6 4 2	 10 6 4 2	 12 8 4 2
115/200 VAC, 400 Hz, 3Ø, (Case Grounded)	Same as DC except inductive is 5 amp and motor is 3 amp	Same as DC except inductive is 5 amp and motor is 3 amp	Same as DC except inductive is 10 amp	Same as DC except inductive is 8 amp	Same as DC rating except resistive is 10 amp
Nominal Coil Voltage(s): DC Non-Latch DC Latch AC Coil	 6/12/28/48 VDC 6/12/28 VDC 28, 115/200 VAC 50-400 Hz	 6/12/28/48 VDC 6/12/28 VDC 28, 115/200 VAC 50-400 Hz	 6/12/28/48 VDC 6/12/28 VDC	 6/12/28/48 VDC 6/12/28 VDC 28, 115/200 VAC 50-400 Hz	 6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz
Coil Resistance(s) Ohms: DC Non-Latch DC Latch AC Coil, Current, I Max.	 30/125/500/1600 43/182/730 .100/.040/.024	 25/100/400/1275 37/148/600 .120/.040/.028	 25/125/500/1600 730	 25/100/400/1275 600 .120/.040/.028	 20/80/320/1000 38/150/600/1600 .240/.040/.024
Operate Time, Maximum (MS): DC Non-Latch DC Latch AC Coil	 4 4 4	 6 6 5	 6 6 N/A	 6 15 15	 10 10 15
Release Time, Maximum (MS): DC Non-Latch DC Latch AC Coil	 4 N/A 4	 6 N/A 25	 6 N/A N/A	 6 N/A 25	 10 N/A 50
Bounce Time, Maximum (MS)	0.5	0.5	1.0	1.0	1.0
ENVIRONMENTAL DATA					
Sinusoidal Vibration, Maximum G	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz
Shock, Minimum G	200	200	200	200	200
MECHANICAL DATA					
Weight, oz./grams, Max.	.56 oz. (16 g.)	1.06 oz. (30 g.)	.56 oz. (16 g.)	1.09 oz. (31 g.)	1.40 oz. (40 g.)
Dimensions, in., Max. L × W × H	0.810 × 0.410 × 0.640	0.810 × 0.810 × 0.640	0.810 × 0.410 × 0.640	0.810 × 0.810 × 0.640	DC: 1.015 × 0.515 × 1.000 AC: 1.015 × 0.515 × 1.125
Sockets Available: Non-Latch DC Coil Latch DC Coil Non-Latch AC Coil 28 VAC Coil	 SO-1064-001 SO-1064-003 SO-1064-10444 SO-1064-10445	 SO-1066-001 SO-1066-003 SO-1066-10385 SO-1066-10386	 SO-1064-10425 SO-1064-10534 N/A N/A	 SO-1065-001 SO-1065-003 SO-1065-10392 SO-1065-10393	 SO-1049-8309 SO-1055-8690 SO-1049-8772 SO-1055-8774
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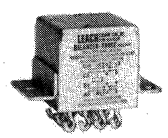
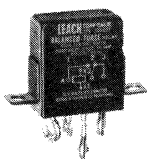
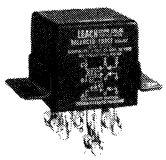
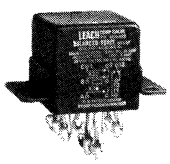


LEACH SERIES:	**K, KA, KL** **BALANCED FORCE DESIGN** Low level to 12 Amp 4 PDT Non-Latch & Latch	**JC, JCA, JCL; JS, JSA** [1] **BALANCED FORCE DESIGN** Low level to 25 Amp 1 PDT Non-Latch & Latch	**KC, KCA, KCL** **BALANCED FORCE DESIGN** Low level to 25 Amp 3 PDT Non-Latch & Latch	**KD, KDA, KDL** **BALANCED FORCE DESIGN** Low level to 25 Amp 3 PST/NO, 2 amp 1 PDT Aux Non-Latch & Latch	**KM** **BALANCED FORCE DESIGN** 50 Amp 1 PST/DB Non-Latch & Latch
DESIGNED TO: APPLICABLE MS NUMBER(S):	MIL-R-6106 Non-Latch: MS27400 Latch: M6106/51	MIL-R-6106 Non-Latch: M6106/19 Latch: M6106/20	MIL-R-6106 Non-Latch: MS27743 Latch: MS27742	MIL-R-6106 Non-Latch: M6106/13 Latch: M6106/12	MIL-R-6106 N/A
ELECTRICAL DATA					
Contact Rating (Amps):					
28 VDC:		JC, JCA, JCL [1] JS, JSA [2]			
Resistive	12	25 10	25	25	50
Inductive	8	12 10	12	12	15
Motor	4	10 4	10	10	30
Lamp	2	5 4	5	5	15
115/200 VAC, 400 Hz, 3Ø, (Case Grounded)	Same as DC rating except resistive is 10 amp	Same as DC rating N/A See Note [2]	Same as DC except inductive is 15 amp	Same as DC except inductive is 15 amp	N/A (see notes)
Nominal Coil Voltage(s):					
DC Non-Latch	6/12/28/48 VDC	6/12/28/48 VDC	6/12/28/48 VDC	6/12/28/48 VDC	6/12/28 VDC
DC Latch	6/12/28/48 VDC	6/12/28/48 VDC	6/12/28/48 VDC	6/12/28/48 VDC	6/12/28 VDC
AC Coil	28, 115/200 VAC 50-400 Hz	28, 115/200 VAC 50-400 Hz	28, 115/200 VAC 50-400 Hz	28, 115/200 VAC 50-400 Hz	N/A
Coil Resistance(s) Ohms:					
DC Non-Latch	18/70/290/890	20/80/320/1000	18/70/290/890	18/70/290/890	18/70/290
DC Latch	28/112/450/1500	38/150/600/1600	28/112/450/1500	28/112/450/1500	28/112/450
AC Coil Current, I Max.	.120/.040/.028	.100/.040/.024	.120/.040/.028	.120/.040/.028	N/A
Operate Time, Maximum (MS):					
DC Non-Latch	15	10	15	15	15
DC Latch	15	10	15	15	15
AC Coil	20	15	20	20	N/A
Release Time, Maximum (MS):					
DC Non-Latch	15	10	15	15	15
DC Latch	N/A	N/A	N/A	N/A	N/A
AC Coil	50	50	50	50	N/A
Bounce Time, Maximum (MS)	1.0	1.0	1.0	1.0 (Aux 4)	1.0
ENVIRONMENTAL DATA					
Sinusoidal Vibration, Maximum G	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz
Shock, Minimum G	200	200	200	200	50
MECHANICAL DATA					
Weight, oz./grams, Max.	DC: 2.5 oz. (71 g.) AC: 2.7 oz. (77 g.)	1.6 oz. (45 g.)	3.0 oz. (85 g.)	3.0 oz. (85 g.)	3.0 oz. (85 g.)
Dimensions, in., Max. L×W×H	1.015×0.015×1.000	DC: 1.015×0.515×1.000 AC: 1.015×0.515×1.125	1.015×1.015×1.000	1.015×1.015×1.000	
Sockets Available:					
Non-Latch DC Coil	SO-1048-8308	SO-1063-9033	SO-1057-8912	SO-1059-8914	N/A
Latch DC Coil	SO-1056-8691	SO-1063-9036	SO-1058-8913	SO-1060-8915	N/A
Non-Latch AC Coil	SO-1048-8776	SO-1063-9034	SO-1062-8917	SO-1061-8916	N/A
28 VAC Coil	SO-1048-8779	N/A	N/A	N/A	N/A
NOTES:	5 mounting styles 3 terminal types	4 mounting styles 4 terminal types Special models available. [1] JS, JCA & JCL @ 50 ADC & 80 amp 400 Hz overload. [2] JS/JSA only designed to switch 115 VAC, 60 Hz case grounded; JS has 20 amp overload capabilities	5 mounting styles 3 terminal types	5 mounting styles 3 terminal types Same design as KC series with added auxiliary pole	Special models available; contact factory for auxiliary contacts, and additional information

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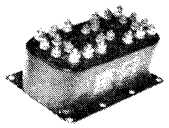
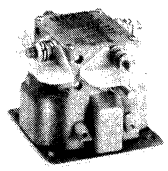
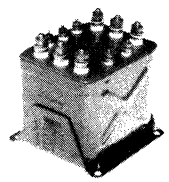

LEACH SERIES:	**9123** 25 Amp 3 PST/NO DB	**9124** 50 Amp 3 PST/NO DB	**9125** 50 Amp 3 PDT-CO DB 6 PST/NO DB	**9207** 25 to 100 Amp 3 PST/NO DB, 4 PST/NO DB, 2 P/NO, 2 P/NC DB	**9213** 25 to 100 Amp 3 PST/NO, 4 PST/NO, 2 P/NO, 2 P/NC DB
DESIGNED TO:	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106 DESC Spec 84192	MIL-R-6106
APPLICABLE MS NUMBER(S):	MS27997	MS27222			
ELECTRICAL DATA					
Contact Rating (Amps):					
28 VDC:					
Resistive	25	50	50	25-100	25-100
Inductive	25	50	50	25-100	25-100
Motor	25	50	50	25-100	25-100
Lamp	N/A	N/A	N/A	N/A	N/A
115 VAC, 400 Hz, 3Ø:					
Resistive	25	50	50	25-100	25-100
Inductive	25	50	50	25-100	25-100
Motor	25	50	50	25-100	25-100
Lamp	N/A	N/A	N/A	N/A	N/A
115 VAC, 50/60 Hz, 3Ø:					
Resistive	15	30	30	50	50
Inductive	15	30	30	50	50
Motor	7	15	15	50	50
Lamp	N/A	N/A	N/A	N/A	N/A
	[1]	[1] 50	[1]	[1]	[1]
Resistance, Ohms ±10% @ 25°C for 28 VDC	50Ω	50Ω	50Ω	44.5Ω	44.5Ω
Nominal Coil Voltage(s)	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz
Operate Time, Maximum (MS):					
AC Coils	30	30	30	40	40
DC Coils	25	25	25	30	30
Release Time, Maximum (MS):					
AC Coils	50	50	50	50	60
DC Coils	10	10	10	20	20
Bounce Time, Maximum (MS)	2	2	2	10	10
ENVIRONMENTAL DATA					
Sinusoidal Vibration, Maximum G	15 G 55 to 1500 Hz	15 G 55 to 1500 Hz	15 G 70 to 1500 Hz	10 G 55 to 500 Hz	10 G 55 to 1500 Hz
Shock, Minimum G	50	50	50	50	50
MECHANICAL DATA					
Weight, oz./grams, Max.	20 oz.	20 oz.	46.4 oz.	28 oz.	44.8 oz.
Dimensions, in., Max. L×W×H	3.73×3.305×2.50	3.73×3.305×2.50	6.21×3.80×2.70	3.63×3.62×2.875	4.22×4.23×4.53

NOTES:	Auxiliary 5 amp contacts available. [1] 440 Vac 60 Hz delta ratings available	Auxiliary 5 amp contacts available. [1] 440 Vac 60 Hz delta ratings available	Auxiliary 5 amp contacts available. [1] 440 Vac delta 60 Hz ratings available	Unsealed rotary, 1, 2, 3 and 4 pole; auxiliary contacts from 5 to 25 amps available [1] 440 Vac 60Hz wye/delta rated	Sealed rotary, 1, 2, 3 and 4 pole; auxiliary contacts from 5 to 25 amps available [1] 440 Vac 60 Hz wye/delta rated

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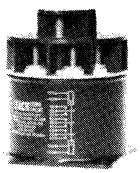




LEACH SERIES:	**H, HT SERIES** 60 Amp 3 PST, 3 PDT, 1 PDT-DB Magnetic Latch	**HC, CENTER-OFF SERIES** 50 Amp 3 PDT-NO 1 PDT-NO DB	**HL, HLT** 60 Amp 3 PST, 3 PDT, 1 PDT-DB	**ZC, CENTER-OFF** 100 Amp 3 PDT-NO, 1 PDT/NO DB	**Z, ZG, ZJ SERIES** 120-200 Amp 3 PDT, 3 PST/NO, SPDT-DB SPST/NO-DB, SPST/NC-DB
DESIGNED TO:	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106
APPLICABLE MS NUMBER(S):	MS27751 M6106/26 and 43	MS27750	MS27749		
ELECTRICAL DATA					
Contact Rating (Amps):					
28 VDC:					
Resistive	50	25	50	50	50
Inductive	20	15	20	30	30
Motor	20	15	20	30	30
Lamp	10	10	10	N/A	N/A
115 VAC, 400 Hz, 3Ø:					
Resistive	60	50	60	100	120-200
Inductive	60	50 [1]	60	100	120-200
Motor	40	30	40	60	80-120
Lamp	15	15	15	N/A	N/A
115 VAC, 50/60 Hz, Δ:					
Resistive	30	30	30	60	60
Inductive	30	30	30	60	60
Motor	30	30	30	40	60
Lamp	N/A	N/A	N/A	N/A	N/A
Resistance, Ohms ±10% @ 25°C for 28 VDC	6 VDC, 12Ω; 12 VDC, 50Ω; 28 VDC, 200Ω; 115 VAC, .090 Amp	6 VDC, 12Ω; 12 VDC, 50Ω; 28 VDC, 200Ω [2] 115 VAC, .100 Amps	6 VDC, 12Ω; 12 VDC, 50Ω; 28 VDC, 200Ω	6 VDC, 9.3Ω; 12 VDC, 38Ω; 28 VDC, 150Ω [1], 115 VAC, 0.9 Amp	6 VDC, 7Ω; 12 VDC, 28Ω; 28 VDC, 113Ω; 115 VAC, .12 Amp
Nominal Coil Voltage(s)	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz
Operate Time, Maximum (MS):					
AC Coils	50	35	35	60	60
DC Coils	50	35	35	60	60
Release Time, Maximum (MS):					
AC Coils	80	80	—	80	40
DC Coils	25	25	—	40	40
Bounce Time, Maximum (MS)	3	3	3	4	4
ENVIRONMENTAL DATA					
Sinusoidal Vibration, Maximum G	10 G 70 to 1000 Hz	10 G 70 to 1000 Hz	10 G 70 to 1000 Hz	5 G 70 to 500 Hz	10 G 70 to 1000 Hz
Shock, Minimum G	50	50	50	15	50
MECHANICAL DATA					
Weight, oz./grams, Max.	14 oz.	15 oz.	15 oz.	32 oz. to 43.2 oz.	32 oz. to 43.2 oz.
Dimensions, in., Max.	2.5 diameter × 3.13	2.50 diameter × 3.13	2.50 diameter × 3.13	3.65 diameter × 4.28	3.65 diameter × 4.28
NOTES:	HT (power transfer model); auxiliary 5 amp contacts and gasket sealed models available	Gasket sealed models available [1] 30 amps for AC coil [2] ±20% @ 25°C	HLT (power transfer model); auxiliary 5 amp contacts and gasket sealed models available	Gasket sealed and magnetically latched versions available [1] ±20% @ 25°C	Auxiliary 5 amp contacts and other configurations available; gasket sealed models available

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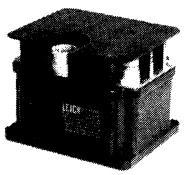

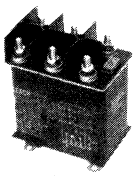

LEACH SERIES:	**ZL SERIES** 120 to 200 Amp 3 PST, 3 PDT, 1 PDT-DB Magnetic Latch	**A, AJ SERIES** 300 to 400 Amp 1 PST/NO DB	**W, WC, WL SERIES** [1] 250 to 275 Amp 1 PDT-DB, 3 PST/NO 1 PST/NO-DB, 1 PST/NC-DB	**REHL SERIES** [1] 15 to 65 Amp 1 PST-DB, 3 PST, 3 PDT
DESIGNED TO:	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106/MIL-C-83883
APPLICABLE MS NUMBER(S):		MIL-R-6106/33		
ELECTRICAL DATA				
Contact Rating (Amps):				
28 VDC:				
Resistive	50	300/400	125	15-50
Inductive	30	100/150	75	12-50
Motor	30	250/250	75	5-20
Lamp	N/A	N/A	N/A	N/A
115 VAC, 400 Hz, 3 Ø:				
Resistive	120	N/A	275	15-65
Inductive	120	N/A	275	15-60
Motor	80	N/A	175	15-40
Lamp	N/A	N/A	N/A	N/A
115 VAC, 50/60 Hz, Δ:				
Resistive	60	N/A	N/A	30
Inductive	60	N/A	N/A	30
Motor	60	N/A	N/A	30
Lamp	N/A	N/A	N/A	N/A
Resistance, Ohms ±10% @ 25°C for 28 VDC	6 VDC, 10Ω; 12 VDC, 40Ω; 28 VDC, 163Ω [1]	6 VDC, 4Ω; 12 VDC, 15Ω; 28 VDC, 60Ω	(W) 8-90Ω; (WL) 9.8Ω; (WC) 100Ω [2]	N/A
Nominal Coil Voltage(s)	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC	28 VDC 115 VAC, 400 HC (W/WC) 28 VDC Suppressed (W/WC)	28 VDC 115 VAC, 400 Hz
Operate Time, Maximum (MS):				
AC Coils	60	N/A	60	N/A
DC Coils	60	35	60	N/A
Release Time, Maximum (MS):				
AC Coils	N/A	N/A	125	N/A
DC Coils	N/A	15	40	N/A
Bounce Time, Maximum (MS)	4	4	4	4
ENVIRONMENTAL DATA				
Sinusoidal Vibration, Maximum G	10 G 55 to 500 Hz	10 G, 70 to 500 Hz 5 G, 500 to 2000 Hz	20 G 60 to 2000 Hz	10 G 55 to 2000 Hz
Shock, Minimum G	15	25	20	25
MECHANICAL DATA				
Weight, Max.	2.0 to 2.75 lbs.	1.75 lbs.	4.5 lbs.	2.0 lbs.
Dimensions, in., Max. L×W×H	3.65 diameter×4.28	3.90×3.64×2.80	4.625×5.56×4.10	3.69×3.25×4.26
NOTES:	[1] ±20% @ 25°C. Auxiliary 5 amp contacts available	Auxiliary 5 amp contacts available	Auxiliary 8 amp contacts available [1] WL Magnetic Latch, WC Center-Off versions [2] ±20% @ 25°C	Auxiliary 5 amp contacts available. [1] Current sensing with remote control capability

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TIME DELAY RELAYS

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SPECIFYING A FIXED TIME DELAY PERIOD

LEACH and the Military identify the time delay period in the same manner. A four-digit dash number specifies the delay period in milliseconds. The first three numbers are significant figures while the fourth indicates the number of zeroes to follow the first three.

Examples: –1001 = 1,000 milliseconds (1 second)
–2502 = 25,000 milliseconds (25 seconds)
–5000 = 500 milliseconds (0.5 seconds)

In the case of a repeat cycle timer (flasher), a similar method is used. The dash number indicates the length of each cycle. (Note: each cycle is 50% on, 50% off).

Examples: –2500 = 250 milliseconds cycle or 4 cycles/sec.
–1001 = 1,000 milliseconds cycle or 1 cycle/sec.
–6002 = 60,000 milliseconds cycle or 1 cycle/min.

USE AND SELECTION OF ADJUSTABLE TIMERS

Adjustable timers are useful in system prototyping or breadboard circuits where the precise time delay period is unknown. By the use of an external resistor, these devices are adjustable over a specific DECADE RANGE. Although any decade range within the overall timing range can be supplied, the following ranges are offered as standards:

0.1 to 1 seconds	(Specify –1001)
1.0 to 10 seconds	(Specify –1002)
5 to 50 seconds	(Specify –5002)
50 to 500 seconds	(Specify –5003)

Note from the above that in specifying a decade range, the four-digit dash number indicates the high or upper limit of the desired decade range.

The formula below provides the proper resistance value to achieve the desired time delay:

$$R_{ext} = \left(\frac{T_1}{T_0} - 1\right) 100{,}000 \text{ Ohms}$$

Where: R_{ext} = External resistance value (Ohms)
T_1 = Desired time in seconds
T_0 = Minimum time (low end of the decade range) in seconds

As an example, if using a 5 to 50 second adjustable timer and a 30 second delay is desired, the calculation is:

$$R_{ext} = \left(\frac{30}{5} - 1\right) 100{,}000 \text{ or } R_{ext} = 500 \text{ K Ohms}$$

Recommended resistors IAW MIL-R-55182 ⅛ WATT, 1% (RNC6OHXXXXFS).

QPL CROSS REFERENCE — MILITARY P/N TO LEACH P/N

Military P/N	Leach P/N	Operation Mode	Output	Timing Range (seconds)
M83726/3[1]	TD-1150/1151	Delay On Operate – Fixed Time	10A, 2PDT	0.1 to 300
M83726/4[1]	TD-1160/1161	Delay On Release – Fixed Time	10A, 2PDT	0.1 to 300
M83726/12	TD-1369	Delay On Release – Fixed Time	10A, 4PDT	0.1 to 300
M83726/14	TD-1370	Delay On Operate – Fixed Time	10A, 4PDT	0.1 to 300
M83726/20	TD-1435	Delay On Operate – Fixed Time	250MA, SPST	0.05 to 500
M83726/21	TD-1436	Delay On Operate – Adjustable[2]	250MA, SPST	0.05 to 500
M83726/22	TD-1412	Repeat Cycle Timer (Flasher)	250MA, SPST	1-600 cycles/min.[3]
M83726/23	TD-1505	"True" Delay On Release – Fixed[4]	10A, 4PDT	0.1 to 75
M83726/24	TDH-1609	Delay On Operate – Fixed Time	150MA, SPST	0.05 to 500
M83726/25	TDH-1610	Delay On Release – Fixed Time	150MA, SPST	0.05 to 500
M83726/28	TDH-8050/8051	Delay On Operate – Fixed Time	10A, 2PDT	0.1 to 600[5]
M83726/29	TDH-8070/8071	Delay On Release – Fixed Time	10A, 2PDT	0.1 to 600[5]
M83726/30	TDH-8060/8061	Delay On Operate – Adjustable	10A, 2PDT	0.1 to 600[5]
M83726/31	TDH-8080/8081	Delay On Release – Adjustable	10A, 2PDT	0.1 to 600[5]

[1] Slash sheets 1, 2, 3 & 4 to MIL-R-83726 have been officially cancelled. DLA specified replacements: /28 replaces /1 and /3 and /29 replaces /2 and /4. Replacement units are smaller and lighter but are electrically and physically compatible with inactivated units.

[2] All adjustable timers use external resistor (not supplied) to adjust timing range.

[3] Each cycle 50% on, 50% off.

[4] "True" time delay on release requires no external power during timing period.

[5] Timing ranges above 500 seconds not MIL qualified.

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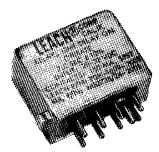
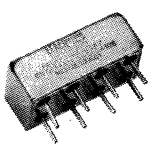
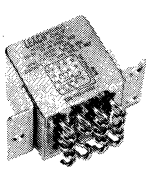
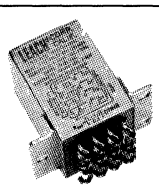
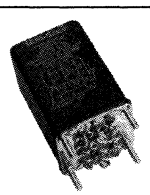
		CONTACT RATING—AMPS	OUTPUT CONFIGURATION	METHOD OF TIMING: ON OPERATE FIXED TIME	METHOD OF TIMING: ON OPERATE ADJUSTABLE	METHOD OF TIMING: ON RELEASE FIXED TIME	METHOD OF TIMING: ON RELEASE ADJUSTABLE	TIMING RANGE IN SECONDS	DIMENSIONS (L×W×H)	WEIGHT MAX OZ.
	TDH-1609	.150	SPST	✓				.05 TO 500	.810 × .410 × .640	0.56 oz.
	TDH-1610						✓			
	TD-1435	.250	SPST	✓				.05 TO 500	.810 × .410 × .310	0.5 oz.
	TD-1436					✓				
	TD-1412			REPEAT CYCLE (FLASHER)				1 TO 600 CYCLES/MIN		
	TDH-8050	10	2PDT	✓				0.1 TO 600	1.025 × 1.025 × 1.010	2.5 oz.
	TDH-8060				✓					
	TDH-8070					✓				
	TDH-8080						✓			
	TDH-6050	10	2PDT	✓				0.1 TO 600	1.025 × .525 × 1.520	1.9 oz.
	TDH-6060				✓					
	TDH-6070					✓				
	TDH-7050	10	4PDT	✓				0.1 TO 600	1.025 × 1.025 × 1.500	3.0 oz.
	TDH-7060				✓					
	TDH-7070					✓				
	TD-1370	10	4PDT	✓				0.1 TO 300	1.531 × 1.531 × 2.340	10.0 oz.
	TD-1369						✓			
	TD-1505	10	4PDT				✓ "TRUE"	0.1 TO 75	2.062 × 2.062 × 1.810	12.0 oz.

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SOLID STATE RELAY DESCRIPTIONS

LEACH Solid State Relays utilizes state-of-the-art custom integration and power MOSFET technology to provide sophisticated features plus optimized power output switching.

In both the Solid State Relay (LS06051B) and Solid State, True Current Sensing Relay (LS06102C), an isolated status pin is provided which acts as a trip indicator. A low status indicates the output has tripped off due to an over-current condition.

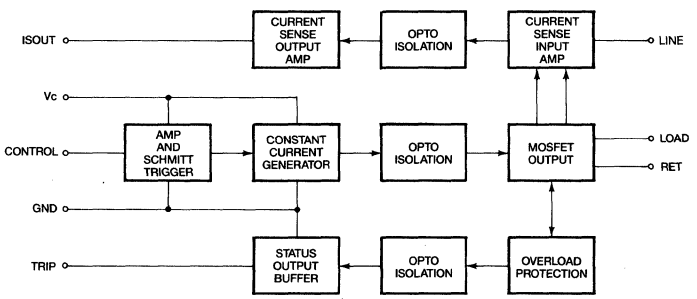
In the Solid State, True Current Sensing Relay (LS06102C), unique and proprietary circuit is used to provide an isolated, analog load current signal. After proper scaling, this signal gives the true load current value.

Both the LS06051B and LS06102C feature integrated short circuit, current overload, and thermal overload protection to protect both the unit and the system wiring. Optical isolation between input and output, while reducing size and cost, helps eliminate EMI and RFI usually present in transformer type isolation circuits. Buffered inputs enable the relay to be driven directly by standard CMOS or open collector TTL Logic. The LS06051B and the LS06102C are housed in a hermetic metal package to maximize heat dissipation.

These are two products from a family of products utilizing LEACH's functional block design concept. Additional features and isolated input/output pins are available.

Solid State Relay
True Current Sensing

BLOCK DIAGRAM



SOLID STATE POWER CONTROLLER DESCRIPTIONS

LEACH Solid State Power Controllers feature reliable, troublefree switching together with short circuit and overload protection. Load current is continuously monitored, and the devices will shutdown within microseconds reacting to an overload condition.

In both Solid State Power Controller Products (LR06014N family and LR06025Q family), the status signal is derived from the load current and is reported via an optically isolated status output.

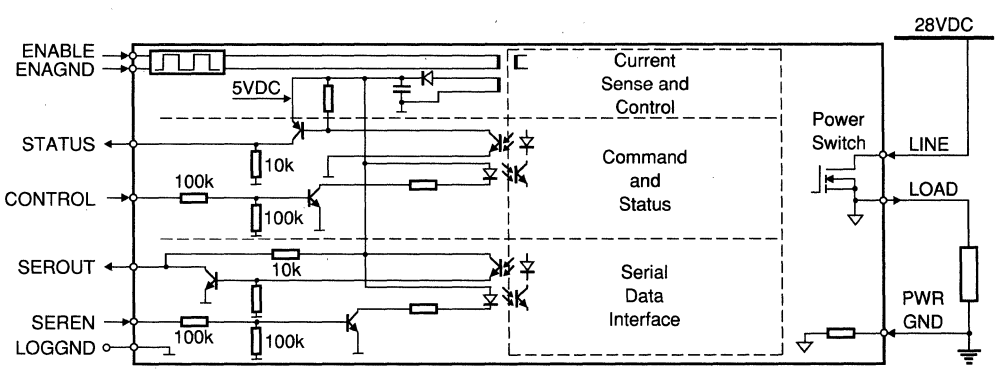
The LR06014N family is designed for operation in 28 VDC power systems with ratings from 1 to 4 amperes.

The LR06025Q family is designed for operation in 28 VDC power systems with ratings from 2 through 10 amperes.

Both the LR06014N family and LR0625Q family are enclosed in a hermetically sealed metal package to maximize heat dissipation.

Solid State Power Controller
Serial Data Word Output

BLOCK DIAGRAM



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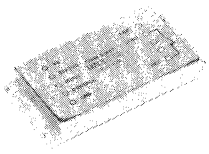

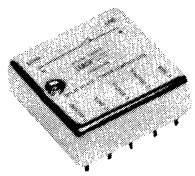

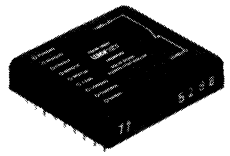

DESCRIPTION:	SOLID-STATE RELAY	SOLID-STATE RELAY	SOLID-STATE POWER CONTROLLER	SOLID-STATE POWER CONTROLLER
LEACH SERIES/PART NUMBER:	LS / LS06051B	LS / LS06102C	LR / LR06014N, LR06024N, LR06044N	LR / LR06025Q, LR06055Q, LR06105Q
FUNCTIONS / FEATURES				
	– Power output switching – Short circuit, current overload and thermal overload protection – Trip status indication – Optical isolation	– Power output switching – Short circuit, current overload and thermal overload protection – True current sense – Trip status indication – Current sense indication – Optical isolation	– Power output switching – Short circuit and current loverload protection – On/off status indication – Optical and transformer isolation	– Power output switching – Short circuit, current overload and thermal overload proptection – On/off status indication – Serial data word including load current information, bit and trip status – Optical and transformer isolation
ELECTRICAL DATA				
INPUT (CONTROL) CHARACTERISTICS	MIN. TYP. MAX. UNITS	MIN. TYP. MAX. UNITS	MIN. TYP. MAX. UNITS	MIN. TYP. MAX. UNITS
Bias Supply Range, V_C	3.8 — 32 V_{DC}	3.8 — 32 V_{DC}	5 V_{DC} Bias 4.5 28 V_{DC} Bias 18 — 5.5 32 V_{DC}	--- Bias Derived From Output ---
Bias Supply Current	13 16 mA	13 16 mA	20 mA	--- Bias Derived From Output ---
Control Input	--- TTL, CMOS Compatible ---	--- TTL, CMOS Compatible ---	--- TTL, CMOS Compatible ---	--- TTL, CMOS Compatible ---
Control Input Hysteresis (CMOS Mode)	1.2 V_{DC}	1.2 V_{DC}	N/A	N/A
Serial Enable Control	N/A	N/A	N/A	--- TTL, CMOS Compatible ---
Enable Voltage	N/A	N/A	N/A	14 — 32 V_{DC}
Enable Current	N/A	N/A	N/A	15 30 mA
OUTPUT (LOAD) CHARACTERISTICS				
Continuous Load Current	5.0 Amps	10.0 Amps	1.0, 2.0, 4.0 Amps	2.0, 5.0, 10.0 Amps
Continuous Operating Output Voltage (Line Voltage)	60 V_{DC}	32 V_{DC}	32 V_{DC}	32 V_{DC}
Output Voltage Drop @ Rated Current	0.5 V_{DC}	0.5 V_{DC}	0.2 V_{DC}	0.22 V_{DC}
Leakage Current @ Max. Output Voltage	1.0 mA	15 @ 32 V_{DC} mA	.1 @ 28 V_{DC} mA	1.0 @ 28 V_{DC} mA
Transient Blocking Voltage	80 V_{DC}	80 V_{DC}	50 V_{DC}	
Turn-On Time	1.0 mSec	2.0 mSec	.125 mSec	
Turn-Off Time	1.0 mSec	2.0 mSec	.185 mSec	
OUTPUT (LOAD) INDICATIONS, ISOLATED				
Status	--- TTL, CMOS Compatible ---	--- TTL, CMOS Compatible ---	--- TTL, CMOS Compatible ---	--- TTL, CMOS Compatible ---
Serial Data Word Out	N/A	N/A	N/A	
Serout Voltage "Low"				0 0.8 V_{DC}
Serout Impedance "High"				8.0 10 12 KΩ
Current Sense Output (ISOUT)	N/A		N/A	N/A
Scale		--- $I_{LOAD} = 2.244 (V_{ISOUT} + 0.1227)$ ---		
Accuracy		±5 %		
ENVIRONMENTAL DATA				
Operating Temperature Range	−55°C to +105°C	−55°C to +105°C	−55°C to +105°C	−55°C to +105°C
Storage Temperature Range	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C
Thermal Impedance	7°C/Watt (Junction to Case)	10°C/Watt (Junction to Case)	20°C/Watt (Junction to Ambient)	15°C/Watt (Junction to Ambient)
Maximum Output Junction Temperature	125°C	125°C	150°C	150°C
Vibration	100 g, 10 to 3000 Hz	100 g, 10 to 3000 Hz	30 g, 10 to 3000 Hz	30 g, 10 to 3000 Hz
Acceleration	5000 g	5000 g	100 g	100 g
Shock	50 g, 11 mSec	50 g, 11 mSec	50 g, 11 mSec	50 g, 11 mSec
MTBF			880,000 hrs.	300,000 hrs.
Altitude			80,000 ft.	80,000 ft.
PHYSICAL DATA				
Enclosure	Hermetically Sealed	Hermetically Sealed	Hermetically Sealed	Hermetically Sealed
Material	Header & Can = Cold Rolled Steel Nickel Plated, Pins = Cu Alloy #52 Gold Plated	Header & Lid = Kovar, Pins = Cu Alloy #52 Gold Plated	Case Finish & Pins = Tin Plated	Case Finish = Matte Black, Pins = Tin Plated
Weight	20 grams max.	50 grams max.	20 grams max.	37 grams max.

NOTES:
[1] See respective Leach Engineering Data Sheets for further details.
[2] All specifications subject to change without notice.
[3] Leach manufactures the M85C-2AS & M33C-1NS under license from Teledyne Solid State, a Division of Teledyne Relay.



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- Siemen
- USD
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- Weidmuller

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- Simpson Electric
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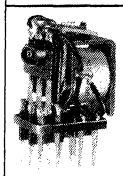
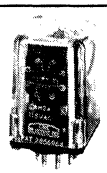
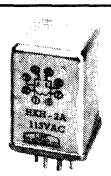
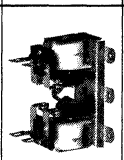
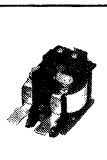
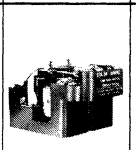
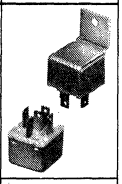
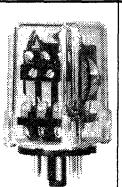
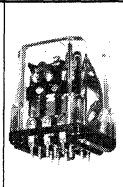
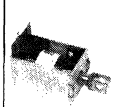
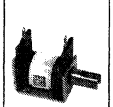
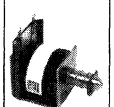
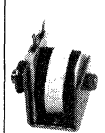
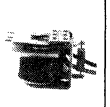
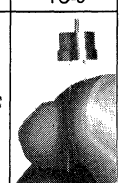
BASIC RELAY TYPE									
TYPICAL DIMENSIONS	W = 1.03 in. H = 1.22 in. L = 1.80 in.	W = 1.38 in. H = 2.16 in. L = 1.38 in. PINS	W = 1.52 in. H = 1.89 in. L = 1.40 in. PINS	W = 1.38 in. H = 2.19 in. L = 1.38 in. PINS	W = 1.75 in. H = 1.75 in. L = 2.75 in. OPEN	W = 1.63 in. H = 1.33 in. L = 2.16 in.	W = 1.47 in. H = 3.41 in. L = 2.63 in.	W = 2.50 in. H = 2.03 in. L = 2.31 in.	W = 1.02 in. H = 1.28 in. L = 1.02 in.
CONTACT ARRANGEMENT	SPST THRU 3PDT	SPST THRU 3PDT	SPST THRU 3PDT	SPST THRU 3PDT	1-6 PDT	SPST-NO-DB SPST-NC-DB	DPDT DPDT + 2NO DPDT + 1NO DPDT + 1NO,1NC 3PDT 2NO + 2NC	SPDT DPDT THRU SPST-NO-DM DPDT (2 AUX.)	SPST SPDT
CONT. RATING AVAILABLE (RESISTIVE)	5A 240VAC 10A 240VAC	5A 240VAC 10A 240VAC	5A 240VAC 10A 240VAC	5A 240VAC 10A 240VAC	15A TUNGSTEN 30A 120VAC 5A 120VAC 10A 120VAC	20A TUNGSTEN 30A 120VAC 1 H.P.	10 AMPS 15 AMPS	30A 277VAC 1 H.P.	30A RESISTIVE 24A IND AT 12VDC
COIL VOLTAGE	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-480 (DC) 6-110	6-24VDC

SENSITIVE RELAYS

	SENSITIVE DC COIL	
	MKF & MKC	SK
BASIC RELAY TYPE		
TYPICAL DIMENSIONS	W = 1.38 in. H = 2.16 in. L = 1.38 in.	W = 1.38 in. H = 1.90 in. L = 1.38 in.
CONTACT ARRANGEMENT	SPST THRU 3PDT	SPDT DPDT 3PDT
CONT. RATING AVAILABLE (RESISTIVE)	PILOT DUTY RATINGS 5A 240VAC 10A 240VAC	PILOT DUTY RATINGS 5A 240VAC 10A 240VAC
COIL VOLTAGE	1PDT-125mw 2PDT-250mw 3PDT-375mw	1PDT-60mw 2PDT-120mw 3PDT-180mw

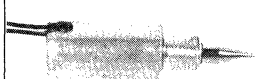
SOLENOIDS AND ACTUATORS

	D.C. OPERATED	U-FRAME	U-FRAME	U-FRAME	ACTUATOR	ACTUATOR	MINIATURE IMPULSE DUTY
	FA	DS	BR	KL	RC	RM	TO-5
BASIC SOLENOID TYPE							
OPERATING VOLTAGES	6, 12, 24, 48 AND 110VDC OTHERS AVAILABLE	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 24VDC
DUTY Continuous	X	X	X	X	X	X	X
Intermittent	X	X	X	X	X	X	X
Pulse	X	X	X	X			X
DIMENSIONS IN INCHES	W = 1.640 H = 1.063 L = 2.125	W = 0.750 H = 1.406 L = 1.563	W = 1.000 H = 1.656 L = 1.563	W = 1.375 H = 2.063 L = 1.563	W = 0.859 H = 1.563 L = 1.375	W = 1.188 H = 1.563 L = 2.438	L = 0.500 D = 0.359
ACTION Push		X	X	X			
Pull	X	X	X	X	X	X	X

BUZZERS

	BUZZERS		
	MD	MA & MB	MC
BASIC RELAY TYPE			
TYPICAL DIMENSIONS	W = 0.88 in. H = 0.88 in. L = 1.66 in.	W = 1.03 in. H = 1.17 in. L = 2.16 in.	W = 2.84 in. H = 1.56 in. L = 3.47 in.
COIL VOLTAGE	6-240VAC	6-240VAC	6-240VAC

CYLINDRICAL SOLENOIDS

	SMALL	MEDIUM
	TYPE EL	TYPE EP
BASIC SOLENOID TYPE		
DUTY Continuous	YES	YES
Intermittent	YES	YES
Impulse	YES	YES
ACTION Push	X	X
Pull	X	X
MINIMUM DIMENSIONS IN INCHES	LENGTH = 1.813 DIAMETER = 0.484	LENGTH = 2.250 DIAMETER = 0.484

LOGITEK

THE LOGICAL CHOICE OF THE TECHNICAL MIND

POWER PRODUCTS

POWER MONITORS AC & DC VOLTAGE MONITORS



GENERAL INFORMATION

Logitek power monitoring equipment is utilized to monitor incoming power on AC or DC power systems. When the system voltage, frequency or phase characteristics deviate from the predetermined acceptable limits, the relay de-energizes to activate an alarm indicator or system shut-down contactors. Voltage sensing is accomplished with an "RMS" type detector that is relatively insensitive to line distortion.

EQUIPMENT TYPES

Individual units monitor AC or DC voltage and line frequency for both high and low limits, and phase rotation for reversal/loss. Power monitors are also available incorporating any combination of these functions into a single unit. This equipment is available with factory set limits or as field adjustable.

OPERATING CHARACTERISTICS

When the voltage and frequency of the input signal are within prescribed high and low limits, and the phase rotation is ABC, the output relay will energize after the specified "pick-up" time delay. If the high or low voltage limits of any phase are exceeded for a time greater than the specified "drop-out" time delay, the relay de-energizes and remains de-energized until all phase voltages return within limits and remain at normal levels for longer than the specified "pick-up" time delay. If the input frequency exceeds the high or low frequency limits for a time exceeding the "drop-out" time delay, the relay de-energizes and remains de-energized until the frequency returns within limits and remains at normal levels for longer than the "pick-up" time delay. The output relay will not energize if the phase rotation is other than ABC or if any phase is disconnected. When the output relay is energized, loss of any phase will cause the relay to drop out immediately, overriding the time delay circuits.

SPECIAL PRODUCTS

Logitek's engineering department is available to discuss your applications of our product or to design special equipment to satisfy your system requirements.

TYPICAL SPECIFICATIONS

ELECTRICAL

Input Voltage	115 VAC/208 VAC/ 230 VAC
Voltage Transients	MIL-STD-704, Limits 1, 2, 3
Input Frequency	50 / 60 / 400 Hz
Sense Voltage	As required
Sense Frequency	As required
Accuracy	±1%
Phase Sequence	ABC
Time Delay (Pick-Up and Drop Out)	250 milliseconds to 10 seconds factory set or field adjustable
Relay Contacts	DPDT, 3PDT
Contact Rating	2 amp, 10 amp
Contact Life	50,000 operations min.
Power Dissipation	6 watts maximum

PHYSICAL

Finish	Gloss Blue #15177, in accordance with MIL-F-14072
Connector	Glass to metal seal solder hooks, MS3113H-20-16PN Connector
Enclosure	Steel case, hermetically sealed and encapsulated

ENVIRONMENTAL

Temperature	−55°C to +125°C −40°C to +85°C −10°C to +70°C
Vibration	Per MIL-STD 810C, Method 514.2, Procedure I, 10-2000 Hz, 20g's
Shock	Per MIL-STD 810C, Method 516.2, Procedure I, 50g's 11 ±1 millisecond any axis
Acceleration	Per MIL-STD 810C, Method 513.2, Procedure I & II, 10g's
Humidity	Per MIL-STD 810C, Method 507.1, Procedure I
Altitude	Per MIL-STD 810C, Method 504.1, Category 6 equipment, sea level to 70,000 ft.

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LOGITEK POWER PRODUCTS

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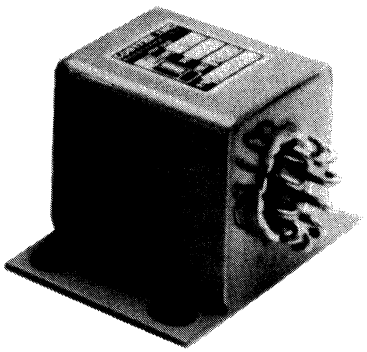
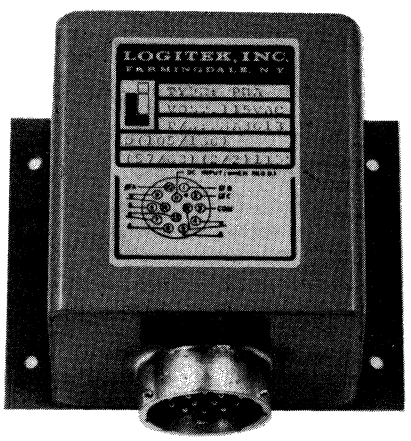
FREQUENCY MONITORS
PHASE MONITORS





GENERAL INFORMATION

Frequency Monitors: Logitek Frequency Monitors are used in applications where electrical systems must be de-energized or alarm devices activated when the power line frequency departs from the predetermined normal range of operations.

Phase Monitors: Logitek Phase Monitors are used to protect three-phase loads, particularly rotating components, from damage resulting from phase reversals or the absence of phase. Contacts may be used to disconnect the load, to operate an alarm, or both.

OPERATING CHARACTERISTICS

Frequency Monitors: Signal voltage from the power line is applied to the designated terminals. If the line frequency is within the specified limits, the output relay energizes. If the frequency deviates from the preset limits for longer than the specified drop-out time delay, the unit de-energizes. After de-energizing, the frequency must return to within the pre-set band for longer than the pick-up time delay to re-energize the output relay.

Phase Monitors: Upon application of power, the output relay energizes if all phases are connected and the phase rotation is abnormal, the relay immediately de-energizes.

SPECIAL PRODUCTS

Logitek's engineering department is available to discuss your applications of our product or to design special equipment to satisfy your system requirements.

TYPICAL SPECIFICATIONS

ELECTRICAL

Input Voltage	115 VAC/230 VAC
Voltage Transients	MIL-STD-704, Limits 1, 2, 3
Input Frequency	50 / 60 / 400 Hz
Sense	As required
Frequency Accuracy	±1%
Phase Sequence	ABC
Phase To Phase Balance	±0.5%
Time Delay (Pick-Up and Drop Out)	250 milliseconds to 10 seconds factory set or field adjustable
Relay Contacts	DPDT, 3PDT
Contact Rating	2 amp, 10 amp
Contact Life	50,000 operations min.
Power Dissipation	4 watts maximum

PHYSICAL

Finish	Gloss Blue #15177, in accordance with MIL-F-14072
Connector	Glass-to-metal seal solder hooks, MS3113H-20-16PN Connector
Enclosure	Hermetically sealed and encapsulated or potted

ENVIRONMENTAL

Temperature	−55°C to +125°C −40°C to +85°C −10°C to +70°C
Vibration	Per MIL-STD 810C, Method 514.2, Procedure I, 10-2000 Hz, 20g's
Shock	Per MIL-STD 810C, Method 516.2, Procedure I, 50g's 11 ±1 millisecond any axis
Acceleration	Per MIL-STD 810C, Method 513.2, Procedure I & II, 10g's
Humidity	Per MIL-STD 810C, Method 507.1, Procedure I
Altitude	Per MIL-STD 810C, Method 504.1, Category 6 equipment, sea level to 70,000 ft.

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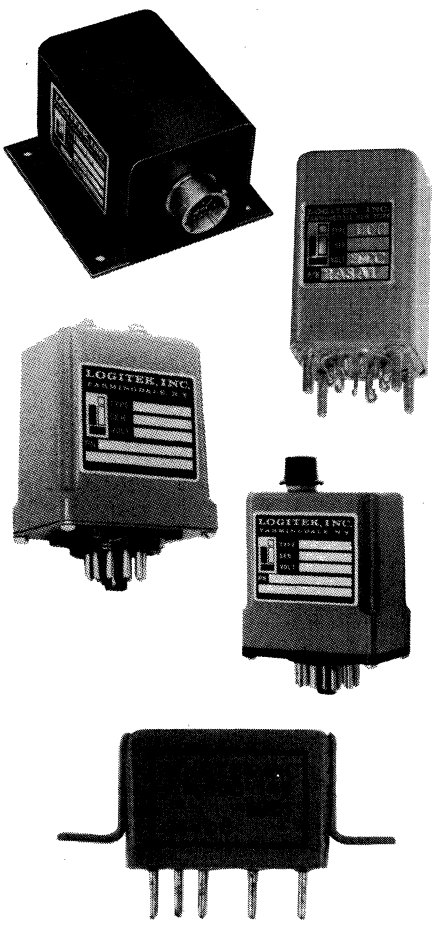
POWER PRODUCTS

TIME DELAY RELAYS
SOLID STATE FLASHERS
REPEAT CYCLE AND INTERVAL TIMERS



GENERAL INFORMATION

The design of complex electrical distribution systems often requires that certain operations be delayed or sustained for a precise interval of time from occurrence of a control or initializing signal. Combinations of various timing devices can be used for sequential startup or shutdown programs, load transfer or shedding, or delayed transfer to avoid race conditions. In addition, pulsers, interval timers, and flashers are used in applications, such as operating instrument panel warning lights or other annunciator devices, landing gear, door open indicators and navigation lights.

QUALITY ASSURANCE

Logitek's facilities are qualified under MIL-Q-9858A and MIL-STD-2000, and maintains a MIL-I-45208 inspection system. These systems, along with Logitek's 100 hour burn-in cycle, contribute substantially to Logiteck's uncompromising product integrity.

OPERATING CHARACTERISTICS

Logitek timing devices are generally CMOS integrated circuits appropriately protected from line transients and other line perturbations and either a solid state or electromechanical relay output circuit. Since there are no large capacitive timing or storage elements in these devices, recycle times (the time after control removal that will cause a new timing cycle within specified accuracy) are very short. In addition, the use of CMOS IC digital counting circuits allows the use of very stable timing elements resulting in excellent stability through wide temperature ranges.

APPLICATIONS

• Aircraft, Electrical Systems • Mobile Radar Systems • Equipment Test Stations • Tanks • Mobile Missile Launchers • Offshore Drilling Rigs • Computer Systems • Shipboard Electrical Systems • Hospital Auxiliary Power Systems

SPECIAL PRODUCTS

Logitek's engineering department is available to discuss your applications of our product or to design special equipment to satisfy your system requirements.

TYPICAL SPECIFICATIONS

ELECTRICAL

Input Voltage	115 VAC/208 VAC/230 VAC
Timing Range	50 milliseconds to 1000 seconds
Accuracy	±10%, ±5%, ±2%
Contacts	
Relay	DPDT
Solid State	
Radio Interference	Per MIL-1-26600

PHYSICAL

Finish	Gloss Blue #15177, in accordance with MIL-F-14072
Connector	Glass-to-metal seal solder hooks, solder pins, MIL connector, octal plug in
Enclosure	Hermetically sealed and encapsulated, Butyrate case

ENVIRONMENTAL

Temperature	−55°C to +125°C −55°C to +85°C −55°C to +71°C −30°C to +30°C
Vibration	Per MIL-STD 810C, Method 514.2, Procedure I, 10-2000 Hz, 20g's
Shock	Per MIL-STD 810C, Method 516.2, Procedure I, 50g's 11 ±1 millisecond any axis
Acceleration	Per MIL-STD 810C, Method 513.2, Procedure I & II, 10g's
Humidity	Per MIL-STD 810C, Method 507.1, Procedure I
Altitude	Per MIL-STD 810C, Method 504.1, Category 6 equipment, sea level to 70,000 ft.

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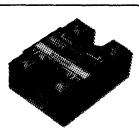
Phone: (213) 452-1336 FAX: (213) 392-9585 Telex: 182041 MASTER SNM

- GENERAL PURPOSE RELAYS
- POWER RELAYS
- SOLID STATE RELAYS
- TIME DELAY RELAYS
- SOLID STATE TIMERS
- INPUT/OUTPUT MODULES
- SOCKETS

SOLID STATE RELAYS



SS SERIES
SSA — SCR's back to back with A.C. control.
SSC — SCR's back to back with D.C. control.

ST SERIES:
STA — TRIAC with A.C. control.
STD — TRIAC with D.C. control.

SPECIFICATIONS

1. Current Rating: 8 to 90 Amps.
2. Minimum load current: 50 ma.
3. Temperature Range:
   a. Operating: −30°C to +80°C
   b. Storage: −28°C to +100°C
4. Duty: Continuous
5. Contacts: 1 Form A (SPNO)
6. Input control: A.C. Models
   a. Control voltage range: 90 — 280 VAC
   b. Must operate voltage: 90 VAC Max.
   c. Must release voltage: 10 VAC Min.
   d. Input impedance: 40,000 OHMS Min.
   e. Input current: 2mA max @ 120 VAC
7. Input control: D.C. Models
   a. Control voltage range: 3-32 VDC
   b. Must operate voltage: 3 VDC Max.
   c. Must release voltage: 1 VDC Min.
   d. Input impedance: 1,500 OHMS Min.
   e. Input current: 4mA max @ 5 VDC
8. Standard: Zero voltage turn on.
9. UL listed and CSA certified.

ORDERING INFORMATION

SCR OUTPUT - SS SERIES

PART NUMBER		Line V ac (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
AC Input	DC Input			
SSA1210	SSD1210	24-140	10	120
SSA1225	SSD1225	24-140	25	250
SSA1240	SSD1240	24-140	40	625
SSA2410	SSD2410	48-280	10	120
SSA2425	SSD2425	48-280	25	250
SSA2440	SSD2440	48-280	40	625
SSA2450	SSD2450	48-280	50	625
SSA2475	SSD2475	48-280	75	1000
SSA4808	SSD4808	80-530	8	72
SSA4812	SSD4812	80-530	12	140
SSA4825	SSD4825	80-530	25	250
SSA4840	SSD4840	80-530	40	400
SSA4875	SSD4875	80-530	75	1000
SSA4890	SSD4890	80-530	90	1200

TRIAC OUTPUT - ST SERIES

STA1210	STD1210	24-140	10	100
STA1225	STD1225	24-140	25	250
STA2410	STD2410	48-280	10	100
STA2425	STD2425	48-280	25	250
STA4825	STD4825	80-530	25	250

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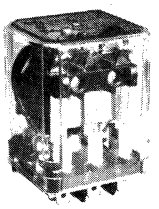
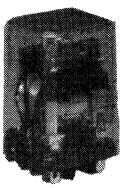
GENERAL PURPOSE RELAYS

IMMEDIATE DELIVERY



SERIES	GV	GQ	GQ-F	GB	GF
Features	• Exceptionally reliable power relay • Octal type plug-in terminations • AC & DC coils • Optional indicator lamp • CSA UL	• Power relay for use in control panels • Optional indicator lamp and push-to-test button • High dielectric strength (2000VAC) • CSA UL	• GQ package with 15 amp rating • Plain or bracket mount dust cover • Ideally suited for many diverse applications • CSA UL	• Enclosed relay with magnetic blow outs • Switches DC currents • Optional flange-top case for panel mounting • CSA UL	• Magnetic latching relay • Single or dual coil input • Low power requirement • Good memory stability • CSA UL
Contact Arrangement	SPDT DPDT TPDT	SPDT DPDT TPDT	1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, 3C, 1X, 1Y, 1Z	1X, 2A, 2C	SPDT DPDT
Contact Rating	10A @ 28 VDC or 230 VAC	10A @ 28 VDC or 240 VAC	15A @ 277 VAC 1/3 HP @ 120 VAC 1/2 HP @ 250-600 VAC 3A @ 600 VAC	(1X) 10A @ 150 VDC (2A) 5A @ 150 VDC (2C) 3A @ 150 VDC	10A @ 28 VDC or 240 VAC
Contact Material	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O
Coil Voltage	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	5-110 VDC 6-277 VAC	6-110 VDC 6-277 VAC	6-110 VDC 6-240 VAC
Nominal Coil Power	(DC) 1.5W (AC) 2.3VA	(DC) 1.2-1.8W (AC) 2.0-2.75VA	(DC) 1.2W (AC) 2.74 VA	(DC) 1.2W (AC) 2.0VA	(DC single coil) 1.2W (DC dual coil) 2.4W
Mechanical Life	5,000,000 operations min.	10,000,000 operations	10,000,000 operations	10,000,000 operations	10,000,000 operations
Approximate Dimensions (inches)	2.07"Hx1.36"L x1.36"W	1.91"Hx1.53"L x1.41"W	1.91"Hx1.53"L x1.41"W	1.91"Hx1.53"L x1.41"W	2.16"Hx1.53"L x1.41"W
Mounting	Socket mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount
Sockets	Screw terminal P.C. terminal	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect

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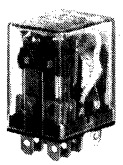
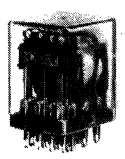
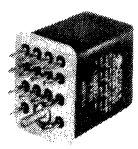
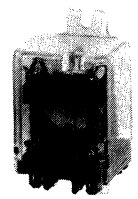
GENERAL PURPOSE RELAYS				POWER RELAYS		
IMMEDIATE DELIVERY						
SERIES	**GL**	**GM**	**GMH**	**GT**	**GH**	**GW**
Features	• Compact general purpose relay • Wide range of applications • Optional indicator lamp and push-to-test button • Ⓢ Ⓟ ᵁL	• Versatile relay • Optional indicator lamp and push-to-test button • Ideal for power and sequence control applications • Ⓢ Ⓟ ᵁL	• Hermetically sealed steel case • Excellent for adverse environments • Ⓢ Ⓟ ᵁL	• 20A and 30A switching • Bracket mount package • 3,750 VRMS coil-to-contact breakdown • Ⓢ Ⓟ ᵁL	• 30 amp contact rating • High in rush capacity • Optional magnetic blowouts and auxiliary switch • 50A unit available • Ⓢ Ⓟ ᵁL	• Mercury displacement relay • 35A and 60A switching • Hermetically sealed • Ideal for adverse environments • Ⓢ Ⓟ ᵁL
Contact Arrangement	DPDT TPDT 4PDT	DPDT TPDT 4PDT	2C, 4C, 5C	SPDT DPDT	1A, 1B, 1C, 2A, 2B, 2C, 1X, 1Y	1A, 2A, 3A 1B, 2B, 3B
Contact Rating	10A @ 24 VDC or 110 VAC	• DPDT, TPDT 5A @ 24 VDC or 220 VAC • 4PDT 3A @ 24 VDC or 220 VAC	Up to 5A @ 120 VAC/28 VDC	• SPDT 30A @ 120/240 VAC 25A @ 28 VDC • DPDT 20A @ 120/240 VAC or 28 VDC	30 Amps @ 300 VAC	• 35A model 35A @ 480 VAC • 60A model 60A @ 480 VAC
Contact Material	Ag Cd O	• DPDT, TPDT Ag • 4PDT Ag (Au Flash)	Ag or Ag Cd O	Ag Cd O	Ag or Ag Cd O	Liquid Mercury
Coil Voltage	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-120 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-220 VDC 6-480 VAC	5-250 VDC 6-480 VAC
Nominal Coil Power	• DPDT (DC) 0.9W (AC) 1.2VA • TPDT, 4PDT (DC) 1.4W (AC) 1.6-2.5VA	(DC) 0.9W (AC) 1.2VA	(DC) 0.90W (AC) 1.20VA	(DC) 1.2W (AC) 2.7VA	(DC) 2.0W (AC) 10.0VA	AC (VA): 1 Pole N.O. 8.0 N.C. 13.0; 2 Pole N.O. 18.6 N.C. 20.5; 3 Pole N.O. 33.0 N.C. 33.0 DC (W): 1 Pole N.O. 6.5 N.C. 8.0; 2 Pole N.O. 7.5 N.C. 10.5; 3 Pole N.O. 12.0 N.C. 12.0
Mechanical Life	AC-50,000,000 operations DC-100,000,000 operations	AC-50,000,000 operations DC-100,000,000 operations	10,000,000 operations	10,000,000 operations	3,000,000 operations	3,000,000 operations
Approximate Dimensions (inches)	1.40″H x 1.10″L x 0.85″W (DPDT Unit)	1.42″H x 1.10″L x 0.85″W	1.42″H x 1.10″L x 0.85″W	1.97″H x 1.53″L x 1.41″W	2.3″H x 3.125″L x 2.5″W (DPDT Unit)	5.06″H x 3.365″L x 3.125″W (TPDT Unit)
Mounting	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Panel mount Track mount	Screws	Box Collar
Sockets	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminals Solder terminals P.C. terminals	—	—	—

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PHONE: (213) 452-1336

TIME DELAY RELAYS

IMMEDIATE DELIVERY



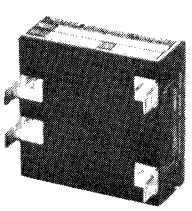
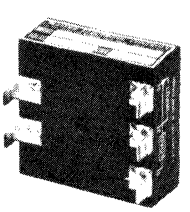
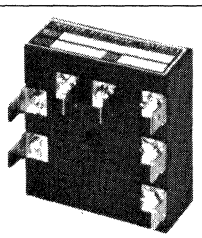
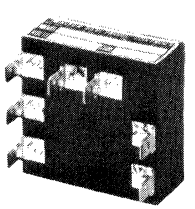




SERIES	DM	DI	DB	DS	RC
Features	• Reliable and accurate • Indicator lamp available in all voltages	• Precise timing cycles • Indicator lamp available in all voltages	• Wide range of industrial applications • Indicator lamp available in all voltages	• Reliable and accurate • Indicator lamp available in all voltages	• Independent on and off delays • Indicator lamp available in all voltages
Mode of Operation	Delay on make	Delay on interval	Delay on break	Delay on single-shot	Recycling timer
Contact Arrangement	DPDT TPDT	DPDT TPDT	SPDT DPDT	SPDT DPDT	DPDT TPDT
Contact Rating	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC
Input Voltage	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC
Delay Time (in seconds)	0.1-3600	0.1-3600	0.1-3600	0.1-3600	0.1-3600 on 0.1-3600 off
Type of Control	Fixed Knob Remote	Fixed Knob Remote	Fixed Knob Remote	Fixed Knob Remote	Knob Remote
Maximum Repeatability	±1%	±1%	±1%	±1%	±1%
Mechanical Life	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations
Approximate Dimensions (in.)	2.75″H x 2.00″L x 1.56″W	2.75″H x 2.00″L x 1.56″W	2.75″H x 2.00″L x 1.56″W	2.75″H x 2.00″L x 1.56″W	2.75″H x 2.00″L x 1.56″W

SOLID STATE TIMERS

IMMEDIATE DELIVERY

SERIES	SDM	SDI	SDB	SDS
Features	• Totally solid state output • Fixed or remote adjustable delays • Transient protected • Completely encapsulated • CSA, UL	• Totally solid state output • Fixed or remote adjustable delays • Transient protected • Completely encapsulated • CSA, UL	• Totally solid state output • Fixed or remote adjustable delays • Transient protected • Completely encapsulated • CSA, UL	• Totally solid state output • Fixed or remote adjustable delays • Transient protected • Completely encapsulated • CSA, UL
Mode of Operation	Delay on make	Delay on interval	Delay on break	Delay on single shot
Output Type	Solid state	Solid state	Solid state	Solid state
Form	Normally open	Closed during timing	Normally open	Normally open
Rating: Steady State	1 Amp	1 Amp	1 Amp	1 Amp
Rating: Inrush	10 Amps	10 Amps	10 Amps	10 Amps
Input Voltage	12, 24, 48, 120 VDC 24, 120, 230 VAC	12, 24 VDC 24, 120, 230 VAC	12, 24 VDC 24, 120, 230 VAC	12, 24 VDC 24, 120, 230 VAC
Delay Time (in seconds)	0.05–720	0.05–720	0.05–720	0.05–720
Approximate Dimensions (in.)	0.75″H x 2.0″L x 2.0″W	0.75″H x 2.0″L x 2.0″W	0.75″H x 2.0″L x 2.0″W	0.75″H x 2.0″L x 2.0″W
Mounting	Surface mount with #8 or #10 screw	Surface mount with #8 or #10 screw	Surface mount with #8 or #10 screw	Surface mount with #8 or #10 screw
Termination	.250″ Male Quick connect terminals	.250″ Male Quick connect terminals	.250″ Male Quick connect terminals	.250″ Male Quick connect terminals

MASTER ELECTRONIC CONTROLS
P.O. Box 25905 • Los Angeles, California 90025-0662 USA
Phone: (213) 452-1336 FAX: (213) 392-9585 Telex: 182041 MASTER SNM

MATRIX
SYSTEMS CORPORATION
5177 NORTH DOUGLAS FIR ROAD
CALABASAS, CALIFORNIA 91302
(818) 222-2301
FAX (818) 222-2304

Coaxial Relay Module 7000 Series

7100 — Standard

7200 — Self-terminating

7300 — High isolation

7400 — Highest isolation

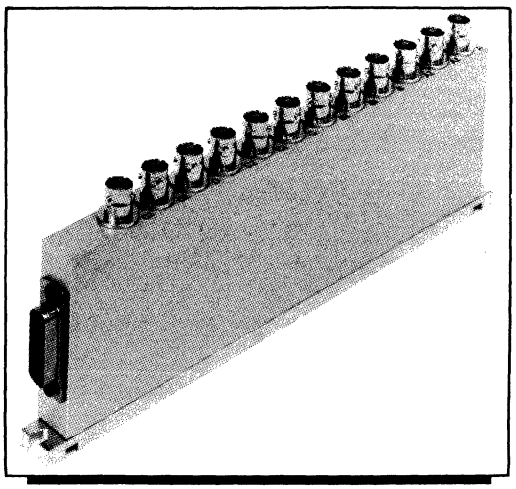
7500 — High power

7600 — Highest isolation self-terminating

7700 — Mercury wetted contacts

7800 — Twinax

7900 — Triax



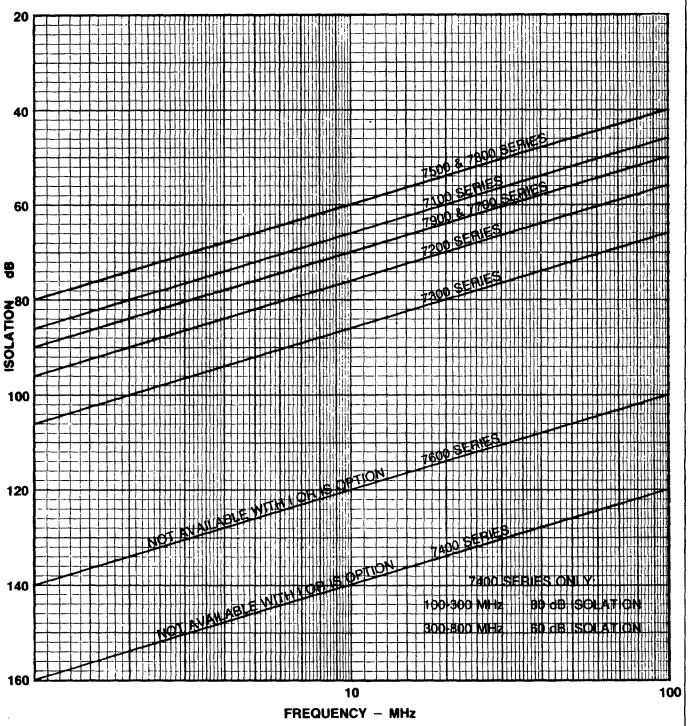
FEATURES:

- DC up to 800 MHz depending on number of throws
- Two to twenty-four throws
- Continuous shield continuity
- Rugged machined aluminum housing
- Crosstalk always lower than isolation
- Switchpoints individually field replaceable
- Extremely low EMI
- Low VSWR
- Matrix configuration easily assembled using 9000 series cross straps
- Signal circuits isolated from control circuitry

MATRIX 7000 Series Relay Modules are designed to maintain coaxial switching continuity over a wider range of critical and high environmental applications. The Relay housings are constructed of precision machined aluminum alloy for structural integrity and hard anodized for durability. All signal shield paths are silver plated with covers gasketed for maximum EMI protection. The basic reed switch elements are hermetically sealed in nitrogen filled gas envelopes and employ rhodium plated contacts to insure non-stick operation. Applications for MATRIX 7000 Series include:

— R.F. and I.F switching where a low VSWR is required.
— CCTV, base band video and pulse switching where low phase distortion and high pulse fidelity are required.
— Applications requiring a high degree of shielding integrity and low contact and induced noise such as pre amp input switching or the switching of high impedance operational amplifier inputs.

Matrix and hybrid switching systems are easily constructed by using Series 9000 (no output), 9100 (one output) or 9200 (two output) push-on cross straps which mate with the BNC connectors on the switch modules. The cross strap output connectors are BNC female type UG 1094/U. The model number of the cross strap is assigned by replacing the two zeros of the series number with the number of inputs desired. For example, a Model 9108 has eight inputs and one output.



MODEL NUMBER ASSIGNMENT

7 X XX — X

Series
Number of throws (N)
Options:
Coil suppression diodes with:
Coil common negative — D
Coil common positive — DR
TNC connectors — T
SMA connectors — S
Self-terminating — Ohms
Insulated shield — I
Insulated and
Switched shield — IS
Expander output — E
Chassis mount — C
Optional voltage — See Factory

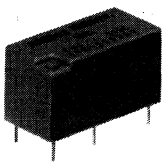
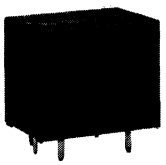
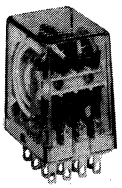
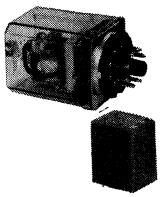
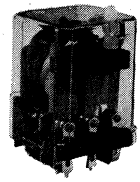
SPECIFICATIONS

FREQUENCY RANGE:	(−1dB) 1310 ÷ (N − .13) MHz where N = Number of Throws
FREQUENCY RANGE:	(−3dB) 1760 ÷ (N + .2) MHz where N = Number of Throws
CHARACTERISTIC IMPEDANCE:	50 ohms - 75 ohm optional
SWITCHING CONFIGURATION:	Single or double pole, two thru twenty-four throws
SWITCHING SPEED:	One mS dry contact, three mS mercury wetted
ISOLATION:	See graph See factory for -I or -IS option
CONTROL - CONNECTOR:	28 VDC, 30 mA- D type-mate supplied
SIGNAL CONNECTOR:	BNC, Twinax, Triax, TNC, SMA or F type optional
OPERATING TEMPERATURE AND HUMIDITY RANGE:	−30°F to +150°F, 0 to 98 percent R.H.
OPERATING SHOCK AND VIBRATION:	50 G's - 1 mS, 2 G's p-p 20-2000 Hz
DIMENSIONS:	.625" W × 3.25" H × 1.44" + (.625" × number of throws)
MOUNTING:	Three 6-32 tapped holes in base or option - C

Midtex Relays, Inc.

9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
PHONE 915-772-1061/FAX: 915-772-1116

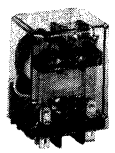
MINIATURE/ GENERAL PURPOSE RELAYS

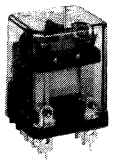
						
SERIES	**190**	**296**	**156**	**158**	**258**	**157**
FEATURES	"The Dipper" Low level switching up to 2 amps. 16 pin dip. Sealed for PC board mounting & immersion.	Economical & reliable designed for low cost PCB switching such as industrial, communications, vending or commercial equipment.	Compact & versatile 2&4 pole industrial relay. Low level switching. Available with many options.	Designed for UL Component Recognition for Motor Controllers through 240 VAC in accordance with UL Std 508, Industrial Control Equipment. Available in Octal Plug-in version.	Economical 2PDT, 10 amp rated relay, available with printed circuit terminals or 3/16", .187 quick connect terminals for plug-in socket capability or direct wiring with flange mounting option.	The 157 is a General Purpose/Industrial control relay, available in 1, 2, or 3 pole versions with multiple contact load capabilities up to 15 amps. All ratings are specified to UL Recognition and CSA Approvals for Industrial Control Equipment. They are approved as motor controllers up to 1/2HP at 240/480/600 VAC (1/3HP at 120 VAC).
EPOXY SEALED	YES	YES	YES	YES	NO	NO
CONTACT ARRANGEMENTS	2 Form C	1 Form C 1 Form A	2 Form C 4 Form C	1 Form C 2 Form C Form A Form B Form X Form Y Form C (1 & 2PDT) Octal	1 Form C 2 Form C 3 Form C 4 Form C	1 Form C 2 Form C 3 Form C 2 Form A 2 Form B 1 Form X 1 Form Y
CONTACT MATERIAL RATINGS	Material -2U0 Silver/Gold Clad Bifurcated 2.0 amps, 30 VDC, resistive 0.6 amps, 120 VAC resistive	Material -200 Silver Cadmium Oxide 5 amps at 30 VDC resistive (UL) 1/8 hp 120 VAC (UL) 1/10 hp 120 VAC; 125VA VAC pilot duty (UL) -300 Silver Cadmium Oxide 10 amps at 120 VAC resistive (UL) 8 amps at 30 VDC inductive (UL)	Material: -100 3/32" Silver (Gold Flash) *3 amps, 28 VDC/120 VAC, 80% pf 2 amps, 240 VAC, 80% pf -700 3/32" Fine silver gold diffused 3 amps, 28 VDC/120 VAC, 80% pf 2 amps, 240 VAC, 80% pf -200 3/32" Silver Cadmium Oxide (Gold flash) *5 amp, 28 VDC/120 VAC, 80% pf 3 amp, 24 VAC, 80% pf *1/10 horsepower, 125 VA, 120/240 VAC	Material -200 5/32" Silver Cadmium Oxide -10 amp, 28 VDC/120 VAC, 7 amp at 240 VAC; 80% pf 1/3 hp, 120/240 VAC -700 5/32" pure fine Silver (Gold flash) -10 amp, 28 VDC/120 VAC, 7 amp at 240 VAC; 80% pf 1/3 hp, 120/240 VAC	Material -200 5/32" Silver Cadmium Oxide SPDT-15 amps at 110 VAC; 15 amps at 24 VDC DPDT, 3PDT, 4PDT-10 amps at 110 VAC; 10 amps at 24 VDC	Material -100 1/8" Fine Silver (gold flash) 5 amp **Ratings** 5 amp, 28VDC/ 120/240 VAC, 80% pf 2 amp, 480/600 VAC, 80% pf 1/8 hp, 120 VAC 1/4 hp, 240 VAC -200 3/16" Silver Cadmium Oxide 10 amp 10 amp, 28 VDC/ 120/240 VAC, 80% pf 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC 3 amp, 480/600 VAC, 80% pf -300 3/16" Silver Cadmium Oxide 15 amp (UL on 1 & 2PDT only) 15 amp, 120 VAC 10 amp, 240 & 277 VAC 28 VDC 3 amp, 480/600 VAC 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC -700 1/8" Fine Silver Gold Diffused 5 amp, 28 VDC/ 120/240 VAC, 80% pf 2 amp, 480/600 VAC, 80% pf 1/8 hp, 120 VAC 1/4 hp, 240 VAC All hp ratings are single phase
COIL VOLTAGE	5, 6, 12, 24, 48 DC	5, 6, 9, 12, 24, 48 DC	5, 6, 12, 24, 48, 90, 110 DC & 6, 12, 24, 48, 120, 240 AC and "Specials"	5, 6, 12, 24, 48, 90 110 (DC) 6, 12, 24, 48, 120, 240 (AC) and "Specials"	6, 12, 24, 48, 110 (DC) 6, 12, 24, 50, 120, 240 (AC)	5, 6, 12, 24, 48, 110 (DC) & 6, 12, 24, 120, 240 (AC) & specials
POWER RATING	-2μ0 Nominal-500 mW maximum continuous-860 mW -2S0 Nominal-360 mV Max. cont.-620 mV	Nominal-400 MW Maximum continuous-562 MW	Nominal (AC) 1.2 VA (DC) 0.9 watts Maximum continuous (AC) 2.0 VA (DC) 2.0 watts	Nominal 1.2 VA (AC) 0.9 watts (DC) Maximum continuous 2.0 VA (AC) 2.0 watts (DC)	Nominal 1.5 VA (AC), 0.9 watts (DC) Maximun continuous 2.0 VA (AC), 2.0 watts (DC)	Nominal-1.7 VA (1 & 2 pole AC); 2.0 VA (3 pole AC); 1.2 watts (DC) Maximum continuous-2.7 VA (1 & 2 pole AC); 3.1 VA (3 pole AC); 1.9 watts (DC)
DIELECTRIC	(Meets FCC Part 68) 1000 VAC coil to poles 1000 VAC between poles 750 VAC across open contact (1500 VDC FCC surge)	2000 VAC RMS 60 Hz all mutually insulated terminals (open contacts 750 VAC)	Greater than 500 VAC RMS 60 Hz across open contacts Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements	Greater than 500 VAC RMS 60 Hz across open contacts. Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements.	Greater than 1000 VAC RMS 60 Hz across open contacts. Greater than 2000 VAC RMS 60 Hz all other mutually insulated elements.	Greater than 750 VAC, RMS 60 Hz across open contacts. Greater than 2500 VAC, RMS 60 Hz all other mutually insulated elements.
LIFE EXPECTANCY	**Mechanical-** in excess of 15 million operations. **Electrical-** 100,000 operations minimum at rated loads.	**Mechanical**–in excess of 10 million operations **Electrical**–100,000 operations minimum at rated loads	**Mechanical**–in excess of 50 million operations **Electrical**–100,000 operations minimum at rated loads	**Mechanical**–in excess of 50 million operations **Electrical**–100,000 operations minimum at rated loads	**Mechanical**–in excess of 5 million operations **Electrical**–100,000 operations minimum at rated loads	**Mechanical** 10 million operations **Electrical** 100,000 operations at rated load.
MAX. SIZE IN INCHES (L×W×H)	.800×.398×.425	.890×.65×.75	1.190×.859×1.281 (Dust Cover)	1.109×.859×1.281 (Dust Cover)	1.42×1.10×8.5 (DPDT, Plain Cover w/quick connect)	1.400×1.525×1.905 (dust cover)
TERMINALS—PC SOLDER/PLUG-IN	Yes No	Yes No	Yes Yes	Yes Yes	Yes Yes	YES YES
OPTIONS	Sensitive coils		Opposite Polarity Barrier Push Button Diode across coil (DC only) Lamp across coil Lamp & Push Button	Opposite Polarity Barrier Push Button Actuator Diode Across Coil, DC only Lamp Across Coil Lamp & Push Button	Special Customer Requirements	Lamp across coil Class B Coil Push Button Actuator Open style Varnished coil
AGENCY APPROVALS	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA

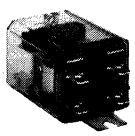
Midtex Relays, Inc.

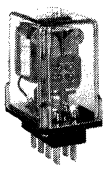
9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
PHONE 915-772-1061/FAX: 915-772-1116

GENERAL PURPOSE RELAYS/ INDUSTRIAL/POWER RELAYS



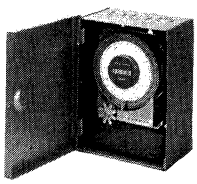






SERIES	157 MAGNETIC LATCHING SERIES	187	188	136
FEATURES	The magnetic latching relay is ideal for use on applications where there is a need to conserve power, retain logic function during power outages or improve reliability over mechanical latching designs. All electrical specifications of the standard type 157 are retained. No mechanical latches or permanent magnets are used which could result in inadvertent operations. Units are avialble in single, or dual coils. TIMING Latching time: 13 MS nominal with a one second pulse of nominal voltage. Unlatch time: 13 MS nominal with a one second pulse of nominal unlatch voltage after latching with a one second pulse of nominal latch voltage. A latch pulse of 50 MS min. at nominal voltage is recommended to insure positive latching. DESIGN & CONSTRUCTION Insulation material, weight, marking, shock, vibration, dielectric breakdown, insulation resistance and temperature range are identical to the Type 157 relay. UL/CSA	DPDT power relay is rated at 20 amps; DPST-NO and NC contact arrangements are rated at 25 amps. Open stud mounted or dust covered versions with 1/4" quick-connect terminals.	30 Ampere relay is an expanded version of the Type 187 20 amp 2PDT relay, utilizing a common coil/mates structure. The 188 is limited to single-pole switching, in order to provide for the 30 amp contact ratings.	A small power relay that will switch 20 amps for industrial use in multipole configuration and 30 amps in multipole configuration at 120 VAC or 240 VAC for appliance use under UL #508.
EPOXY SEALED		NO	NO	NO
CONTACT ARRANGEMENTS		2 Form C 2A, DPST 2B, DPST 1 Form X 1 Form Y	Form X Form Y Form Z	1 Form C 2 Form C 2PST-NC 2PST-NO 1PST-NO-DM 1PST-NC-DB 3PST-NO
CONTACT MATERIAL RATINGS		Material -100 1/4" Diameter Fine Silver 20 amp, 28 VDC 20 amp, 120/240/277 VAC 10 amp, 480/600 VAC 3/4 hp, 120 VAC 1-1/2 hp, 240 VAC -200 1/4" Diameter Silver Cadmium Oxide 20 amp, 28 VDC 20 amp, 120/240/277 VAC 10 amp, 480/600 VAC 3/4 hp, 120 VAC 1 1/2 hp, 240 VAC -300 3/16" Diameter Silver Cadmium Oxide 10 amp, 28 VDC 15 amp, 120/240/277 VAC 3 amp, 480/600 VAC 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC -400 3/16" Silver Cadmium Oxide High Conductivity Blade 10 amp, 28 VDC 10 amp, 120/240 VAC 3 amp, 480/600 VAC 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC -600 1/4" Silver Cadmium Oxide (On contacts 2A & 2B only) 25 amp, 28 VDC 25 amp, 120/240/277 VAC 10 amp, 480/600 VAC 3/4 hp, 120 VAC 1-1/2 hp, 240 VAC	Material -100 1/4" Silver 30 amp 120/240/277 VAC 30 amp 28 VDC 15 amp 480/600 VAC 1 hp 120 VAC, 1 phase 1-1/2 hp 240 VAC, 1 phase -200 1/4" Silver Cadmium Oxide Ratings Identical for -100 & -200 contacts.	Material -3/8" diameter Silver 20 amp, 120/240 VAC 20 amp, 28 VDC -3/8" diameter Silver Cadmium Oxide (UL recognized) Industrial Use 1/4 hp, 120 VAC 15 amp, 120 VAC 15 amp, 28 VDC 10 amp, 240 VAC 1 kw tungsten, 120 or 240 VAC Appliance Use 1/4 hp, 120 VAC 20 amp, 28 VDC 30 amp, 120 or 240 VAC 1 kw tungsten, 120 or 240 VAC
COIL VOLTAGE	MAGNETIC LATCHING OPTION ALSO AVAILABLE ON 187 AND 188 SERIES	5, 6, 12, 24, 48, 110, (DC) and 6, 12, 24, 120, 208, 240 (AC) and Specials	5, 6, 12, 24, 48, 110 (DC) 6, 12, 24, 120, 208, 240 (AC) and Specials	6, 12, 24, 48, 110 (DC) 6, 12, 24, 120, 240 (AC) and Specials
POWER RATING		Nominal-2.7 VA (AC); 1.2 watts (DC) Maximum continuous-3.4 VA (AC); 1.9 watts (DC)	Nominal-2.0 VA (AC); 1.2 watts (DC) Maximum continuous-3.1 VA (AC); 1.9 watts (DC)	Maximum continuous-10 VA (AC); 2.9 watts max. (DC)
DIELECTRIC		Greater than 750 VAC RMS 60 Hz across open contacts Greater than 2500 VAC RMS 60 Hz all other mutually insulated elements.	Greater than 750 VAC RMS 60 Hz across open contacts Greater than 2500 VAC RMS 60 Hz all other mutually insulated elements.	
LIFE EXPECTANCY		**Mechanical**-10 million operations **Electrical**-100,000 operations at rated load	**Mechanical**-10 million operations **Electrical**-100,000 operations at rated load	**Mechanical**-5 million operations **Electrical**-100,000 operations at rated load
MAX. SIZE IN INCHES (L×W×H)		1.400×1.525×1.905	1.400×1.525×1.905	2.375×1.75×2.80
TERMINALS—PC SOLDER/PLUG-IN		YES YES	YES YES	NO YES
OPTIONS		Class B Coil Varnished Coil Lamp in Parallel with Coil Special Customer Requirements	Lamp in parallel with coil Class B Coil Varnished Coil Special Customer Requirements	Special Customer Requirements
AGENCY APPROVALS		UL/CSA	UL/CSA	UL

CYCLEMASTER 24-HOUR TIMER



620 SERIES

Program Time Switch-up to 48 ON-OFF operations per day with timing intervals as low as fifteen minutes. 14-day wheel, with Sunday and Holiday Skipper, provides programming for two full weeks. Eliminates operations on unwanted days.

SWITCHING ACTION
SPDT (usable three ways: SPST open; SPST closed; SP transfer)
LOAD CAPACITY
20 amps at 125, 250, or 480 VAC (1 hp at 125 VAC; 2 hp at 250 VAC) (10 amps at 125 VAC inductive)
TERMINALS
Screw terminals conveniently located
METHOD OF PROGRAMMING
Trip pin (12 supplied)
TEMPERATURE RANGE
−40 F to +140 F
Dimensions
With enclosure 8.188" H × 6.375" W × 4.125" D; without enclosure 6⅝" H × 4½" W × 2 13/16" D

TIMING APPLICATIONS

- Lawn sprinkling
- Greenhouse misting
- Irrigation
- Program music
- Chime system
- Oil well pumping
- Programmed heating
- Air conditioning
- Traffic systems
- Industrial processing
- Power plant exercising
- Industrial lubrication systems
- Stoker hold-fire
- Battery charging
- Paint and enamel baking
- Laboratory testing
- Oven purging
- Automatic livestock and poultry feeding systems
- Conveyors, material handling systems
- Ventilating fans
- Elevators and stairways
- Pumps and motors
- Water softening control
- Bulk, milk cooler agitation
- Laundry equipment
- Heat treating
- Plastic molding
- Bakery machinery

Midtex Relays, Inc.

9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
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FOR ENGINEERING ASSISTANCE CALL TOLL FREE

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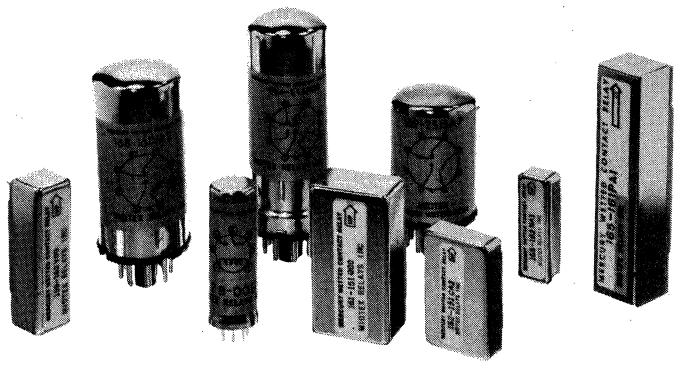
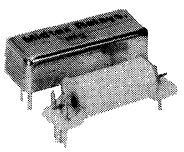
MERCURY RELAYS

Mercury-wetted contacts represent the nearest thing to the perfect contact yet developed, being characterized by such parameters as: Bounce-free operation; very low and stable contact resistance; hermetic protection; fast operating speeds; Form C or Form D contact action; contact life measured in billions of operations.



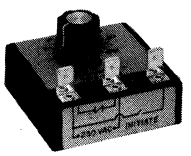
	TWO-AMPERE RATED RELAYS						FIVE-AMPERE RATED RELAYS		
PARAMETER	**TYPE 159**	**TYPE 160**	**TYPE 161**	**TYPE 162**	**TYPE 166**	**TYPE 168**	**163**	**164**	**165**
COILS									
Single wound—max. ohms	8,600	9,000	43,500	3,500	9,000	11,000	4,000	4,000	4,300
Double wound—max. ohms	4,275	4,500	21,700	1,750	4,275	5,500	2,000	2,000	8,000
Rating—watts continuous	2.0	1.75	3.0	3.0	1.5	2.0	4.0	4.0	4.0
Temp. rise—° C per watt	30°	35°	20°	30°	35°C	30°	20°	20°	20°
Dielectric breakdown —RMS, 60Hz	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Insulation resistance megohms—500 VDC	1,000	1,000	1K-10K	1K-10K	1,000	1,000	100	100	100
Capacitance—armature to coil pf, typical	9.0	9.0	9.0	9.0	9.0	7.0	12	12	14
Electrostatic shielding optional	yes	yes	yes	yes	yes	yes	yes	yes	yes
Typical operate times —MS, 2X must operate	1-3	1-3	1-3	1-3	1-3	1-3	3.5	3.5	3.0
Typical release times —MS 2X	2.5	2.5	3.0	3.0	2.8	3.0	4.5	4.5	4.2
Contact form available	C, D	C, D	2C, 2D	2C, 2D	C, D	C, D	D	D	D
Adjustments available									
Single-side-stable	yes	yes	yes	yes	yes	yes	yes	yes	yes
Bi-stable	yes	yes	yes	yes	yes	yes	yes	yes	yes
Polar 1% balance	yes	yes	no	no	yes	yes	yes	yes	yes
Temperature range Operating ° C Storage ° C	All types -38.8°C to +85°C All types -65°C to +100°C								
Weight—ounces	2.0	0.5	2.3	1.6	0.5	4.0	4	4	3
Encapsulant	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Polyureth.
Mounting method	PCB	PCB	PCB	PCB	PCB	Octal	Octal	Octal	PCB

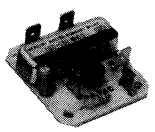
REED RELAYS



The Midtex dry reed relay series offers hermetically sealed, non-position sensitive switching in a small size with rapid response and low actuate power requirements. Available contact forms include A, B, C and D with dry reeds and forms A and B with mercury wetted. Contact arrangements include 1 to 5 Form A, 1 to 4 Form C, and 1 to 3 Form B, or any combination within the 5 pole bobbin. Consult the factory for additional details.

CUSTOM CONTROL PRODUCTS & BOARD ASSEMBLIES





Midtex Relays, Inc. designs and manufactures custom control modules and board assemblies to specific customer applications. A few common applications are listed below:

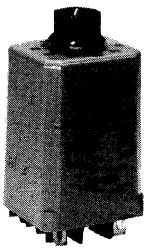
- True Form D Relay
- 20–25 amp 3/4 hp time delay relay
- 12–96 Hour Timer
- Sequencing Module For Stagger Motor Start Up
- Impulse Relay That Transfers When Voltage Is Removed
- True Off Delay Timers
- Complete Control Systems (Board level, encapsulated & Cabinet)
- Wire Wrapped Relay Control Assemblies
- Interface Modules

Most designs are generated from customers requesting a "Black Box" to solve a system problem, improved performance, lower costs etc. Please call us on our Engineering Hot Line (1-800-MIDTEX1) to discuss your application directly with Midtex Engineering.

Midtex Relays, Inc.

9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
PHONE 915-772-1061/FAX: 915-772-1116

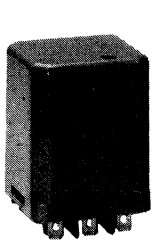
TIME DELAY RELAYS/ LINE MONITORING DEVICES/ CURRENT VOLTAGE/PHASE



612 SERIES

Delay-on-release timer which utilizes an R-C solid state trigger circuit to drive a secondary solid state switch, which in turn controls the integral 10 amp output relay.

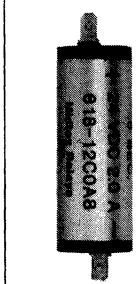
ELECTRICAL/MECHANICAL CHARACTERISTICS
All ratings at 25°C ambient.
Repeatability ±3%
Total timing variation ±10%
Operate time (max.) 100ms
Recycle time (max.) 100ms
Dial scale Ref. only
Input voltage limits—
AC ±10%
DC ±25%
Power requirements—
AC (approx.) 1.5 VA
DC (approx.) 1.2 watts
Switching action 2PDT
Switching rating (max.)
-Fine Silver contact (Gold flash)
5 amp, 28 VDC/120,240 VAC; 80% pf 1/8 hp, 120 VAC
-Silver Cadmium Oxide
10 amp, 28 VDC/120,240 VAC; 80% pf, 1/3 hp, 120 VAC 1/2 hp, 240 VAC
Delay types Delay-on-release
Momentary transfer upon timing cycle interruption.....NO
TEMPERATURE RANGE
-operating: -10°C to +55°C
-storage: 40°C to +85°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)
TIMING SET
Fixed
External Resistor
Knob Adjust



614 SERIES

Identical to the 612 series, except it functions as a **delay-on-operate.** Available with "fixed", "external resistor" adjust time setting, or "knob adjust", through an overall range of 1 to 300 seconds delay.

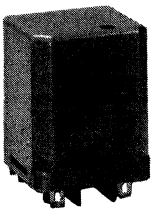
ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset (release) time (max.) 50ms
Recycle time (max.) 100ms
Dial scale Ref. only
Input voltage limits
AC ±10%
DC ±25%
Power requirements—
AC (approx.) 3.0 VA
DC (approx.) 1.2 watts
Switching action 2PDT
Switching rating (max.)
-Fine Silver contacts (Gold flash)
5 amp, 28 VDC/120 VAC, 3 amp, 240 VAC .80% pf 1/8 hp, 120 VAC
-Silver Cadmium Oxide (Gold flash)
10 amp, 28 VDC/120 VAC, 1/3 hp, 120 VAC, 6 amp, 240 VAC .80% pf 1/2 hp, 240 VAC
Delay types Delay-on-operate
Momentary transfer upon timing cycle interruption.....NO
TEMPERATURE RANGE
-operating: -10°C to +55°C
-storage: 40°C to +85°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)
TIMING SET
Fixed
External Resistor
Knob Adjust



618 SERIES

An electronic time delay module that provides a 0.5 or 2 amp SCR output to drive relays, solenoids or lamps. Units are fully encapsulated and are versatile and economic, especially when used in conjunction with power relays in the 30 amp rating category.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset time (max.) 75ms
Recycle time (max.) 25ms
Input voltage limits
+25%. DC must be filtered, max. ripple 5% at nominal voltage
Switching action SPST
Solid State Output, 1.5 V voltage drop max. when on
Switching rating (max.)
-Type 1–0.5 amp at +55°C
-Type 2–2.0 amp at +25°C
1.25 amp at +55°C
TEMPERATURE RANGE
-40°C to +55°C



619 SERIES

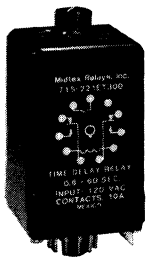
IMPULSE RELAY
An electronically controlled single input latching relay. Repetitive input pulses cause the relay to latch and unlatch alternately up to 1,200 total pulses per minute.

ELECTRICAL/MECHANICAL CHARACTERISTICS
All ratings at 25°C ambient
Pulse width 25 ms. min.
Pulse repetition rate
1200 pulses per minute max.
Duty Continuous
Input voltage
12, 24, 48, 110 VDC (±25%)
Power requirements
1.8 watts
Switching action 2PDT
Switching rating (max.)
-Fine Silver contacts (Gold flash)
5 amp, 28 VDC, 120/240 VAC 1/8 hp, 120 VAC
-Silver Cadmium Oxide
10 amp, 28 VDC, 120/240 VAC
1/3 hp, 120 VAC
1/2 hp, 240 VAC
TEMPERATURE RANGE
-10°C to +55°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)

719 SERIES

IMPULSE RELAY
Miniature PC style impulse relay that will alternately change states when pulsed at a common input, without changing polarity.

ELECTRICAL/MECHANICAL CHARACTERISTICS (25°C)
LIFE EXPECTANCY:
Mechanical—100 million operations min.
Electrical—100,000 operations min. at rated load
CONTROL VOLTAGES:
5 to 48 VDC standard
Set & Reset time 3ms typical
DIELECTRIC 1500 VAC input to contacts
1000 VAC across open contacts
TEMPERATURE -40°C to +70°C
CONTACTS
-Silver/Gold bifurcated Rating
2.0 amp 30 VDC resistive
0.6 amp 110 VDC resistive
1.0 amp 125 VAC resistive



715 SERIES

Multi-function time delay relay industry standard 8 and 11 pin octal, side terminal strip for flush mounting, and the 11 pin square base to fit the Midtex Type 157 relay sockets.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±2%
Total timing variation ±10%
Reset time—25 ms typical, 50 ms max. (release of delay-on-operate)
Recycle time—50 ms typical. 100 ms. max. (minimum off time between timing intervals)
Input voltage limits
AC ±10%
DC ±25%
Power requirements
AC 2.5VA
DC 1.5watt
Switching action 2PDT
Switching rating (max.)
-Silver Cadmium Oxide
10 amp,28 VDC/120 VAC; 1/3 hp, 120/240 VAC
Delay types
Delay-on-operate, Delay-on-release, Cycle, Interval and Interval-momentary start timing.
Momentary transfer upon timing cycle interruption: NO
TEMPERATURE RANGE
—operating -10°C to +55°C
—storage-40°Cto+85°C
SHOCK
15 g's, 11 ±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10–55 Hz (non-operating test)



655 SERIES

Delay-on-operate timers which use solid state timing circuits to control an integral relay.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset time 50 ms
Recycle time (max.) 100 ms
Input voltage limits
AC ±10%
DC ±25%
Power requirements
AC (approx.) 3VA at 120 VAC
DC (approx.) 1.2 watts
Switching action 1,2,4PDT
Switching rating
5 amp, 28 VDC, 120 VAC
10 amp, 28 VDC, 120 VAC
Delay types
Delay-on-operate
Momentary transfer upon timing cycle interruption: NO
TEMPERATURE RANGE
—operating-10°Cto+55°C
—storage-40°C to+85°C
SHOCK
15 g's, 11 ±1 ms, 1/2 sinewave
VIBRATION
10 g's; 10 to 55 Hz
TERMINALS-
Solder, PC, Plug-In.

657 SERIES

Delay-on-operate timer which uses solid state timing circuits to control an integral relay.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±5%
Total timing variation ±10%
Reset time (max.) 100 ms
Recycle time (max.) 100 ms
Input voltage limits
DC ±25
Power requirements
DC (approx.) 0.7 watt
Switching action 2PDT
Switching rating
2 amp, 28 VDC, 120 VAC
Momentary transfer upon timing
cycle interruption: NO
TEMPERATURE RANGE
—operating-10°Cto+55°C
—storage -40°C to +85°C
SHOCK
12 g's, 11 ±1 ms, 1/2 sinewave
VIBRATION 8 g's; 10 to 55 Hz
MAX SIZE IN INCHES (L × W × H)
1.190 × .859 × 1.281
TERMINALS
Solder, PC, Plug-In



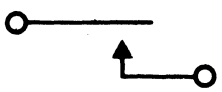
753 SERIES

753 series voltage sensor is designed for use in monitoring voltage fluctuations. It is designed to energize and de-energize at predetermined voltage levels that may be fixed or set with adjusting knobs. Packages are available for either direct plug-in or terminal strip connection.

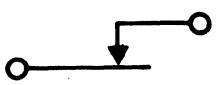
ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±1% max.
Response time 15 ms typical
25 ms maximum
Duty cycle is continuous, maximum input limit of 125% of nominal input voltage.
Switching action SPDT
Switching rating
—100 silver/gold flash
3 amps at 24 VDC or 125 VAC resistive;
1 amp at 24 VDC or 125 VAC inductive;
1.5 amps at 250 VAC resistive;
0.5 amps at 250 VAC inductive
—200 Silver Cadmium Oxide
5 amps at 24 VDC or 125 VAC resistive
2 amps at 24 VDC or 125 VAC inductive
2.5 amps at 250 VAC resistive
1 amp at 250 VAC inductive —300 Silver Cadmium Oxide
10 amps at 24 VDC or 125 VAC resistive
4 amps at 24 VDC or 125 VAC inductive
5 amps at 250 VAC resistive
2 amps at 250 VAC inductive
TEMPERATURE RANGE
—operating -10°C to +55°C
—storage -40°C to +85°C
SHOCK
15 g's, 11 ±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10–55 Hz (non-operating test)

MINIGLOSSARY
RELAY CONTACT FORMS

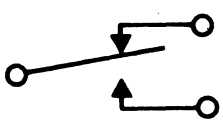
A
Make
SPST-NO



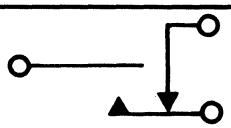
B
Break
SPST-NC



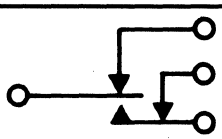
C
Break, Make
(Transfer)
SPDT



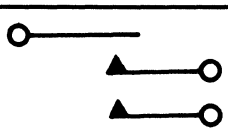
D
Make, Break
(Continuity
Transfer)



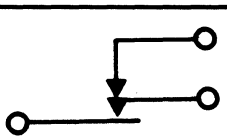
E
Break,
Make,
Break



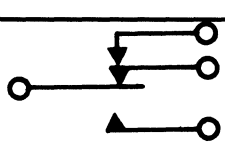
F
Make,
Make



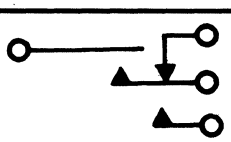
G
Break,
Make



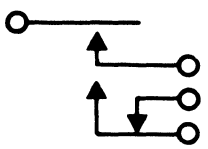
H
Break,
Break,
Make



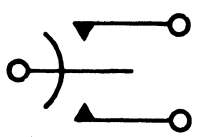
I
Make,
Break,
Make



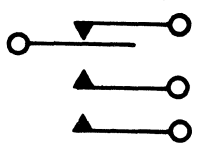
J
Make,
Make,
Break



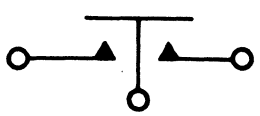
K
Center off
SPDT



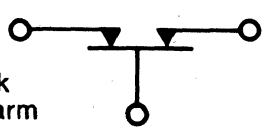
L
Break,
Make,
Make



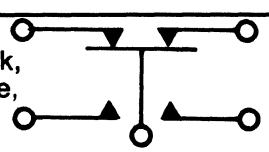
U
Double
make
Contact
on arm



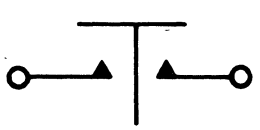
V
Double break
Contact on arm



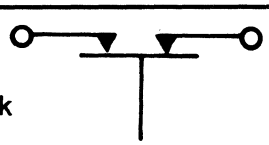
W
Double break,
Double make,
Contact
on arm



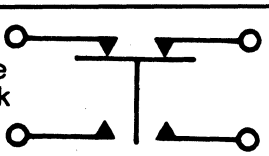
X
Double
make



Y
Double break



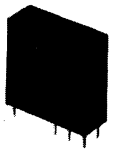
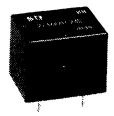
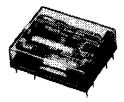
Z
Double make
Double break
SPDT-DB



MSD INC.
Manufacturers of Struthers-Dunn
Commercial/Industrial Relay Products

COMMERCIAL/INDUSTRIAL RELAYS DIVISION
700 Orange St., Darlington, SC 29532-9986
Tel. 803-393-5421 FAX (24 HRS.) 803-393-4123

PRINTED CIRCUIT TERMINAL—LOW LEVEL TO 30 AMP, 1-4 POLE, SEALED AND UNSEALED

SERIES	276	277	232	233	270	272	272L	273	403
									
DIMENSIONS (L x W x H)	0.787" x 0.500" x 0.394"	1.142" x 0.512" x 1.024"	0.630" x 0.433" x 0.453"	0.905" x 0.827" x 0.768"	0.866" x 0.630" x 0.622"	0.787" x 0.390" x 0.354"	0.787" x 0.390" x 0.354"	0.866" x 0.630" x 0.622"	1.156" x 0.938" x 0.344"
FEATURES	• 10 Amp Contact • Miniature Size • Polarized for Coil Sensitivity—40 mA@ 5VDC • 4 mm Coil—Contact Spacing • 5KV Surge Withstand • Immersion Cleanable • PBT Materials	• AC or DC Coil Construction • 8 mm Coil—Contact Spacing • 10KV Surge Capability • Sealed Terminals • PBT Materials • 0.1" Term. Grid	• Subminiature Size • 1 Form C; 1 Amp Contact • Immersion Cleanable • 0.2W Coil Available • 0.1" Term. Grid	• Automotive Applications • Incandescent Lamp Switching • 30 Amp Switching 15A Continuous • Low Cost • Dust Cover	• General Purpose Relay • 3, 5 or 10 Amp Switching • Immersion-Cleanable • TV-5 Rating	• 0.1" Grid DIP Relay • Immersion-Cleanable • 1500V FCC Surge Capability • Meets FCC Part 68 • Crossbar Bifurcated Contacts • Polarized For Coil Sensitivity	• 0.1" Grid DIP Bistable Mag. Latch—2 Coil • Immersion Cleanable • 1500V FCC Surge Capability • Meets FCC Part 68 • Crossbar Bifurcated Contacts	• Very Low Audible Noise Relay • Immersion Cleanable • 10 Amp Switching at 16VDC and 250VAC	• Low Profile—0.5" Board Spacing • 2 Form C or 4 Form C • Immersion-Cleanable • Low Capacitance Design • 0.1" Grid Term.
CONTACT DATA									
Form:	1 Form A;1 Form C	2 Form A;2 Form C	1 Form C	1 Form A;1 Form C	1 Form A 1 Form C	2 Form C	2 Form C	1 Form A;1 Form C	2 Form C;4 Form C
Material:	Silver Alloy	Silver Alloy	Silver Alloy—Gold Plate	Silver Alloy	Silver Alloy / Sil. Cad. Oxide	Gold Clad—Silver Nickel	Gold Clad—Silver Nickel	Silver Alloy	Gold Plated—Silver Palladium
Ratings:	1A 1C							1A 1C	
120/AC	10A 7A	5A	0.5A	10A	3A 5A, 10A	1A	1A	10A 7A	0.27A
240/AC	10A 7A	5A	—	—	1.5A 2.5A, 5A	—	—	10A 7A	—
30/DC	10A 7A	5A	1A	10A 30A@ 12VAC 150W Lamp Load @ 12VDC	3A 5A,10A	2A	2A	10A 7A	1A
COIL DATA									
AC Volts	—	6, 12, 24, 120	—	—	—	—	—	—	—
DC Volts	3, 5, 6 9, 12, 24	3, 5, 6, 12, 24, 48, 110	1.5, 3, 5, 6, 9, 12, 24	12, 24	6, 9, 12, 24, 48	3, 5, 6, 9, 12, 24, 48	3, 5, 6, 9, 12, 24	5, 6, 9, 10, 12, 24	6, 12, 24, 48
Power:									
AC VA	—	0.9	—	—	—	—	—	—	—
DC Watts	0.2	0.53	0.45	1.0	0.36	0.4	0.36	0.2	0.33—2 Form C 0.5—4 Form C
GENERAL DATA									
Ambient Temp.:	−40°C to +70°C	−40°C to +70°C	−25°C to +55°C	−30°C to +80°C	−30°C to +60°C	−40°C to +70°C	−40°C to +70°C	−40°C to +70°C	−10°C to +65°C
Operate Time:	10 ms	15 ms	3 ms	10 ms	6 ms	3 ms	3 ms	10 ms	7 ms
Release Time:	10 ms	10 ms	1 ms	10 ms	2 ms	2 ms	2 ms	10 ms	3 ms
VDE Spacing:	4 mm	8 mm	—	—	—	—	—	—	—
Life:									
Rated Load	100,000	100,000	500,000	100,000	100,000	500,000	100,000	100,000	5 million
No Load	50 million	10 million	5 million	5 million	10 million	100 million	100 million	10 million	100 million
OPTIONS	Dust Cover Version	AC Coil Operation	High Sensitivity Coil Dust Cover Version	Stronger Coil (intermittent duty) for Automotive Applications Flux Tight Term. Seal	TV-5 Rated Versions (Form A only) Appl. and Auto Types Dust Cover Types	High Sensitivity 0.2W Coil Available	High Sensitivity 0.12W Coil Available	Dust Cover Version	—
APPROVALS	UL, CSA	UL, CSA	UL	UL, CSA	UL, CSA	UL, CSA	UL, CSA	UL, CSA (Pending)	—

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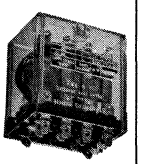
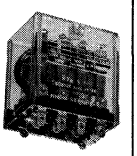
Commercial/Industrial Relay Products

COMMERCIAL/INDUSTRIAL RELAYS DIVISION
700 Orange St., Darlington, SC 29532-9986
Tel. 803-393-5421 FAX (24 HRS.) 803-393-4123

3-WAY TERMINAL, 5-15 AMP, 1-3 POLE

3-WAY TERMINAL, 10-AMP, 4 POLE

SERIES	A283	285	286	287	292	284	306	308
								
DIMENSIONS (L x W x H)	1.500" x 1.375" x 2.156"	1.500" x 1.375" x 2.156"	1.500" x 1.375" x 3.281"	1.500" x 1.375" x 3.281"	1.500" x 1.375" x 2.156"	1.500" x 1.938" x 2.156"	1.5" x 1.938" x 2.156"	1.500" x 1.938" x 2.156"
FEATURES	• 3 Way Term. Solder 0.187 Q.C. Plug In • Open Style or Enclosed • Compact • Polycarbonate Cover • 600 VAC Rated	• Perm. Mag. Latch Relay • Single or Dual Coil • 3 Way Term.: Solder 0.187 Q.C. Plug In • High Sensitivity Coils Avail. • AC or DC Input	• Delay-On Timer • 3 Way Term.: Solder 0.187 Q.C. Plug In • Adjustable Timing 0.1 to 300 sec • Inverse Polarity Protection • ±3% Repeatability • 150 ms max. Recycle Time • Transient Protection • No False Contacting • Electronic Module—Epoxy Molded	• Delay-Off Timer • 3 Way Term.: Solder 0.187 Q.C. Plug In • Adjustable Timing 0.1 to 300 sec • Inverse Polarity Protection • Transient Protection • ±3% Repeatability • 150 ms max. Recycle Time • Electronic Module—Epoxy Molded	• Low Power DC Relay • 3 Way Term.: Solder 0.187 Q.C. Plug In • 125 mW/Pole • Operate over Wide Voltage Range • Clear Poly-carbonate Cover	• 3 Way Term.: Solder 0.187 Q.C. Plug In • Sockets: Screw Term. Front-Connected PC Term. Solder Term. • QC Term. • Polycarbonate Cover • Compact Size	• Delay-On Timer • 3-Way Term.: Solder 0.187 Q.C. Plug-In • Adjustable Timing 0.1 to 300 sec • ±3% Repeatability • Inverse Polarity Protected • No False Contacting • Transient Protection • 150 ms max. Recycle Time • Electronic Module—Epoxy Molded	• Perm. Mag. Latch Relay • 3 Way Term.: Solder 0.187 Q.C. Plug In • AC or DC Input • No False Transfer with 5 Times Nom. Voltage Pulse
CONTACT DATA								
Form:	1 Form C to 3 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	4 Form C	4 Form C	4 Form C
Material:	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Silver	Gold Sil. Cad Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide
Ratings:								
120/AC	10A, ⅓ HP	10A, ⅓ HP	10A, ⅓ HP	10A, ⅓ HP	5A	10A,⅓ HP	10A, ⅓ HP	10A, ⅓ HP
240/AC	10A, ½ HP	10A, ½ HP	10A, ½ HP	10A, ½ HP	5A	10A, ½ HP	10A, ½ HP	10A, ½ HP
30/DC	10A, —	10A, —	10A, —	10A, —	5A	10A	10A, —	10A, —
COIL DATA								
AC Volts	6 to 240	6 to 120 (240 with series resistor)	24 to 240	24 to 240	—	6 to 240	24 to 240	6 to 120 (240 with series resistor)
DC Volts	6 to 125 (250VDC with series resistor)	6 to 125 (250VDC with series resistor)	12 to 125	12 to 125	15 to 139 (11.1 to 3.5 ma)	6 to 125 (250VDC with series resistor)	12 to 125	6 to 125 (250 with series resistor
Power:								
AC VA	2 (2 Pole) 2.7 (3 Pole)	0.78	2 (2 Pole) 2.7 (3 Pole)	2 (2 Pole) 2.7 (3 Pole)	—	3.4	3.4	1.33W
DC Watts	1.2 (1.5W @ 125V)	1.6 Standard 0.5 Sensitive	1.2 (1.5W @ 125V)	1.2 (1.5W @ 125V)	0.125/Pole	1.2 (1.9W @ 125V)	1.2 (1.9W @ 125V)	1.2 (1.9W @ 125V)
GENERAL DATA								
Ambient Temp.:	−45°C to +70°C	−45°C to +70°C	−10°C to +70°C	−10°C to +70°C	−45°C to +70°C	−45°C to +50°C AC −45°C to +70°C DC	−10°C to +45°C AC −10°C to +70°C DC	−45°C to +70°C
Operate Time:	15 ms	25 ms AC; 15 ms DC	As selected	15 ms	20 ms	15 ms	As selected	25 ms AC; 15 ms DC
Release Time:	10 ms	25 ms AC; 15 ms DC	10 ms	As selected	15 ms	10 ms	10 ms	25 ms AC; 15 ms DC
Life:								
Rated Load	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
No Load	10 million	10 million	10 million	10 million	10 million	10 million	10 million	10 million
OPTIONS	Indicator Lamp Manual Actuator PC Sockets QC Sockets 15 Amp Contacts 5 Amp Contacts Perm. Mag. Blowout 130°C Coil Gold Diffus. Contacts Tungsten Contacts	Indicator Lamp Manual Actuator PC Sockets QC Sockets 15 Amp Contacts 5 Amp Contacts 130°C Coils Gold Diffus. Contacts	PC Sockets QC Sockets Stud or Bracket Mount 15 Amp Contacts 5 Amp Contacts Gold Diffus. Contacts Fixed Timing Remote Timing	PC Sockets QC Sockets Stud or Bracket Mount 15 Amp Contacts 5 Amp Contacts Gold Diffus. Contacts Fixed Timing Remote Timing	Indicator Lamp (125DC Coil Only) Manual Actuator PC Socket QC Socket Stud or Bracket Mount Gold Diffus. Contacts	Indicator Lamp Manual Actuator Mounting Styles: 6-32 Stud Tapped Hole PC Terminals Gold Diffus. Contacts 5 Amp Contacts	Sockets: Screw Term. Front Connected PC Term. Solder Term. QC Term. Fixed Timing Remote Timing 5 Amp Contacts	Sockets: Screw Term. Front Connected PC Term. Solder Term. QC Term. Dual Coil Construction 5 Amp Contacts
APPROVALS	UL, CSA	UL, CSA	UL, CSA	UL	UL	UL, CSA	UL	—

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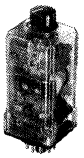
MSD INC.
Manufacturers of Struthers-Dunn Commercial/Industrial Relay Products

COMMERCIAL/INDUSTRIAL RELAYS DIVISION
700 Orange St., Darlington, SC 29532-9986
Tel. 803-393-5421 FAX (24 HRS.) 803-393-4123

2-WAY TERMINAL, 20 AMP, 1-3 POLE — OCTAL STYLE PLUG IN, 5-10 AMP, 1-3 POLES — ICE CUBE STYLE, 1-10 AMP, 2 & 4 POLE

SERIES	298	300	A314	326	327	392	C281	282
								
DIMENSIONS (L x W x H)	1.500" x 1.375" x 2.906"	1.500" x 1.375" x 2.906"	1.375" x 1.375" x 2.813"	1.3.75" x 1.375" x 4.375"	1.375" x 1.375" x 4.375"	1.375" x 1.375" x 2.813"	1.125" x 0.875" x 1.531"	1.125" x 0.875" x 3.125"
FEATURES	• 2 Way Terminals 0.25 Q.C. Solder • Handles Tough Loads at Low Cost • 277VAC, 20A • 600VAC, 5A • Polycarbonate Cover with Mounting Tabs	• 2 Way Terminals 0.25 Q.C. Solder • Handles Tough Loads at Low Cost • 277VAC, 20A • 600VAC, 5A • Accepts 0.25 Booted Quick Connect • Polycarbonate Cover with Mounting Tabs	• Long Life • Low Cost • Open or Plug-In (8 & 11 pin) • Straight Thru Wiring: Fewer Solder Joints Greater Reliability	• Delay-On Timer • Adjustable Timing 0.1 to 300 sec • Low Cost • Octal Plug-In • Transient Protection • Polarity Protection • Electronic Module-Epoxy Molded • Repeatability ±3% • No False Contacting	• Delay-Off Timer • Adjustable Timing 0.1 to 300 sec • Octal Plug-In • Transient Protection • Polarity Protection • Electronic Module-Epoxy Molded • Repeatability ±3% • No False Contacting	• Low Power DC Relay 125 mW/Pole • Low Cost • Operate Over Wide Voltage Range • Clear Polycarbonate Cover	• General Purpose Low Cost • 1-Amp Bifurcated Contacts • 3A Silver Contacts • 5A and 10A Silver Cad-Oxide Contacts	• Delay-On Timer • Plug-In Mount • PC Mount • Adjustable Timing 0.1 to 300 sec • Transient Protection • Polarity Protection • Electronic Module-Epoxy Molded • Repeatability ±3% • No False Contacting
CONTACT DATA								
Form:	1 Form C to 3 Form C	2 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	2 Form C 4 Form C	2 Form C 4 Form C
Material:	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Silver	SCO | SIL/SCO	SCO | SIL/SCO
Ratings:								
120/AC	20A, ¾ HP	20A, ¾ HP	10A, ⅛ HP	10A, ⅛ HP	10A, ⅛ HP	5A	10 | 3/5	10 | 3/5
240/AC	20A, 1 HP	20A, 1 HP	5A, ⅓ HP	5A, ⅓ HP	5A, ⅓ HP	—	— | —	— | —
30/DC	20A, —	20A, —	10A, —	10A, —	10A, —	5A	10 | 3/5	10 | 3/5
COIL DATA								
AC Volts	6 to 240	6 to 240	6 to 240	24 to 240	24 to 240	—	6 to 220	12 to 120
DC Volts	6 to 125 (250VDC with series resistor)	6 to 125 (250VDC with series resistor)	6 to 110-125	12 to 125	12 to 125	15 to 139 (11.1 to 3.5 ma)	6 to 110	12 to 110
Power:								
AC VA	3.4	3.4	2.1	2.1	2.1	—	1.2	1.2
DC Watts	1.2 (3 Pole, 2W)	1.2	1.2 (1.5W @ 125V)	1.2 (1.5W @ 125V)	1.2 (1.5W @ 125V)	0.125/Pole	1.0 (1.1W @ 110V)	1.0 (1.1W @ 110V)
GENERAL DATA								
Ambient Temp.:								
AC	−30°C to +50°C	−30°C to +50°C	−45°C to +55°C	−10°C to +55°C	−10°C to +55°C	—	−45°C to +70°C	−10°C to +55°C
DC	−30°C to +60°C	−30°C to +60°C	−45°C to +70°C	−10°C to +70°C	−10°C to +70°C	−45°C to +70°C	−45°C to +70°C	−10°C to +70°C
Operate Time:	20 ms	20 ms	15 ms	As Selected	15 ms	20 ms	15 ms	As Selected
Release Time:	15 ms	15 ms	10 ms	10 ms	As Selected	15 ms	10 ms	10 ms
Life:								
Rated Load	100,000	100,000	100,000	100,000	100,000	100,000	500,000	500,000
No Load	10 million	10 million	10 million	10 million	10 million	10 million	50 million	50 million
OPTIONS	Indicator Lamp Manual Actuator Silver Contacts Perm. Mag. Blowout Mounting Styles: 6-32 Stud (Core) 6-32 Stud (Top) 6-32 Tapped Core 130°C Coil	Indicator Lamp Manual Actuator Silver Contacts Perm. Mag. Blowout Mounting Styles: 6-32 Stud (Core) 6-32 Stud (Top) 6-32 Tapped Core 130°C Coil	Indicator Lamp Manual Actuator Silver Contacts Perm. Mag. Blowout 130°C Coil Open Styles: 6-32 Stud (Core) 6-32 Tapped Core Gold Diffus. Contacts	Perm. Mag. Blowout Silver Contacts Gold Diffus. Contacts Fixed Timing Remote Timing	Perm. Mag. Blowout Silver Contacts Gold Diffus. Contacts Fixed Timing Remote Timing	Indicator Lamp (125DC Coil Only) Manual Actuator Open Styles: 6-32 Stud (Core) 6-32 Tapped Core	Indicator Lamp Manual Actuator Various Mountings Opp. Pol Barrier Diode Across Coil Sealed (Immersion Cleanable) PC Term. Version	Fixed Timing Remote Timing
APPROVALS	UL	UL	UL, CSA	UL, CSA	UL, CSA	UL	UL, CSA	UL

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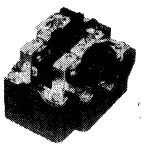
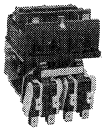
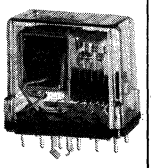
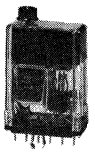
Commercial/Industrial Relay Products

COMMERCIAL/INDUSTRIAL RELAYS DIVISION
700 Orange St., Darlington, SC 29532-9986
Tel. 803-393-5421 FAX (24 HRS.) 803-393-4123

SCREW TERMINAL, 15-30 AMP, 1-3 POLE | **SCREW/Q.C. TERMINAL, MOTOR CONTACTORS, 1-7.5 HP, 3-4 POLE** | **INDUSTRIAL PLUG IN, 5-10 AMP, 2-6 POLE**

SERIES	425	A275	375	219	T219	246	247
							
DIMENSIONS (L x W x D)	3.250″ x 2.500″ x 2.500″	2.875″ x 3.625″ x 2.750″	4.650″ x 3.250″ x 2.620″	12 PIN: 2.625″ x 1.469″ x 3.406″ 14 PIN: 3.063″ x 1.469″ x 3.406″	2.625″ x 1.469″ x 5.250″	2.625″ x 1.469″ x 4.093″	2.625″ x 1.469″ x 4.093″
FEATURES	• High Current • Low Cost • Long Life • Multi-Contact Arrangement • Motor Loads • High Inrush Loads • Var. Speed Drive Load • 600VAC Rated	• 2 Coil Reversing Contactor 1 HP Rated • 0.25″ Dual Quick-Connect Terminals • Up to 4 Auxiliary Contacts • Encapsulated Coils—AC or DC • Mechanical Interlock • 600VAC Rated • Operate in Any Position	• 20 Amp Reversing Contactor with Mechanical Interlock • Auxiliary Contacts • 0.25″ Dual Quick-Connect Load Terminals • Panel Mounting • Encapsulated Coils	• 10 Amp Multi-Pole—to 4 Form C or 6 Form A • Industrial Plug-In with Locking Clip • Encapsulated Coil • Polycarbonate Cover • Gold Diff. Sil. Cad Oxide Contacts • Single Level Socket Wiring	• Time Delay Relay: Delay-On Interval Flasher • Adjustable Timing: 0.1 sec to 36 hrs. • C/MOS Circuitry • AC/DC Input—Not Polarity Sensitive • Repeatability: AC ±0.5%, DC ±0.2% • No False Contacting Recycle Time: 60 ms • Single Level Socket Wiring	• Delay-On-Operate ISO Timer • Adjustable Timing: 0.1 to 300 sec • Repeatability: ±3% • No False Contacting • Polarity Protection • Recycle Time: 150 ms Max. • Transient Protection • Single Level Socket Wiring	• Delay On-Release ISO Timer • Adjustable Timing: 0.1 to 300 sec • Repeatability ±3% • Recycle Time: 150 ms Max. • Transient Protection • Single Level Socket Wiring
CONTACT DATA							
Form:	Up to 3 Form C	6P DM (3 Per Coil)	8P DM (4 Per Coil)	2 Form C to 4 Form C or up to 6 Form A-Form B Combinations	2 Form C to 2 Form A & 2 Form C	2 Form C to 2 Form A & 2 Form C	2 Form C; 3 Form C
Material:	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide—Gold Diffused	Sil. Cad. Oxide—Gold Diffused	Sil. Cad. Oxide—Gold Diffused	Sil. Cad. Oxide—Gold Diffused
Ratings:	120VAC 30A* 240VAC 30A* 480VAC 12.5A 600VAC 10A 30VDC 15A — *25A for 3 pole relay	120VAC 15A, 1 HP 240VAC 10A, 2 HP 480VAC 5A, 2 HP 600VAC 5A, 2 HP 30VDC 15A 125VDC 5A 250VDC 1A	120VAC 20A, 2 HP 240VAC 15A, 7.5 HP 480VAC 15A, 7.5 HP 600VAC 15A, 7.5 HP	24/DC or 120/AC Make 30A, Carry 10A, Break 10A 240/AC Make 30A, Carry 10A, Break 5A 125/DC Make 30A, Carry 10A, Break 0.5A	24/DC or 120/AC Make 30A, Carry 10A, Break 10A 240/AC Make 30A, Carry 10A, Break 5A 125/DC Make 30A, Carry 10A, Break 0.5A	24/DC or 120/AC Make 30A, Carry 10A Break 10A 240/AC Make 30A, Carry 10A, Break 5A 125/DC Make 30A, Carry 10A, Break 0.5A	24/DC or 120/AC Make 30A, Carry 10A Break 10A 240/AC Make 30A, Carry 10A, Break 5A 125/DC Make 30A, Carry 10A, Break 0.5A
COIL DATA							
AC—Volts	6 to 480	12 to 240	12 to 600	6 to 240	24 to 120	24 to 240	24 to 240
DC—Volts	6 to 220	12 to 120	—	6 to 125 (250V with series resistor)	24 to 125	24 to 125	24 to 125
Power:	1&2 pole 3 pole						
AC VA	9.8 11	16.7	10 (52 Inrush)	5	1.8W	5	5
DC Watts	2.0 4	4.5	—	1.8 (2.5W @ 125VDC)	1.8	1.8	1.8
GENERAL DATA							
Ambient Temp.:							
AC:	−55°C to +45°C	−45°C to +50°C	−45°C to +50°C	−10°C to +60°C	−20°C to +65°C	−10°C to +45°C AC	−10°C to +45°C
DC:	−55°C to +80°C	−45°C to +70°C	—	—	−10°C to +70°C DC	−10°C to +70°C DC	
Operate Time:	30 ms	50 ms	50 ms	25 ms	As Selected	As Selected	20 ms
Release Time:	15 ms	30 ms	30 ms	20 ms	20 ms	20 ms	As Selected
Life:							
Rated Load	100,000	100,000	100,000	100,000	100,000	100,000	100,000
½ Rated Load	500,000	500,000	500,000	500,000	500,000	500,000	500,000
No Load	10 million	5 million	10 million	10 million	20 million	10 million	10 million
Dielectric Strength	2,500VAC	2,500VAC	2,500VAC	—	—	—	—
OPTIONS	Quick-Connect Term. High Inrush Tungsten Contacts Auxiliary Contacts Perm. Mag. Blowout 130°C Coil	Auxiliary Contacts—Up to Four with 0.25″ Quick-Connect Term. Rated 5A	Auxiliary Contacts — Up to 4 Form C Rated 5A at 300VAC Screw Terminals on Main Contacts	Indicator Lamp Manual Actuator Bifurcated Contacts Coil Suppression Perm. Mag. Blowout 130°C Coil Nuclear Qualified	Indicator Lamp Manual Actuator Bifurcated Contacts Perm. Mag. Blowout Fixed Timing	Indicator Lamp Manual Actuator Bifurcated Contacts Magnetic Blowout Fixed Timing Remote Adjust.	Indicator Lamp Manual Actuator Bifurcated Contacts Magntic Blowout Fixed Timing Remote Adjust.
APPROVALS	UL, CSA	UL, CSA	UL	UL, CSA	—	UL, CSA	UL

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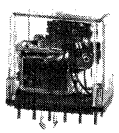
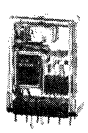
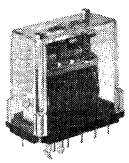
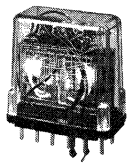
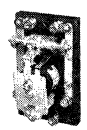
Manufacturers of Struthers-Dunn Commercial/Industrial Relay Products

COMMERCIAL/INDUSTRIAL RELAYS DIVISION
700 Orange St., Darlington, SC 29532-9986
Tel. 803-393-5421 FAX (24 HRS.) 803-393-4123

INDUSTRIAL PLUG IN, 5-10 AMP, 2-4 POLE

INDUSTRIAL PLUG IN, 2-5 AMP, 1-2 POLE

SCREW TERMINAL, 2-200 AMP, 1-2 POLE

SERIES	B255	A311	349	112-PGF	RSX1800	C85	102/103
							
DIMENSIONS (L x W x H)	2.625" x 1.469" x 4.563"	2.625" x 1.469" x 3.406"	2.625" x 1.469" x 4.875"	2.625" x 1.469" x 3.625"	2.625" x 1.469" x 3.406"	5.000" x 3.000" x 2.625"	4.250" x 2.656" x 3.000"
FEATURES	• 2 Coil Mechanical Latch • Single Level Socket Wiring • Continuous Duty Coils • Both Coils May Be Energized Simultaneously—No Damage	• Sequence (Stepping) Relay • Single Coil • Contact Transfer on Energizing/ De-energizing Stroke of Relay • Single Level Socket Wiring • Continuous Duty Coil	• Over/Undervoltage Sensing Relay • Single Phase or Three Phase • Fixed or Adjustable Differential • Single Level Socket Wiring	• Low Power Design • Withstand 5 to 10 Times Coil Rating • Polycarbonate Cover • Front Removable Cover for Field Adj. • Ground Fault Sensor • Single Level Socket Wiring	• Plug-In Alarm Relay • All Electro-Mechanical Design • Operate from Normally Open or Normally Closed Trouble Contact • Clear Polycarbonate Cover • Sustained or Momentary Alarm • Single Level Socket Wiring	• Heavy Duty Sequence Relay • Positive Action • Front Connected • Any Sequence Up to 12 Steps	• Heavy Duty DC Solenoid Type Contactors • To 200 Amp Switching • Enclosed Contacts
CONTACT DATA							
Form:	2 Form C, 3 Form C or Up to Four Form A/B Combinations	2 Form C	2 Form C or 2 Form A & 2 Form C	Up to 2 Form C	1 Form A and 1 Form C	2 Form A or 1 Form A & 1 Form B	1 Form X
Material:	Sil. Cad. Oxide—Gold Diffused	Sil. Cad. Oxide	Sil. Cad. Oxide—Gold Diffused	Fine Silver	Sil. Cad. Oxide	Fine Silver	Sil. Cad. Oxide
Ratings:							Model 102 / 103
24/DC or 120/AC	30A, 10A, 10A	5A	30A, 10A, 10A	2A	5A	20A	100A / 200A
240/AC	30A, 10A, 10A	—	30A, 10A, 10A	1A	—	20A	100A / 200A
125/DC	30A, 10A, 0.5A	0.1A	30A, 10A, 0.5A	—	—	—	— / —
COIL DATA							
AC—Volts	6 to 240	6 to 240	85 to 135	1 to 225	6, 12, 24, 120	24 to 550	—
DC—Volts	6 to 125 (250V with series resistor)	6 to 125 (250V with series resistor)	0.08 to 21 (125VDC with series resistor)	6, 12, 24, 125	24 to 240	12,24,48	
Power:							
AC VA	5 OP 3 RESET	5	1.8W	Single Pole 0.2 Double Pole 1.0	2.4	18	—
							Model 102 / 103
DC Watts	1.8 OP 1.9 RESET	1.8	—	Single Pole 15mW Double Pole 65mW	2.4	14	10.5 / 13.3
GENERAL DATA							
Ambient Temp.:	−10°C to +60°C	−10°C to +60°C	−10°C to +60°C	−45°C to +65°C	−10°C to +70°C	−45°C to +65°C	−45°C to +65°C
Operate Time:	25 ms	35 ms	20 ms	25 ms max.	50 ms	30 ms	
Release Time:	20 ms	35 ms	25 ms	20 ms	20 ms max.	50 ms	30 ms
Life:							
Rated Load	100,000	100,000	100,000	100,000	500,000	100,000	100,000
½ Rated Load	500,000	500,000	500,000	—	—	—	—
No Load	10 million	5 million	20 million	500,000	20 million	500,000	500,000
OPTIONS	Indicator Lamp Manual Actuator Bifurcated Contacts Magnetic Blowout Coil Suppression Time Delay On Reset Coil	Indicator Lamp Coil Suppression Non-Standard Sequences	Indicator Lamp Bifurated Contacts Magnetic Blowout	Special Pick-up and Drop-out Adjustments Series Coils to 10 Amps	Operate from N.O. Trouble Contact Operate from N.C. Trouble Contact	7, 8, 9, 10, 11 and 12 Tooth Ratchets Available for Special Sequences, Non-Standard Coil Voltages	Other DC Coils AC Operation Form D Contact Form Y Contact
APPROVALS	UL, CSA	UL	—	—	—	—	—

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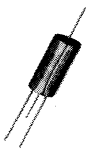
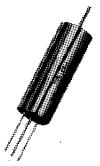
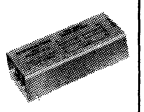
PRINTED CIRCUIT TERMINAL REED, 0.25-1 AMP, 1-4 POLE

SERIES	MRR-D	MRRQ	MR-Y	MRRK	MRRN	MRR	RR	RRN
								
DIMENSIONS (L x W x H)	0.750" x 0.300" x 0.275"	0.750" x 0.250" x 0.260"	0.950" x 0.400" x 0.312"	1.290" x 0.660" x 0.445"	1.125" x 0.609 x 0.375"	1.062" x 0.425" Dia.	1.875" x 0.655" Dia.	2.500" x 0.740" x 0.641"
FEATURES	• Epoxy Molded • 8 or 14 Pin Designs • 14 Pin DIP Socket Compatible • DTL, TTL and HNIL Compatible • Magnetic Shielding • Low Cost • Form A, Form B or Form C Contacts	• Epoxy Molded—4 Term. Design • 14-Pin Dip Socket Mount (2-Side by Side) • Form A or B Contacts • Magnetic Shielding • DTL, TTL and HNIL Compatible	• Epoxy Molded—End Termination • 0.100 or 0.150 Grid Spacing • Magnetic Shielding • DTL, TTL and HNIL Compatible	• KEL-F Enclosure Ultrasonically Sealed • Magnetic Shielding • 0.1" Grid Spacing • Minimal Switch Stress • Thermal Stability	• Miniature-Open Construction • Magnetic Shielding • 0.1" Grid Terminals • Single Piece, Glass-Filled Nylon Bobbin and Terminal Support • Terminals are Non-Magnetic	• Epoxy Molded—Axial Lead • Magnetic Shielding • Miniature Size	• Epoxy Molded—Axial Lead • Magnetic Shielding • Standard Size	• Standard-Open Construction • Magnetic Shielding • 0.2" Grid Spacing • Single Piece, Glass-Filled Nylon Bobbin and Terminal Support • Terminals are Non-Magnetic
CONTACT DATA								
Form:	1 Form A 2 Form A 1 Form B 1 Form C	1 Form A or 1 Form B	1 Form A to 2 Form C	1 Form A to 3 Form A 2 Form B or 2 Form C	1 Form A to 4 Form A 1 Form C to 3 Form C	1, 2, 4 or 12 Form A	1, 2 or 4 Form A; 1 Form B	1 Form A to 4 Form A 1 Form C to 3 Form C
Material:	Rhodium	Rhodium	Rhodium	Rhodium	Rhodium	Rhodium	Rhodium	Rhodium
Ratings:								
Volts (max)	Form A/B: 100 / Form C: 28	100	Form A/B: 200 / Form C: 28	Form A/B: 200 / Form C: 28	Form A/B: 200 / Form C: 28	200	250	Form A/B: 250 / Form C: 250
Amps (max)	Form A/B: 0.5 / Form C: 0.25	0.5	Form A/B: 0.5 / Form C: 0.25	Form A/B: 0.5 / Form C: 0.25	Form A/B: 0.5 / Form C: 0.25	0.5	1.0	Form A/B: 1.0 / Form C: 0.5
Watts (max)	Form A/B: 10 / Form C: 3	10	Form A/B: 10 / Form C: 3	Form A/B: 10 / Form C: 3	Form A/B: 10 / Form C: 3	10	15	Form A/B: 15 / Form C: 10
COIL DATA								
AC Volts	—	—	—	—	—	—	—	—
DC Volts	5 to 24	5 to 24	5 to 24	6 to 48	6 to 48	6 to 48	6 to 48	6 to 48
Power:								
AC VA	—	—	—	—	—	—	—	—
DC mW	50 to 280	50 to 280	270 (1 Contact) 450 (2 Contacts)	360	189 to 900 depending on No. of Contacts	125 to 1,500 depending on No. of Contacts	400 to 1,500 depending on No. of Contacts	240 to 1,000 depending on No. of Contacts
GENERAL DATA								
Ambient Temp.:	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C
Operate Time:	2 ms	1 ms	2 ms	2 ms	5 ms	2 to 10 ms depending on No. of Contacts	2 to 5 ms depending on No. of Contacts	6 ms
Release Time:	2 ms	1 ms	2 ms	1.5 ms	3 ms	1 to 5 ms depending on No. of Contacts	1 to 4 ms depending on No. of Contacts	3 ms
Dielectric (VDC)	Form A/B / Form C	Form A/B	Form A/B / Form C	Form A/B / Form C	Form A/B / Form C			
Across Gap	150 / 100	150	300 / 200	300 / 200	400 / 250	400	600	500
Contact/Coil	1,500 / 1,500	1,500	1,500 / 1,500	1,500 / 1,500	1,500 / 1,500	1,500	1,500	1,500
To Ground	1,500 / 1,500	1,500	1,500 / 1,500	1,500 / 1,500	1,500 / 1,000	1,500	1,500	1,500
Insulation Resistance:	1,000 Megohms	1,000 Megohms	1,000 Megohms	1,000 Megohms	1,000 Megohms	1,000 Megohms	1,000 Megohms	1,000 Megohms
Life:			Form A/B / Form C	Form A/B / Form C	Form A/B / Form C			Form A/B / Form C
Rated Load	5 million	5 million	10 mill. / 5 mill.	10 mill. / 5 mill.	10 mill. / 10 mill.	10 million	10 million	10 mill. / 10 mill.
No Load	20 million	20 million	100 mill. / 50 mill.	100 mill. / 50 mill.	200 mill. / 50 mill.	200 million	200 million	200 mill. / 50 mill.
OPTIONS	Suppression Diode Electrostatic Shield 50 MW Coil Sensitivity Magnetic Latch Versions Mercury Switch MIL-Spec. Qualified	Internal Suppression Diode Electrostatic Shield Mercury Switch	Low Power Coils Internal Suppression Diode Electrostatic Shield Mercury Switch	Internal Suppression Diode Electrostatic Shield Mercury Switch	Special Wiring Internal Suppression Diode Electrostatic Shield Mercury Switch Magnetic Latch Version	Pre-Formed Leads Welded Lead Extensions	Pre-Formed Leads Welded Lead Extensions	Special Wiring Internal Suppression Diode Electrostatic Shield Magnetic Latch Version
APPROVALS	UL	—	CSA	—	UL	—	—	—

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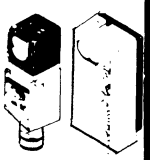
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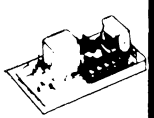
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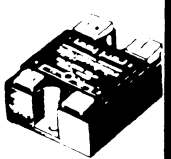
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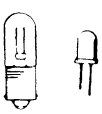
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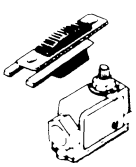
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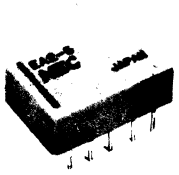
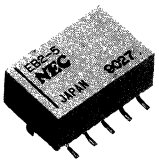
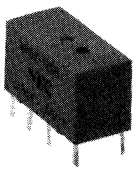
Miniature Relay—Signal

	EA2	EB2	MR62	MR62-Y
Type of relay				
Features	• low power consumption • low magnetic interference • 1500 FCC surge 1000V AC FCC • compact, light weight • latching type available	• surface mount • low power consumption • low magnetic interference • 1500V FCC surge 1000A AC FCC • compact, light weight • latching type available	• DIP terminal • sealed package for flow soldering • stable contact resistance at high temperature • 1500V FCC surge	• DIP terminal • sealed package • low power consumption (400mW) • stable contact resistance at high temperature • 1500V FCC surge
Contact arrangement	2C	2C	2C	2C
Contact material (standard)	silver alloy with gold overlay		silver alloy with gold overlay	silver alloy with gold overlay
Contact rating (resistive) (switching)	30W/62.5VA 3A 2A 1A 1.0A	30W/62.5VA 1.0A	60W/125VA 2.0A	60W/125VA 2.0A
Coil voltage	3, 4.5, 5, 6, 9, 12, 24 V. DC		5, 6, 9, 12, 24, 48 V. DC	5, 6, 9, 12, 24, 48 V. DC
Nominal operating power	140W (single coil latch type 100mW)		550mW	400mW
Must operate voltage	75%		62 to 72%	70%
Must release voltage	10%		5%	5%
Operate time (typ.) (Excluding bounce)	2ms		3ms	4ms
Release time (typ.) (Excluding bounce)	1ms		2ms	2ms
Life (operations) Electrical	0.2×10^6 30V DC, 1A (resistive) 0.1×10^6 125V AC, 0.5A (resistive)		1×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	10×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A
Life (operations) Mechanical	100×10^6		10×10^6	10×10^6
Breakdown voltage Between open contacts	1000V AC		500V AC	500V AC
Breakdown voltage Between adjacent contacts	1000V AC		1000V AC	1000V AC
Breakdown voltage Between contact and coil	1000V AC		1000V AC	1000V AC
Surge withstand voltage	1500V FCC		1500V FCC*	1500V FCC*
UL, CSA, VDE	UL, CSA	UL, CSA	UL, CSA	UL, CSA
Option			—	—
Height (mm)	5.4	7.5	11.4	11.4
Mounting space (mm)	9×14	9.3×14.3	9.8×20.2	9.8×20.2

* 1500V FCC surge between coil and contacts and between adjacent contacts.

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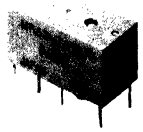
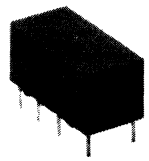
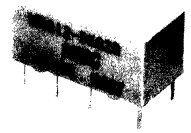
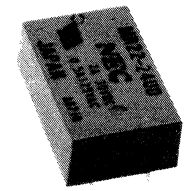
Miniature Relay—Signal

		MR62-K	MR602	MR612	MR622	MR22
Type of relay						
Features		• DIP terminal • sealed package for flow soldering • stable contact resistance at high temperature • 1500 FCC surge	• low power consumption • 1500V FCC surge, 1000V AC FCC breakdown voltage • latching type available	• low power consumption • 1500V FCC surge, 1000V AC FCC breakdown voltage • latching type available	• high-breakdown voltage (coil to contact) • low power consumption • 1500V FCC surge	• long life • automatic wave soldering possible • latching type available
			Polarized Type			
Contact arrangement		2C	2C or 2D	2C or 2D	2C or 2D	2C or 2D
Contact material (standard)		silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay
Contact rating (resistive) (switching)		60W/125VA 3A 2A 2.0A 1A	60W/125VA 2.0A	60W/125VA 2.0A	60W/125VA 2.0A	60W/125VA 2.0A
Coil voltage		5, 6, 9, 12, 24, 48 V. DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48 V. DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48 V. DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48 V. DC	5, 6, 12, 24, 48, 60 V. DC
Nominal operating power		400mW or 550mW	200mW (latching type-single wound coil 100mW)	400mW (latching type-single wound coil 200mW)	400mW	Approx. 280mW
Must operate voltage		70% 48V...80%	70% (From D type 80%)	70%	70%	80% (Y type 70%)
Must release voltage		5%	10%	10%	10%	10%
Operate time (typ.) (Excluding bounce)		3ms (KY type 4ms)	3.5ms	3.5ms	3.5ms	10ms
Release time (typ.) (Excluding bounce)		2ms	1.5ms	2.0ms	2.0ms	3ms
Life (operations)	Electrical	1×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1×10^6 30V DC, 1A
	Mechanical	10×10^6	10×10^6	10×10^6	10×10^6	100×10^6
Breakdown voltage	Between open contacts	1000V AC	1000V AC or 500V AC*	1000V AC or 500V AC*	1000V AC or 500V AC*	1000V AC or 750V AC*
	Between adjacent contacts	1000V AC	1000V AC	1500V AC	1500V AC	1000V AC
	Between contact and coil	1000V AC	1000V AC	1000V AC or 2000V AC**	4000V AC	1000V AC
Surge withstand voltage		1500V FCC*	1500V FCC	1500V FCC	1500V FCC	1500V FCC (Form C)
UL, CSA, VDE		UL, CSA	UL, CSA	UL, CSA		UL, CSA
Option		—	latching type	latching type	—	latching type
Height (mm)		11.4	10.1	10.1	10.1	11.5
Mounting space (mm)		9.8×20.2	10.1×20.3	10.1×20.3	10.1×20.3	19.7×29.7
			*Form D type	*Form D type **K type	*Form D type	*Y type (Form D type: 500V. AC)

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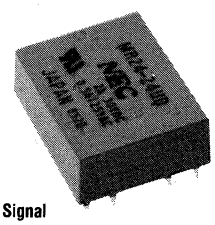
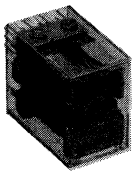
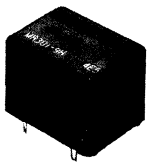
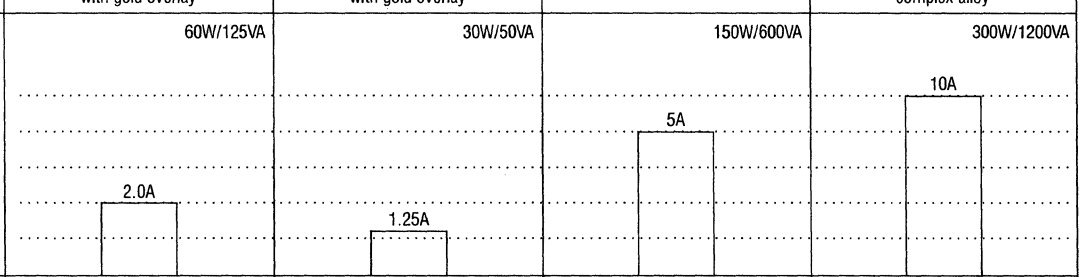
Miniature Relay Signal & Power

	MR24	MR10/MR11/MR11-500	MR301	MR301-H
Type of relay	 Signal	 Signal	 Power	 Power
Features	• long life • automatic wave soldering possible • latching type available	• long life • 12-pole contacts (up to 18 contacts) • flux tight base cap available	• low profile • specialty for automotive • flux tight	• low profile • high power switching • flux tight
Contact arrangement	4C, 4D or 2C + 2D	4C, 4D or 2C + 2D 6C, 6D or 4C + 2D 12A, 12B or 6C + 6A or 6B	1C	1C
Contact material (standard)	silver alloy with gold overlay	silver alloy with gold overlay	silver nickel alloy	silver oxide complex alloy
Contact rating (resistive) (switching)				
Coil voltage	5, 6, 12, 24, 48, 60 V. DC	5, 6, 9, 12, 24, 48, 60 V. DC/ *6, 12, 24, 48 V. DC	3, 5, 6, 9, 12, 24, 48 V. DC	3, 5, 6, 9, 12, 24, 48 V. DC
Nominal operating power	Approx. 470mW	1.0 to 1.5W	360mW	360mW
Must operate voltage	80% (Y type 70%)	55 to 80%	70%	70%
Must release voltage	10%	—	10%	10%
Operate time (typ.) (Excluding bounce)	10ms	15ms/*20ms	10ms	10ms
Release time (typ.) (Excluding bounce)	3ms	6ms/*4ms	10ms	10ms
Life (operations) Electrical	1×10^6 30V DC, 1A	50×10^6 115V AC, 0.25A with spark supression	0.1×10^6 120V. AC, 5A	0.1×10^6 120V. AC, 10A
Life (operations) Mechanical	100×10^6	50×10^5	10×10^6	10×10^6
Breakdown voltage Between open contacts	1000V AC or 750V AC*	Form C 1000V AC Form D 500V AC	750V AC	750V AC
Breakdown voltage Between adjacent contacts	1000V AC	1000V AC	—	—
Breakdown voltage Between contact and coil	1000V AC	1000V AC	1500V AC	1500V AC
Surge withstand voltage	1500V FCC (Form C)			
UL, CSA, VDE	UL, CSA		UL	UL
Option	latching type			
Height (mm)	11.5	1.182 (30.0)	17.0	17.0
Mounting space (mm)	24.3×29.7	.749×1.071/* .993×1.272 (19×27.2/* 25.2×32.3)	16.5×22.5	16.5×22.5

*Y type
(Form D type: 360V. AC)

*for 500 series

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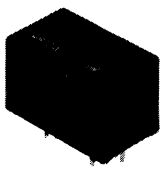
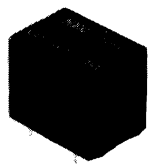
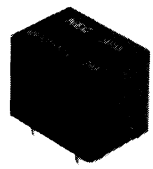
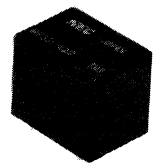
Miniature Relay—Power

	MR321A	MR321A-H	MR331-N10	MR331-N14	MR331-N20
Type of relay					
Features	• electric heater switching (up to 1KW/100V AC) • low profile • compact • flux tight	• electric heater switching (up to 1.5KW/100V AC) • low profile • compact • flux tight	• best for inductive load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for inductive load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for capacitive load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life
Contact arrangement	1A	1A	1C	1A	1A
Contact material (standard)	silver oxide complex alloy	silver oxide complex alloy	silver oxide complex alloy	silver oxide complex alloy	silver oxide complex alloy
Contact rating (resistive) (switching)	30A, 25A, 20A, 15A, 10A, 5A 1200VA 12A	30A, 25A, 20A, 15A, 10A, 5A 1600VA 15A	cut-off 30A (14V. DC)	cut-off 30A (14V. DC)	cut-off 10A (14V. DC)
Coil voltage	3, 5, 6, 9, 12, 24, 48 V. DC	3, 5, 6, 9, 12, 24, 48 V. DC	12 V. DC	12 V. DC	12 V. DC
Nominal operating power	360mW	360mW	800mW	450mW	450mW
Must operate voltage	70% (48V. DC: 80%)	70% (48V. DC: 80%)	8.0 V. DC	8.0 V. DC	8.0 V. DC
Must release voltage	10%	10%	1.2 V. DC	1.2 V. DC	1.2 V. DC
Operate time (typ.) (Excluding bounce)	10ms	10ms	10ms	10ms	10ms
Release time (typ.) (Excluding bounce)	10ms	10ms	10ms	10ms	10ms
Life (operations) Electrical	0.5×10^6 100 V. AC, 12A	0.5×10^6 100 V. AC, 15A	0.2×10^6 (door interlock system)	0.5×10^6 (car air conditioner)	0.1×10^6 12V. DC, 5A* capacity 2200μF+12000μF
Life (operations) Mechanical	10×10^6	10×10^6	10×10^6	10×10^6	100×10^6
Break-down voltage Between open contacts	750V. AC	750V. AC	500V. AC	500V. AC	500V. AC
Break-down voltage Between adjacent contacts	—	—	—	—	—
Break-down voltage Between contact and coil	1500V. AC	1500V. AC	500V. DC	500V. DC	500V. DC
Surge withstand voltage					
UL, CSA, VDE	UL	UL			
Option					
Height (mm)	16.5	16.5	18.0	18.0	18.0
Mounting space (mm)	16.5×26.0	16.5×26.0	16.5×22.5	16.5×22.5	16.5×22.5

*technical data booklet is available.

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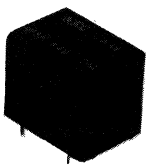
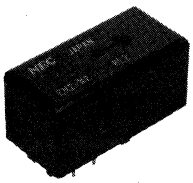
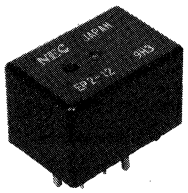
Miniature Relay—Power

Type of relay	MR331-N30	MR331-N40	EN2	EP2
				
Features	• best for lamp load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for lamp load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• twin relay • motor and solenoid reversible control • 30% less relay space than 2 conventional relays • symmetrical structure • flux tight housing	• twin relay • motor and solenoid reversible control • 50% less relay space than 2 conventional relays • symmetrical structure • flux tight housing
Contact arrangement	1A	1A	1C×2	1C×2
Contact material (standard)	silver nickel alloy to palladium alloy	silver alloy	silver oxide complex alloy	silver oxide complex alloy
Contact rating (resistive) (switching)	30A 25A 20A cut-off 20A (14V. DC) 15A 10A 5A	30A 25A 20A cut-off 30A (14V. DC) 15A 10A 5A	30A 25A 20A 35A (16V. DC) 15A 10A 5A	30A 25A 25A (16V. DC) 20A 15A 10A 5A
Coil voltage	12V. DC	12V. DC	12V. DC	12V. DC
Nominal operating power	450mW	450mW	0.64W/0.8W/1.15W	0.48W/0.64W
Must operate voltage	8.0V. DC	8.0V. DC	6.5 to 8.5V. DC	6.5 to 8.5V. DC
Must release voltage	1.2V. DC	1.2V. DC	0.6 to 0.9V. DC	0.9V. DC
Operate time (typ.) (Excluding bounce)	10ms	10ms	10ms	10ms
Release time (typ.) (Excluding bounce)	10ms	10ms	10ms	10ms
Life (operations) Electrical	2.5×10^6 lamp 23W/12V×5*	0.1×10^6 lamp 60W/12V×1	0.1×10^6 motor load 14V. DC, 25A/7A	0.1×10^6 motor load 14V. DC, 20A/3A
Mechanical	10×10^6	10×10^6	1×10^6	1×10^6
Breakdown voltage Between open contacts	500V. DC	500V. DC	500V. DC	500V. DC
Between adjacent contacts	—	—		
Between contact and coil	500V. DC	500V. DC	500V. DC	500V. DC
Surge withstand voltage				
UL, CSA, VDE				
Option			Separate type	Separate type
Height (mm)	18.0	18.0	17.0	16.5
Mounting space (mm)	16.5×22.5	16.5×22.5	16.5×33.5	16.7×24.3

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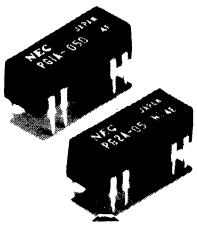
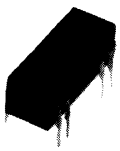
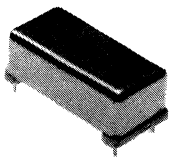
Reed Relay—Dry

		PG1A/PG2A	PG1C	PU	LR1A/LR2A	URA
Type of relay						
Features		• DIP terminal • high speed • glass encapsulated reed switch • 1 Form A • 2 Form A	• DIP terminal • high speed • glass encapsulated reed switch • 1 Form C	• single-in-line pin configuration (SIP) • high speed • 5.08mm pitch terminal	• compact • light weight • economy • tubular type • easy handling (plastic coated)	• high sensitivity (only 2mW) • high dielectric withstanding voltage
Contact arrangement		1A, 2A	1C	1A	1A, 2A	1A
Contact rating (resistive) (switching)		10W/100V DC	3W/30V DC	10W/100V DC	10W/100V DC	10W/100V DC
	3A	.....	.....	.....	.....	.....
	2A	.....	.....	.....	.....	.....
	1A	..... 0.5A	..... 0.2A	..... 0.5A	..... 0.5A	..... 0.5A
Coil voltage		5, 12, 24V DC	5, 12, 24V DC	5, 12, 24V DC	5, 6, 12, 24V DC	(10 to 16mA)
Nominal operating power		50 to 270mW	180 to 385mW	50 to 290mW	160 to 360mW	1.5 to 2.0mW
Must operate voltage		75%	75%	75 to 80%	55 to 65%	(9 to 14.4mA)
Must release voltage		8 to 16%	8 to 10%	8 to 16%	7 to 8%	(2 to 3.2mA)
Operate time (typ.) (Excluding bounce)		0.1 to 0.3ms	0.2 to 0.5ms	0.1 to 0.3ms	0.2 to 0.9ms	3.0ms
Release time (typ.) (Excluding bounce)		0.05ms (0.65ms with diode)	0.25ms (1.25ms with diode)	0.03ms (0.65ms with diode)	0.05ms (0.65ms with diode)	1.5ms
Life (operations)	Electrical	100×10^6 5V DC, 5μA 10×10^6 24V DC, 5mA 1×10^6 30V DC, 0.1A	1×10^6 24V DC, 50mA	100×10^6 5V DC, 5μA 10×10^6 24V DC, 5mA 1×10^6 30V DC, 0.1A	100×10^6 5V DC, 5μA 10×10^6 12V DC, 5mA 0.5×10^6 48V DC, 0.1A	10×10^6 12V DC, 5mA 1×10^6 24V DC, 0.5A
	Mechanical	100×10^6	50×10^6	100×10^6	100×10^6	100×10^6
Breakdown voltage	Between open contacts	250V DC	200V DC	250V DC	250V DC	250V DC
	Between adjacent contacts	—	—	—	—	—
	Between contact and coil	500V DC	500V DC	1000V AC	1500V AC	1500 or 3500V AC*
Surge withstand voltage						
Insulation resistance		10^4MΩ (at 100V DC)	10^3MΩ (at 100V DC)	10^4MΩ (at 100V DC)	10^4MΩ (at 100V DC)	10^3MΩ (at 100V DC)
UL, CSA						
Option		electrostatic shield (1A type) magnetic shield (1A and 2A type) with a diode				
Height inches (mm)		.276 (7.0)	.276 (7.0)	.315 (8.0)	.355 (9.0)	.453 to .630 (11.5 to 16)
Mounting space inches (mm)		.276×.768 (7.0×19.5)	.311×.768 (7.9×19.5)	.197×.749 (5.0×19.0)	.394×1..024/.473×1.024 (10.0×26.0/12.0×26.0)	.552 to .630 ×1.143 (14.0 to 16.0 ×29.0)

* High breakdown voltage type

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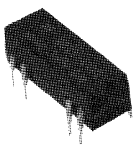
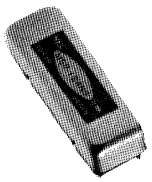
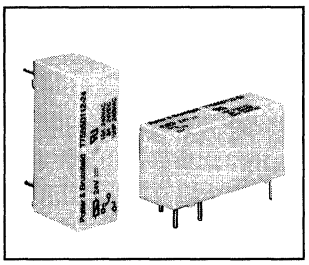
Reed Relay—Wet

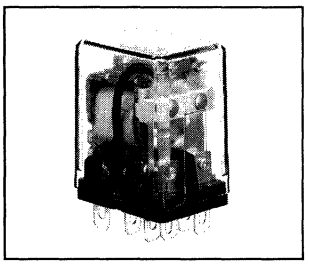
		UMD	PTW	NMR	RMP-1, 2	MSP
Type of relay						
Features		• DIP terminal • compact • long life with wetted contact switch	• SIP terminal • long life with wetted contact switch	• low power consumption • low profile • high speed (200 pps) • low contact noise (±20μV)	• compact • light weight • high reliability and long life	• large contact capacity • high reliability • latching type available
		Non-polarized Type		Polarized Type	Non-polarized Type	Polarized Type
Contact arrangement		1A	1A	1C, 1C× 2	1A or 1C (RMP-1) 2A or 2C (RMP-2)	1C or 1D
Contact rating (resistive) (switching)		50W/500V DC	50W/500V DC	50W/500V DC	50W/500V DC	100W/500V DC
	3A					
	2A					2A
	1A	1A	1A	1A	1A	
Coil voltage		5, 12, 24V DC	5, 12, 24V DC	5, 12, 24V DC	5, 12, 24, 48V DC	5, 12, 24, 48V DC
Nominal operating power		250 to 300 mW	420 to 480 mW	200 to 300 mW	300 to 380 mW	320 to 380 mW
Must operate voltage		80%	80%	70%	75%	40%
Must release voltage		10%	10%	10 ~ 13%	8%	7%
Operate time		1.0 to 2.0ms	1.0 to 2.0ms	1.2ms Max.	1.0 to 2.0ms	1.0 to 1.5ms
Release time		1.0 to 2.0ms (2.5ms with diode)	1.0 to 2.0ms (2.5ms with diode)	1.3ms Max. (with diode)	1.0 to 2.0ms (2.5ms with diode)	1.0 to 2.0ms (2.5ms with diode)
Life (operations)	Electrical	200×10^6 50V DC, 1A	200×10^6 50V DC, 1A	200×10^6 50V DC, 1A	200×10^6 50V DC, 1A	5×10^8 50V DC, 2A
	Mechanical	1×10^9	1×10^9	1×10^9	1×10^9	10×10^9
Breakdown voltage	Between open contacts	1000V AC	1000V AC	1000V AC	1000V AC	1000V DC
	Between adjacent contacts	—	—	—	1000 V AC (RMP-2)	—
	Between contact and coil	1000V AC	1000V AC	1000V AC	1000V AC	1000V AC
Surge withstand voltage						
Insulation resistance		10^3 MΩ (at 100V DC)	10^3 MΩ (at 100V DC)	10^3 MΩ (at 500V DC)	Between open contact: 10^2MΩ, others: 10^3MΩ (at 500V DC)	10^3 MΩ (at 500V DC)
UL, CSA					UL	
Option		magnetic shield, with a diode		electrostatic shield	—	latching type electrostatic shield
Height inches (mm)		.276 (7.0)	.315 (8.0)	.335 (8.5)	.394/.414 (10.0/10.5)	.402 (10.2)
Mounting space	**inches (mm)**	.351×.768 (8.9×19.5)	.256×.768 (6.5×19.5)	.355×.945/.650×.945 (9×24/16.5×24)	.374×1.280/.808×1.300 (9.5×32.5/20.5×33.0)	.552×1.599 (14×40.6)

Potter & Brumfield A Siemens Company

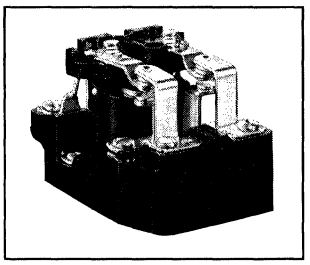
200 S. Richland Creek Dr., Princeton, IN 47671-0001 • Phone (812) 386-1000 • Fax (812) 386-2335



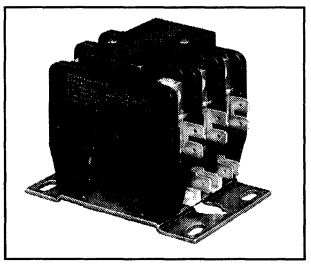
P.C. Board Relays
- Dry circuit to 30A ratings
- Up to 4PDT arrangements
- Open, dust cover and sealed units
- AC and DC coils
- Polarized types
- Latching models



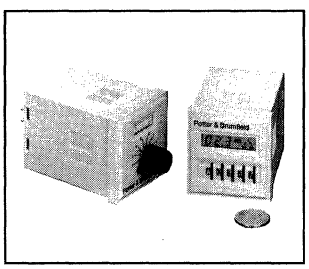
General Purpose Relays
- Dry circuit to 30A ratings
- Up to 8PDT arrangements
- Open, dust cover and sealed units
- AC and DC coils
- P.C. board, socket and panel mount types



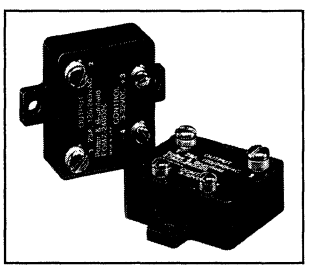
Power Relays
- Ratings to 60A
- Up to 4PDT arrangements
- Available as open relays or with dust covers
- AC and DC coils
- Socket and panel mount types



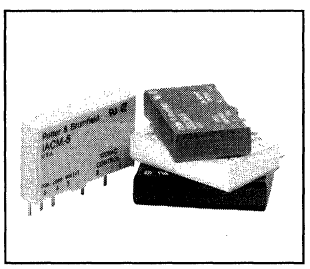
Contactors
- Ratings to 60A
- 1Ø and 3Ø switching
- Up to 4PST-NC-DM arrangements
- AC and DC coils
- Available with universal mounting plates



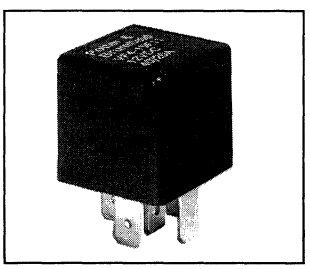
Time Delay Relays
- Ratings to 10A
- Time up to 9,990 hours
- Up to 10 timing modes
- Field programmable types
- AC and DC input
- Knob, resistor, switch and fixed adjustment types
- Socket and P.C. board mountings



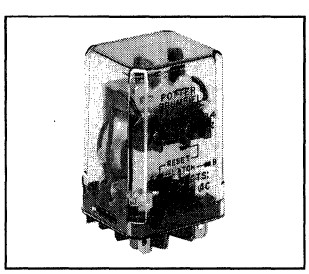
Solid State Relays
- Current ratings to 110A
- Switch voltage to 480VAC
- P.C. board and chassis mount types
- Single, dual and quad output
- AC and DC input
- Triac and inverse parallel SCR output types



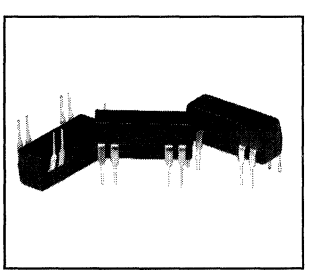
Input/Output Modules
- Standard, slim line, flat pack, quad pack and DIP package styles
- Output ratings to 6A
- Compatible for series operation
- Standard, slim line and quad pack mounting boards available



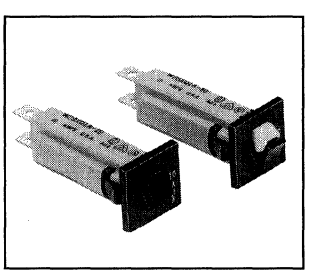
Automotive Relays
- Current ratings to 70A
- Standard and miniature varieties
- Choice of quick connect or PC terminals
- Various package styles and mounting options
- Coil suppression resistors available on some models



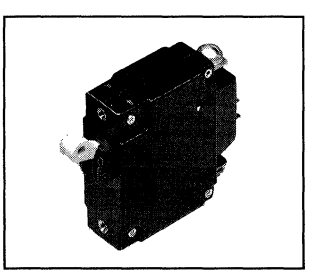
Impulse/Latching Relays
- Mechanical and magnetic latching types
- P.C. board, plug-in and chassis mount types
- Ratings to 20A
- Single and dual coil models
- Up to 16 poles



Reed Relays
- Dry and Hg-wetted types
- P.C. board, plug-in and chassis mount types
- Up to 5 poles
- Ratings to 250VA (with contact protection)
- Coil suppression diodes available on some models



Thermal Circuit Breakers
- Threaded bushing and snap-in mounting options
- Ratings to 50A
- Choice of quick connect or screw terminals
- Toggle, push/pull or push-to-reset actuators
- Series trip



Magnetic Circuit Breakers
- Choice of screw or snap-in mounting
- Ratings to 50A
- Up to 4 poles
- Actuator-per-unit and actuator-per-pole types
- Various circuit functions and time-trip curves

Need additional information about Potter & Brumfield products?

Contact an authorized P&B distributor or sales rep. For the name and phone number of one serving your area, call 800-255-2550.

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
Microwave Components, Product Selection Guide **A**•1746
Military Qualified Products List **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide **B**•1233
Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
Relays, Product Selection Guide **B**•1397
Resistor Color Codes **A**•1924
Resistors, Product Selection Guide **A**•1835
Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
Solenoids, Product Selection Guide **B**•1614
Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

1KV TO 300KV PK TEST

B-1001-G

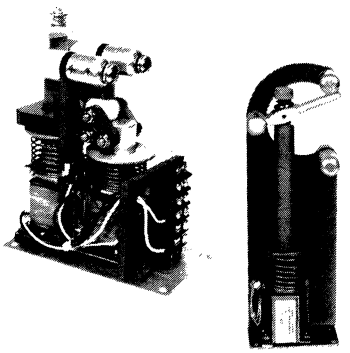
HIGH VOLTAGE RELAYS

HV BASIC RELAYS

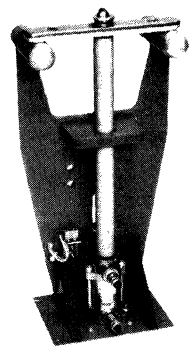
For transfer, safety grounding, tap selection, polarity selection. In the range of 1KV to 200KV DC or PK AC with PK test voltages up to 300KV PK. Most high voltage contacts have full insulation above ground. A higher insulation level to ground is optional. Some units are spring return and can mount in any position, or with gravity return by mounting in the proper position. Also usable in oil or insulating gas. Relays are available with replaceable tungsten alloy contacts for high current capacitor discharge use and with auxiliary contacts for holding, indicating or interlocking.

H.V. LATCHING RELAYS: Loss of control power will not cause an unwanted transfer. Power is not required to maintain position, reducing energy requirments and heat. Pulse actuation may be desirable in some applications.

E40-LC- -



E40-DT-60- -



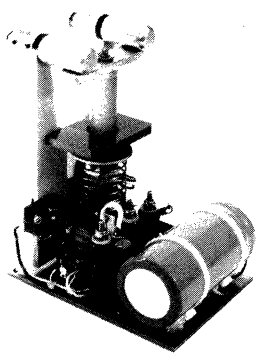
E60-NCP- -

HV AIR OPERATED RELAYS

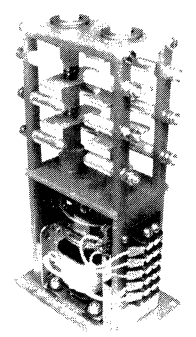
Air operated relays can be actuated with compressed air or other gas pressures of 80 to 120 PSI. Some can be operated at pressures as low as 30 PSI. Some units have spring return with loss of air. Auxiliary air valve type indicators can be provided in place of auxiliary electrical type contacts to provide complete isolation from high voltage, and provide answerback to indicate full open or closed, or other control. Units designed to be submerged in insulating fluid are also available with air exhaust outlets to exterior to avoid contaminating the insulating fluids.

HV DELAYED OPENING AND CLOSING RELAYS

For some high voltage control and safety applications, a delayed action but positive automatic closing (normally closed) or opening (normally open) of high voltage relays upon accidental loss or normal shut down of control power is desirable if not mandatory. These relays are designed for safety shorting and for use with HV power supplies having stored energy which must not be discharged before other control relays operate, or current flow which must not be interrupted too soon. Delay can be initiated either when control voltage is turned on or turned off, or both.



E40-NC- -ZA



ET6-14-6PNO- -

HIGH VOLTAGE MULTI-POLE RELAYS

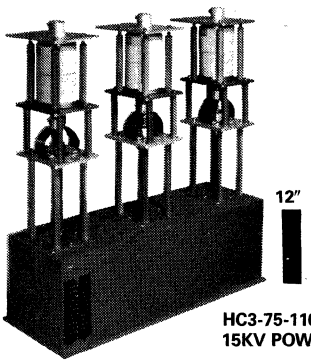
The Multi-pole E series relays are designed for high voltage applications where 2 or more poles are required. These air insulated relays are constructed using fire retardant, moisture sealed anti-tracking epoxy glass laminate of the highest quality. Environmental resistant materials are standard throughout to assure long life and ruggedness. Applications for these relays include: 3 phase tap or load selection, transfer, polarity reversing, safety grounding, and shorting. These units can be used in air, oil, or other insulating mediums and are designed to be mounted base down. Contacts are available in normally open, normally closed and double throw configurations. Latching units are also available.

ROSS ENGINEERING CORP.
540 Westchester Drive Campbell, CA 95008
PH: (408) 377-4621 - FAX (408) 377-5182

ROSS ENGINEERING CORP
540 Westchester Dr., Campbell, CA 95008 (406) 377-4621 TLX-85-8840 TWX-910-590-8033 FAX (408) 377-5182

HIGH VOLTAGE DEVICES

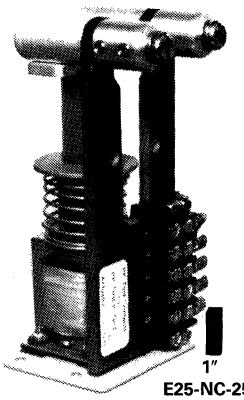
208V to 900KV and 0.01V to 1,000V Instrumentation



HV VACUUM CONTACTORS & 1 CYCLE CIRCUIT BREAKERS

Vacuum switches, single phase, three phase, upright or low profile, for high reliability sealed arc interrupting or crobar shorting. 208V to 200KV RMS operate. 50 to 4,000 amps continuous, 2,000 to 35,000 amps AC, 10 to 20,000 amps DC interrupt, 5,000 to 100,000 amps momentary and capicitor discharge.

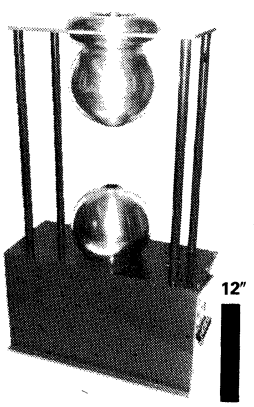
HC3-75-110-600-2-2
15KV POWER CLASS



HV RELAYS 1KV TO 300KV

HV relays of the air insulated type both for low and high current. This series has ratings from .1 to 200 amps continuous, 100 to 100,000 amps momentary and capacitor discharge. Peak test voltages from 5 to 300KV. Single or multipole. NO, NC and DT. Auxiliary contacts optional on all types. Latching extended life and tungsten contacts also available for high current closing. Also usable in oil or insulating gas.

E25-NC-25-1-0,
25KV PK TEST

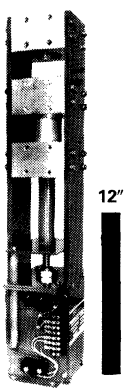


HV SPHERICAL RELAYS

Extra high voltage low corona, transfer, polarity reversing and grounding realys of the air insulated type. Ratings up to 600KV PK at 100 amps continuous. Solenoid, motor or air cylinder operated and spring or gravity return.

SPST, DT, 2PST, DT

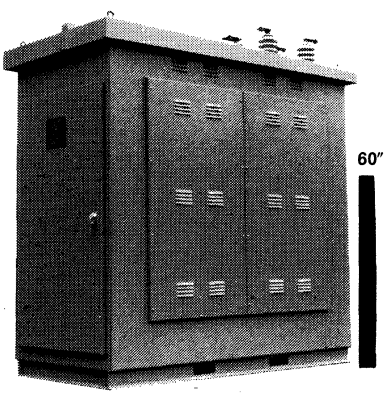
DH-300-NC-40-2-0-1
300KV PK TEST



HIGH CURRENT SWITCHES

Models are available up to 20,000 amps continuous, and over 500,000 amps pulse, with voltage ratings of 6 volts to 300KV peak test. Many are air cylinder or motor operated for high contact force.

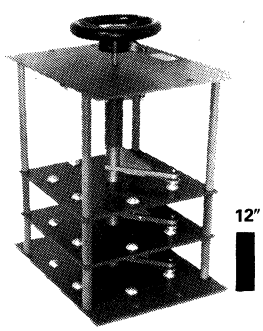
GD-27-DTP-40-1600-2-43,
27KV PK TEST



HIGH POWER HIGH SPEED HIGH VOLTAGE CONTROL AND STEP-START SYSTEMS

½ to 1 cycle sensing and interrupt vacuum circuit breakers. Metal enclosed for indoor or outdoor applications. 5KV-38KV.

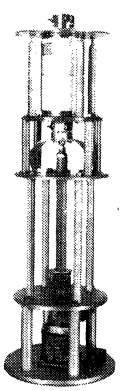
200-1200A CONTINUOUS
2000-28000A INTERRUPT
5-15KV CLASS, 28000A I.C.



HV ROTARY SWITCHES

Ratings from 5 to 150KV, 1 to 200 amps. Either manual or electrical operators, depending upon requirements. Position detents and interlocks to prevent opening under load.

R-60-3P7T-60-1-0-H,
60KV PK TEST



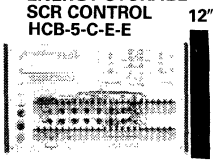
HIGH SPEED HV CONTACTORS AND SOLENOID DRIVERS ENERGY STORAGE UNITS

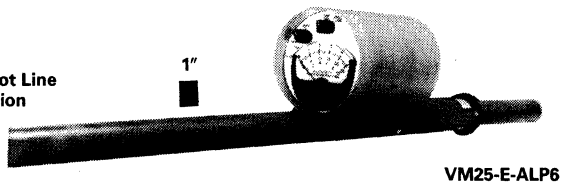
One Millisecond Contact Opening

For high speed or loss of power automatic circuit breaker trip and for high speed activation of contactor or circuit breaker solenoids. Energy storage up to 400 joules or more at 150 to 700 volts or more, 100 to 4,000 microfarad or more. Instantaneous SCR control available.

HA-73-NO-100-2-0
70KV PK TEST
CONTACTOR

ENERGY STORAGE
SCR CONTROL
HCB-5-C-E-E





VM25-E-ALP6
100V TO 25KV OR 50KV RMS

Hi-Ztm HV VOLTMETERS SAFE POWER LINE USE AC/DC FOR UTILITIES, CONTRACTORS & FIRE & SAFETY DEPARTMENTS

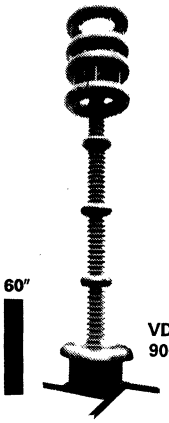
Fully safe, portable, all solid state, 2% to 5% accuracy. Taut band shielded high voltage measurement with minimum circuit loading. 0.001V to 50KV AC and DC. Ideal for use with Elbow capacitance tap voltage test points. For cable test point or direct line voltage and phasing, or differential measurement. Digital also available with 0.5%-1% accuracy.



WIDE BAND HV VOLTAGE DIVIDERS DC-10 MHz

Precision compensated resistance-capacitance voltage dividers for 1KV to 900KV, DC up to 10MHz or to 0.02μ Sec rise time pulse. 1,000/1 ratio matched to 1 megohm, 20 to 50 pf display or recorder. Other ratios and loads as required. Accuracy and stability: 0.01% to 0.1% DC. 0.2% to 1% AC 3% DC-1MHz. 3DB 10MHz.

VD60-6.2-B-LB-A
60KV PK OPERATE



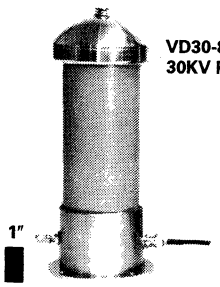
WEATHER PROOF WIDEBAND HIGH VOLTAGE DIVIDERS For Power Line Use

High accuracy 5KV RMS to 345KV RMS power class. 30KV PK to 900KV PK operate. 60KV to 1350KV basic impulse level. DC to 1MHz frequency response. For DC, AC and transient measurement and recording.

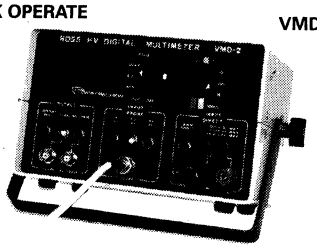
VD900-20-T-KB-E,
900KV PK OPERATE

HV DIGITAL MULTIMETERS

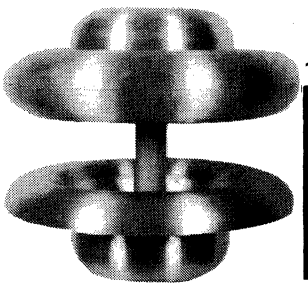
Easy to read, 4½-digit display; 0.1% and 0.01% accuracy. 0.0001 volt to 900KV. Battery/AC with charger. Recorder and scope outputs. DC, AC RMS average, AC RMS true, AC PK Ripple & Wide Band DC—1MHz.



VD30-8.3-A-LB-A,
30KV PK OPERATE



VMD2-FA

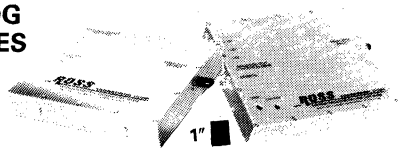


HIGH ACCURACY HV SHIELDED VOLTAGE DIVIDER 0.01% DC, 0.2%-3% AC

Special high accuracy, shielded, compensated resistance-capacitance voltage dividers up to 900KV wideband DC to 1MHz. Matched to 1 megohm, 50 PF or other load. Used for measurement of AC and DC, high frequency, line transients, and smalll differential pulse voltages.

VD150-10-CBD-KL-B,
150KV PK OPERATE

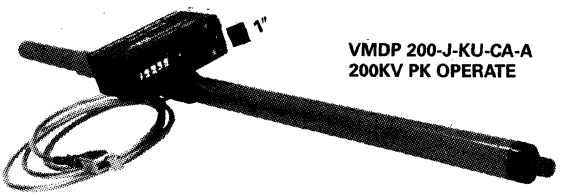
FIBER OPTIC TRANSMITTERS & RECEIVERS ANALOG DC-10MHz MODULES



Ross Engineering Corporation has developed basic wideband shock and vibration resistant analog fiber-optic transmitter and receiver modules. High accuracy output will drive DC-10MHz measurement control and recording instrumentation. Optional input impedances 1 megohm or 10 megohms. ±1V PK input with ±10V PK or +10V PK output. Also AC or 12V battery powered complete variable voltage range systems available. For high voltage they can operate with Ross Engineering Corporation's high accuracy high voltage wideband DC-10MHz Voltage Dividers up to 900KV PK.

HV DIGITAL PROBES

HV DC, AC, & Wideband DC-1HMz Safety Probes for any scope or digital display or VTVM. Also available complete with large 4½-digit display 0.1% to 5% AC/DC accuracy, safety handle digital voltmeter. Battery/AC with charger. Removable Digital Display or Multimeter. 0.0001 volt to 200KV.



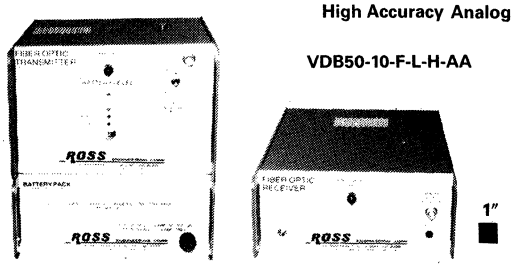
VMDP 200-J-KU-CA-A
200KV PK OPERATE

WIDE BAND FIBER OPTIC TRANSMISSION DC-10MHz

AC or rechargeable battery/AC operated. DC to 10MHz System has a maximum output of 10V PK (20V PK to PK) and maximum input of .1V to 1,000V PK direct from signal source. Useful from 0.01V and to over 900KV when used with Ross HV wide band dividers. Single or multiple ranges.

High Accuracy Analog Systems

VDB50-10-F-L-H-AA



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Schrack produces industrial and general purpose power relays, signal relays, miniature and PC relays. Printed circuit relays are manufactured under clean room conditions. As with all Schrack products, quality control is an integral part. Quality technicians are located at various production stages in every relay line. Computers provide in-line testing as well as 100% final testing. Schrack relays have most major world approvals including UL, CSA, VDE, Semko, Demko, Nemko. We maintain a modern warehouse in Ronkonkoma, New York and a nationwide network of representatives and distributors.

In addition to relays, Schrack designs and manufactures circuit breakers, street lighting controls, solenoids, power supplies, automotive controls and thick film hybrid components. Our systems group designs, manufactures and installs: telephone equipment and systems, digital radio links, fiber optic transmission equipment, security systems, fire alarm management systems, hospital communications management systems, hotel communication and fire alarm systems, broadcast studio systems, energy distribution systems and data systems.

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SCHRACK RELAYS
CROSS REFERENCE CHART

SCHRACK	CAD	RA	RM	RM 8	RP 010/110	RP 310	RP 410	RP 420	RS	RU B	RY	ZC	ZD	ZF	ZKU/ZLU	ZM
ALLIED	KN														T154	
AMERICAN ZETLER	AZ9	AZ1309	1200		AZ690		A2735	AZ730	AZ820	AZ3	AZ696		AZ2100	AZ4	AZ420	
AROMAT		HC	HP		JR			JR	DS				JT		K	HL
CLARE		GP1R	GP3R						LM						VP	
C-D	301	A104/A114	200							603				953		
DELTROL	200	280/290	203/206				404/410	406/407							250	
ELESTA	SKR	FR			SGR 362	SGR 662	SGR 462	SGR 282								
ESSEX RBM	93P		93Q							MS64						
FEME	RCP				FTA	MZH		MHP	XF							
FUJITSU	FRL 256	FRL 263	FRL 253			FBR 611		FBR 621	FBR 244					FBR 111		FRL 260
GRAINGER	5X822 - 827 3X740 - 742		5X834-842 1A486-488													
GRUNNER	REL 682	REL 104			175	275	281C & D	281 A & B								
GUARDIAN	1200/1410	1300	1510/15		1475/1655				1495	1345				1575	1155	1540/45
HASCO					MPR	MPR	MPR	MPR	HAS112				HAT901	LT1C		
IDEC	RR2/3	RY	RR1B		RG	VS		VB	RD	RE				RCN	RT	RH2
ITT						HZ1		HZ2	MTZ							
LINE	MK/MD	SJR/SRE	CRH											SR		
MAGNECRAFT	WX88	W78	W388	W389	W65			W76		W49					W67	78
MIDTEX	155	156/158	157	187		409			190					296		258
NEC									MR62					MR31		
OMRON	MK	MY	MJ		G2L	G2R	G2R	G2R	G2V		G6C		G8P	LC/G2U	MHS	LY
ORIGINAL		SRE				OMI			OMF					SRUDH		SRET
P & B	KRP/KAP	KHP/U	KUP	KUHP	RK	RK	RK	RK	T82			VKP (Europe)	T90	T70/T71	R10	K10
SIEMENS	V23100	V9000			V23027		V23056		V23102						V23054	
SIGMA	50	67	68	45						49				78	70	623/70R
SKY	SKK	SKM	SKAP										SKJB			
STRUTHERS – DUNN	A314	C281	A283					277						233		
TAKAMISAWA		MAT			VS			VB	RZ		JY			CS	24,25,26	MAT

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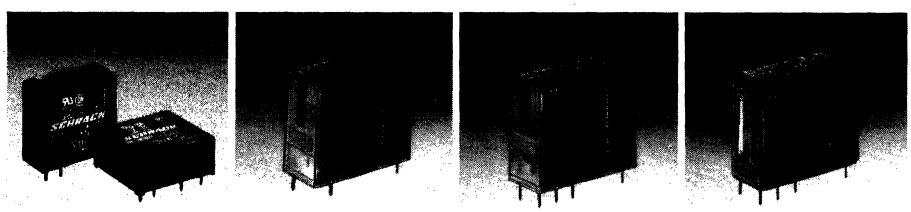

Relay Range

Type of Relay		PCB Relays RP 010, RP 110		PCB Relays RP 411/410	Heavy-duty PCB Relays RP 310	PCB Relays RP 420	
Dimensions	mm	28 × 11 × 24.7 (25.5)		29 × 12.6 × 25.5	29 × 12.6 × 25.5	29 × 12.6 × 25.5	
Detailed information: see Relay Manual page		10		14	18	22	
Contacts:							
Number (Configuration)		1 N.O. or 1 N.C. or 1 C		1 N.O. or 1 N.C. or 1 C	1 N.O. or 1 N.C. or 1 C	2 N.O. or 2 N.C. or 2 C	
Type of contact		single cont.	twin cont.	single cont.	single cont.	single cont.	twin cont.
Max. break voltage	VAC	440		440	440	440	
Rated current	A	10		10/12	16	10	3
Rated breaking capacity	VA	2000	500	2000/3000	4000	2000	250
Coil:							
Rated voltage	VDC VAC	3 . . . 110 –		3 . . . 110 24 . . . 240	3 . . . 110 24 . . . 240	3 . . . 110 24 . . . 240	
Rated power consumption	appr. W appr. VA	0.5 –		0.5 1.0	0.5 1.0	0.5 1.0	
General Data:							
Max. switching rate (mechanical)	ops/h	72000		72000	72000	72000	
Ambient temperature DC coil AC coil	°C °C	−40 . . . +70 –		−40 . . . +70 −40 . . . +60	−40 . . . +70 −40 . . . +60	−40 . . . +70 −40 . . . +60	
Vibration resistance (N.O. contact) (30 . . . 150 Hz)	g	14		10	10	11	
Dielectric strength coil-contact	VAC	4000		4000	4000	4000	
Insulation category/Voltage rating to VDE 0110		C 250 (B 250 solder-machine proof)		C 250	C 250	C 250	
Relay weight	appr. gr	13		18	18	17	
Packaging Unit Gross weight	pcs appr. gr	100 1400		100 1900	100 1900	100 1800	
Standard variation		Bistable (remanence type), immersion-proof		Bistable (remanence type), immersion-proof	Bistable (remanence type), immersion-proof	Bistable (remanence type), immersion-proof	

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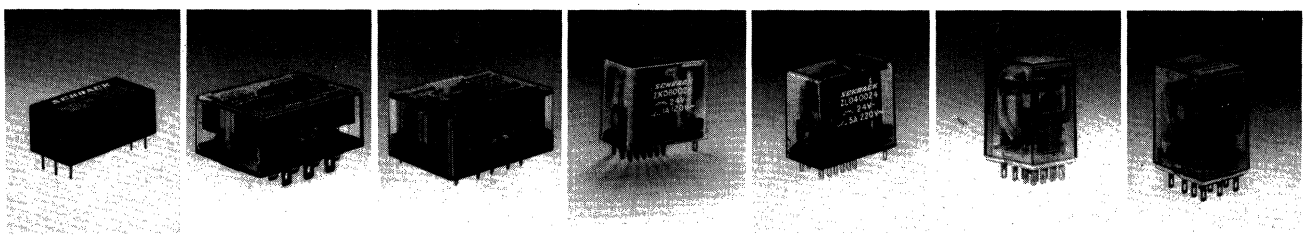

Reed Relays	Power Relays		Power Relays		Miniature Relays	Miniature Relays	Miniature Relays		Miniature Relays
RU 6	RX 02 RX 12	RX 04 RX 14	RX 21 RX 31	RX 23 RX 33	ZKU	ZLU	RA 2/4		RA 3
29.3 × 14.5 × 11	50.2 × 25.7 (36.9) × 22.1		50.3 × 26.8 (37.5) × 23.6		19 × 25 (35) × 30	19 × 30 (35) × 30	22 × 28.2 × 38.5		22 × 28.2 × 38.5
40	42		42		48	48	52		52
1 N.O., 2 N.O., 1 C, 2 C	2 C	4 C	2 N.O. + 2 N.C.	4 N.O. + 4 N.C.	2 C or 4 C or 6 C	2 C or 4 C	2 C	4 C	3 C
Reed contacts	twin cont.		twin cont.		single or twin cont.	single or twin cont.	single or twin cont.		single cont.
200	440		440		115	220	440		440
0.5/0.25	16	10	16	10	2	5	3		5
10/3	4000	2500	4000	2500	50	500	350		1250
3 . . . 24 –	3 . . . 48 –		3 . . . 60 –		6 . . . 110 –	6 . . . 110 –	6 . . . 220 6 . . . 240		6 . . . 220 6 . . . 240
0.12/0.18 –	0.3 (bistable 0.1/0.3) –		0.3 (bistable 0.1/0.3) –		1.2 –	1.2 –	0.9 1.65		0.9 1.65
1000/500	6000		6000		72000	72000	6000		6000
−40 . . . +85	−50 . . . +60 –		−50 . . . +60 –		−40 . . . +75 –	−40 . . . +75 –	−45 . . . +70 −45 . . . +60		−45 . . . +55 −45 . . . +45
	10 (10 . . . 60 Hz)		20 (10 . . . 60 Hz)				7		
2000	3000		3000		500	1000	2500	2000	2500
	B 125		C 250		B 125	B 250	B 125	B 60	C 250
7/10	51	65	50	62	29	29	36		36
50 400/550	20 1100	10 700	20 1080	10 670	120/100/80 2900/2500/2400	100/80 2500/2400	50 2100		50 2100
	PCB version		immersion-proof						

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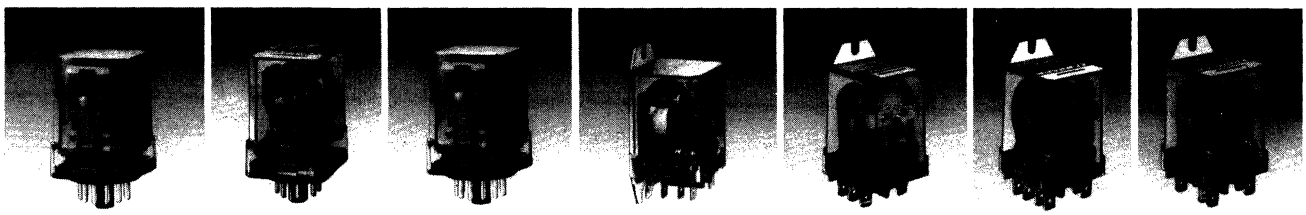

Relay Range

Plug-in Relays	Plug-in Relays	Plug-in Relays	Power Relays			Power Relays		Power Relays	Power Relays
CAD	CMD/CSD	CRD	RM 2	RM 3	RM 7	RM 5	RM 6	RM 8	RMC/RMD
35.5 × 35.5 × 52	35.5 × 35.5 × 52	35.5 × 35.5 × 52	38.5 × 35.5 × 48.5			38.5 × 35.5 × 48.5		38.5 × 35.5 × 48.5	38.5 × 35.5 × 48.5
58	58	58	64			64		64	64

1 C or 2 C or 3 C			1 C or 2C or 3C	2 C or 3 C		2 C	3 C	3 C	2 N.O.	3 N.O.	2 C	1N.O. or 1N.O. + 1N.C.
single cont.	twin cont.	single cont.	single cont.	single cont.	single cont.	single cont.			single cont.		single cont.	2 (4) single cont.
440			440	440	440	440	440	440	440		440	440
5	5	10	2	5	10	16	10	16	16	10	25	30
1250	500	2500	500	1250	2500	6000	3800	6000	6000	3800	6000	7200
single cont. = single contact twin cont. = twin contacts												

6 ... 220 6 ... 240	4.9 ... 100 5 ... 200	12 ... 110 24 ... 220	6 ... 220 6 ... 380			6 ... 220 6 ... 380		6 ... 220 6 ... 380	6 ... 220 6 ... 380
1.2 2.0	0.04 ... 0.3 0.2	2.6 5.3	1.2 2.0	1.2 2.8	1.6 2.8	1.6 2.8	1.2 2.8	1.2 2.8	1.2 2.8

6000	6000	6000		6000			6000		6000	6000
−45 ... +60 −45 ... +60	−45 ... +60 −45 ... +60	−45 ... +60 −45 ... +60	−45 ... +50 −45 ... +50	−45 ... +70 −45 ... +55	−45 ... +60 −45 ... +45	−45 ... +60 −45 ... +45	−45 ... +70 −45 ... +55	−45 ... +60 −45 ... +45	−45 ... +65 −45 ... +40	−45 ... +60 −45 ... +40
12		12		6			6		10	10
2500	2500	2500		2500			2500		2500	2500
C 250	C 250	C 250		C 380			C 380		C 250	C 250
80	80	80		81			81		81	83
25 2125	25 2025	25 2125		25/10 2100/1000			25/10 2100/1000		25/10 2100/1000	25/10 2100/1000
open-frame relays										

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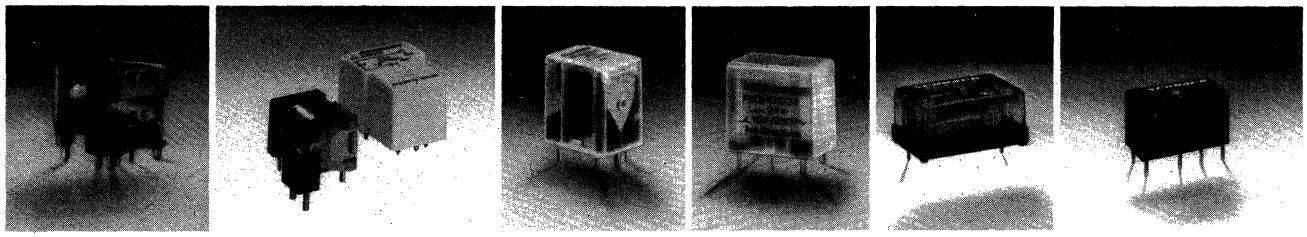

Heavy-duty PCB Relays	Heavy-duty PCB Relays	Heavy-duty PCB Relays	Heavy-duty PCB Relays	PCB Relays	Subminiature Relays		
ZC	ZD	ZF	RU.	RU 110	RS 1	RS 2	RS 3
24 × 19 × 18.5	32.5 × 27.5 × 20.5	21.2 × 16.2 × 23.5	32 × 20.5 × 30.8	30 × 19.5 × 13.3	20.2 × 9.9 × 12		
28	30	32	34	36	38		

1 N.O., 1 N.C.	1 C	1 N.O.	1 C	1 N.O.	1 N.C.	1 C or 1 N.O. or 1 N.C.		1 N.O.	1 C	1C,1N.O.	1 C	2 C			
single cont.			single cont.			single cont.		single cont.			single cont.	s. cont.	twin cont.	twin cont.	twin cont.
			440			440		440			440	125	125	125	125
12	N.C. 12, N.O. 20	40	5.20	10.30	5.15	10	5	15	N.C. 10, N.O. 15	10	6	1.25	1.25	1.25	1.25
720	N.C.720,N.O.1200	2400	1250 . . . 5000	2500 . . . 7500	1250 . . . 3750	1200	600	1800	2200	2200	1320	60	60	60	60
single cont. = single contact twin cont. = twin contacts															

3 . . . 48 –	5 . . . 110 –	3 . . . 48 –		3 . . . 110 6 . . . 220	5 . . . 110 –	5 . . . 48 –		
1.3 –	1.0 –	0.5 --	0.36 –	0.5 1.6	0.8 –	0.55 –	0.1 Remanence –	0.15 –

36000	36000	72000	144000	36000	72000	
−45 . . . +60/90 –	−55 . . . +80/105 –	−40 . . . +80 –	−45 . . . +70 −45 . . . +70	−40 . . . +55 –	−25 . . . +75 –	−25 . . . +85 –
					10	
750	2000	2000	1500	2000	1000	
A 125/B 60	C 250	C 250	B 250	B 250	Ao 125	
16	26	15	27	12	5	
100/500 1800/10000	100 2400	250/1000 3700/16000	100 3000	100 1700	25 200	
Buzzer	open-frame version dust-covered version immersion-proof	immersion-proof	sensitive type			

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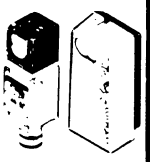
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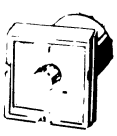
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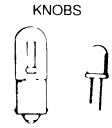
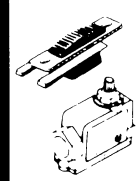
CIRCUIT BREAKERS FUSES & FUSEHOLDERS


KNOBS


LAMPS & LEDS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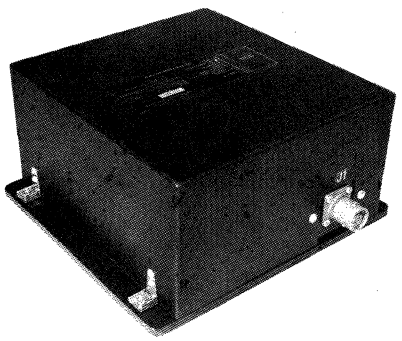
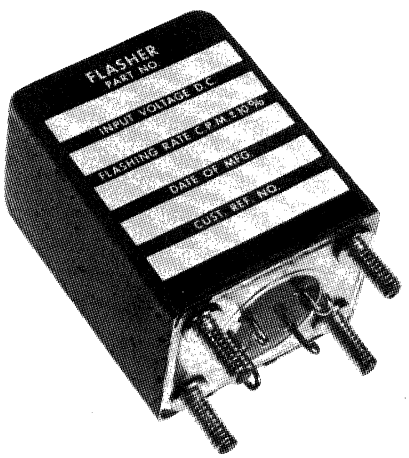
SCIENTIFIC TECHNOLOGIES INCORPORATED

ELECTRIC POWER MONITOR



SPECIFICATIONS
INPUT VOLTAGE: 115 VRMS line to neutral ± 5.8 VRMS, 400 Hz ± 20 Hz, 3 phases plus neutral, phase sequence A-B-C (pins 1, 2, 3 & 8)
NORMAL OUTPUT: 28 VDC ± 2.8V, 4.5 to 5.0 AMP max. (pin 5), voltage regulation and ripple: 10% and 1V peak-to-peak max.
ALARM OUTPUT: 28 VDC nominal, 1.8 to 2.0 AMP max. (pin 7)
RESET SWITCH: Customer will supply a momentary normally open switch to permit normal operation when the switch is activated providing none of the fault conditions exist and the input voltage is applied (switch across pins 6 & 4)
MATERIAL AND FINISH: Housing is aluminum with black anodized finish.
OPERATING TEMP. RANGE: 0°C to +85°C
DIELECTRIC STRENGTH: 1250V, 60 Hz between contacts and case and between isolated circuits
VIBRATION: 5 to 55 CPS with DA of .06 in along any axis.
SHOCK: 20G'S for 11 MS
FAULT CONDITIONS: The monitor will supply the alarm output when any of the following conditions exist:
OVER/UNDER VOLTAGE SENSOR; Voltage is above 126.5 VAC ± 1.5V or below 105.5 VAC ± 1.5V across any one or more of the phases with respect to neutral.
PHASE SENSOR: Improper phase sequence (C-B-A) or if any one phase is open with the remaining phases closed.
FREQUENCY SENSOR: Frequency is above 420 Hz +0 Hz/–5 Hz or below 380 Hz +5 Hz/–0 Hz
VOLTAGE DROP: Any one or more of the phases drop to 95 VAC, the voltage regulation and ripple will be 10% and 1 volt peak-to-peak max. Any one or more of the phases drop to 80 VAC, the voltage regulation and ripple will be 30% and 3 volt peak-to-peak max. Any one phase is open while these conditions exist, the voltage regulation and ripple will be 30% and 6 volt peak-to-peak max.

FLASHERS



FEATURES:
- High reliability
- Rugged
- Hermetically sealed
- Compact and lightweight
- Solid state and relay outputs
- Long life

SPECIFICATIONS
SOLID STATE FLASHER
INPUT VOLTAGE: 18 to 32 VDC
POWER CONSUMPTION: 3 Watts (Not Including Lamp Power).
FLASHER OUTPUT: 200 ma, 500 ma, 2 AMP, or 5 AMP Lamp or Relay Load.
OUTPUT POLARITY: Positive or Negative Types.
NOT DAMAGED BY REVERSE POLARITY.
FLASHING RATES: AS SPECIFIED.
ON:OFF RATIOS ARE: AS SPECIFIED
OPERATING TEMPERATURE RANGE: –55 C to +71 C.
OPERATING LIFE EXPECTANCY: 10,000 Hours Min.
SHOCK: 100 G's for 11 Milliseconds
VIBRATION: 10 G's at 10 to 500 CPS.
HERMETICALLY SEALED.
MOUNTING: Stud or Flange.
SOLDER HOOK TEMINALS.
WEIGHT: 4 Ounces Nominal.
VOLTAGE DROP: 1.5 Volts Maximum.

RELAY TYPE FLASHER
INPUT VOLTAGE: 18 to 32 VDC.
POWER CONSUMPTION: 4 watts (not including lamp power).
FLASHER OUTPUT: 500 ma, 2 AMP, 5 AMP, lamp or relay load.
CONTACTS ARE S.P.S.T. normally open.
NOT DAMAGED BY REVERSE POLARITY.
FLASHING RATES: AS SPECIFIED.
ON: OFF RATIOS ARE: AS SPECIFIED
OPERATING TEMPERATURE RANGE: –55 C to +71 C.
OPERATING LIFE EXPECTANCY: 500,000 cycles minimum at rated load.
SHOCK: 15 G's for 11 milliseconds.
VIBRATION: 10 G's at 10 to 500 CPS
UNIT: Hermetically sealed.
MOUNTING: Studs or flange.
SOLDER HOOK TERMINALS.
WEIGHT: 8 ounces nominal.

PHASE SEQUENCE INDICATORS



DESCRIPTION
A unique passive element circuit within the housing allows the indicator to illuminate only when the phase sequence of power being monitored is A-B-C. The phase sequence indicator will not illuminate when any one or more of the power inputs are opened or if the phase sequence is C-B-A.

The indicator will provide trouble-free instantaneous indication with no warm-up time required. The units are potted in an aluminum housing with no moving parts. Designed to meet severe environmental requirements of military applications.

SPECIFICATIONS
POWER CONSUMPTION: 2 watts
OPERATING TEMPERATURE: –55 to +125 C
WEIGHT: 2 ounces
MOUNTING: 5/8 inch dia. hole, panel thickness to 3/4 inch
LEADS: 18 inches long, teflon insulated
HOUSING MATERIAL: aluminum, black anodized
FREQUENCY AND VOLTAGE: per customer specifications
INDICATOR: lights up when all input leads are energized and phase sequence is A-B-C

CONTROL COMPONENTS DIVISION 31069 Genstar Road, Hayward, CA 94544 USA
Phone 415/471-9717 FAX: 415/471-9752

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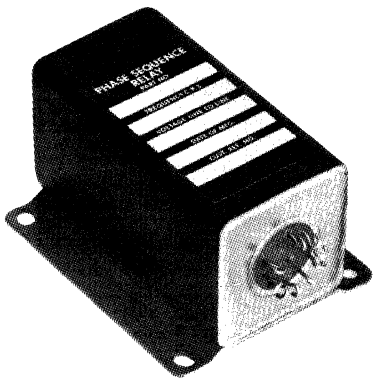
PHASE SEQUENCE RELAYS



FEATURES
- Designed for use in severe environmental conditions
- Automatic monitoring of phase sequence
- Solid state sensing circuit
- Hermetically sealed
- Light weight, small size
- Many voltages and frequency combination available

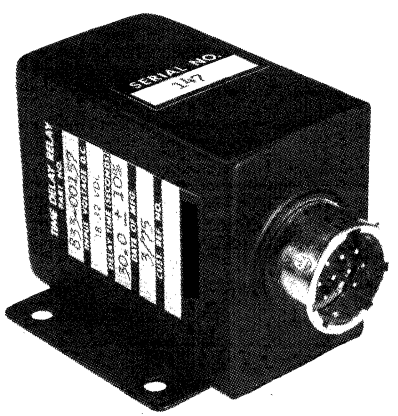
SPECIFICATIONS
Relay picks up when all input terminals are energized and phase sequence is A-B-C.
Relay drops out if one or more power leads are grounded, opened or if the phase sequence is C-B-A.
POWER CONSUMPTION: 10 watts maximum.
OPERATING TEMPERATURE: –55 C + 71 C
CONTACT RATINGS: (Per MIL-C-5757)

28 VDC	Resistive (Form C)	Inductive
2 AMP	2.0 AMPS	1.0 AMPS
3 AMP	3.0 AMPS	1.0 AMPS
10 AMP	10.0 AMPS	5.0 AMPS

115 VAC	Resistive (Form A&B)	Resistive (Form C)
2 AMP	2.0 AMPS	0.2 AMPS
3 AMP	3.0 AMPS	0.2 AMPS
10 AMP	10.0 AMPS	2.0 AMPS

VIBRATION: 10 G's to 500 Hz.
SHOCK: 30 G's for 11 milliseconds stud mount.
100 G's for 11 milliseconds flange mount.
SEAL: Hermetically sealed.
CONTACT RESISTANCE: .08 ohm maximum.
INSULATION RESISTANCE: 100 megohms minimum between terminals and case, between open contacts.
DIELECTRIC STRENGTH: 1000 Vrms 60 Hz, between terminals and **CASE;** 500 Vrms 60 Hz, between open contacts.
LIFE: 100,000 operations minimum.
WEIGHT: 11 ounces maximum.
Relays per MIL-R-5757.
Environmental testing per MIL-E-5272.
Test methods per MIL-STD-202.
Marking per MIL-STD-130.

TIME DELAY RELAYS



FEATURES
- Solid state sensing circuit
- Transient protected
- 2 amp, 3 amp, and 10 amp relay contacts, dpdt.
- Hermetically sealed.
- Light weight (3.5 to 9 oz).
- Choice of 3 operating modes.
- Designed for use in severe environmental conditions.

SPECIFICATIONS
INPUT VOLTAGE: 18 to 32 vdc
POWER REQUIREMENTS AT 28 VDC: 5 watts max, 2 amp relays
6.5 watts max, 10 amp relays
TEMPERATURE RANGE: –65 F to + 185 F
VIBRATION: 20 G's, 10 to 2000 Hz
SHOCK: 100 G's for 11 milliseconds
CONTACTS: DPDT
LIFE: 100,000 cycles minimum at rated load
DROP-OUT TIME: 10 milliseconds max.
DROP-OUT VOLTAGE: 1 volt min.
PULL-IN VOLTAGE: 18 volts max.
INSULATION RESISTANCE: 100 megohms min.
DIELECTRIC STRENGTH: 500 volts 60 Hz case to terminals and across open contacts
CONTACT RATING:
2 amp & 3 amp unit: 2 amp & 3 amp resistive at 32 vdc
1 amp inductive at 32 vdc
10 amp unit: 10 amp resistive at 28 vdc or 115 vac
5 amp inductive at 28 vdc or 115 vac
CONTACT RESISTANCE: 0.050 ohms at rated current
RESET-TIME: 0.050 sec. max.
TRANSIENT PROTECTION: Will not be damaged by transients per Mil-Std-704
INTERNAL RELAYS: Per MIL-R-5757

CONTROL COMPONENTS DIVISION 31069 Genstar Road, Hayward, CA 94544 USA
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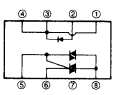
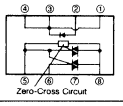
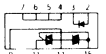
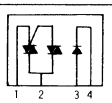
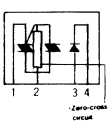
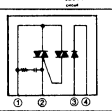
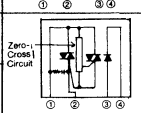
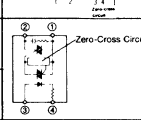
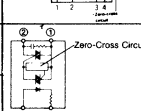
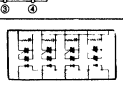
Magnecraft ELECTRIC COMPANY

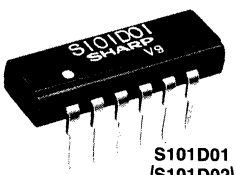
SHARP Optoelectronics

Solid State Relays

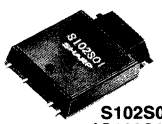
Sharp has a wide product line-up, such as multi-channel types suited for high density mounting, DIP type, SIP type, and TO-220 package type as solid state relays for medium power control of on-state current ranging from 0.6 to 16A.

Model No.	Internal connection diagram	Features	Zero cross circuit	Package	Approved by overseas safety standard		Absolute maximum ratings			Electrical characteristics		
							On-state current I_T	Repetitive peak off-state voltage V_{DRM}	Isolation voltage (AC) Viso	Minimum trigger current		
					UL	CSA	(Arms)	(V)	(Vrms)	I_{FT} (mA) MAX.	V_D (V)	R_L (Ω)
S16MD01		compact, high current output type		DIP 8-pin	○	△	1.7	400	4,000	10	6	100
S26MD01		compact, high current output type		DIP 8-pin	○	△	1.7	600	4,000	10	6	100
S16MD02		compact, high current output type	X	DIP 8-pin	○	△	1.7	400	4,000	10	6	100
S26MD02		compact, high current output type	X	DIP 8-pin	○	△	1.7	600	4,000	10	6	100
S101D01		low-priced		DIP 16-pin	○	△	1.2	400	5,000	10	6	—
S201D01		low-priced		DIP 16-pin	○	△	1.2	400	5,000	10	6	—
S101D02		low-priced	X	DIP 16-pin	○	△	1.2	600	5,000	10	6	—
S201D02		low-priced	X	DIP 16-pin	○	△	1.2	600	5,000	10	6	—
S101S01		compact low-priced, high rush current resistant type		SIP 4-pin	○	○	1,5	400	4,000	15	6	30
S201S01		compact low-priced, high rush current resistant type		SIP 4-pin			1,5	600	4,000	15	6	30
S101S02		compact low-priced, high rush current resistant type (built-in zero-cross circuit)	X	SIP 4-pin	○	○	1,5	400	4,000	15	6	30
S201S02		compact low-priced, high rush current resistant type (built-in zero-cross circuit)	X	SIP 4-pin			1,5	600	4,000	15	6	30
S102S03		compact low cost type		SIP 4-pin	○	○	8	400	4000	5	12	30
S202S03		compact low cost type		SIP 4-pin	○	○	8	600	4000	5	12	30
S102S02		compact, low cost type	X	SIP 4-pin	○	○	8	400	4,000	8	6	30
S202S03		compact, low cost type	X	SIP 4-pin	○	○	8	600	4,000	5	6	30
S102S11		compact low cost type with snubber circuit		SIP 4-pin	○	○	8	400	4,000	8	12	30
S202S11		compact low cost type with snubber circuit		SIP 4-pin	○	○	8	600	4,000	8	12	30
S102S12		compact low cost type with snubber circuit	X	SIP 4-pin	○	○	8	400	4,000	8	6	30
S202S12		compact low cost type with snubber circuit	X	SIP 4-pin	○	○	8	600	4,000	8	6	30
S112S01		compact, low-cost		SIP 4-pin	○	○	12	400	4,000	8	12	30
S212S01		compact, low-cost		SIP 4-pin			12	600	4,000	8	12	30
S112S02		compact, low-cost	X	SIP 4-pin	○	○	12	400	4,000	8	6	30
S212S02		compact, low-cost	X	SIP 4-pin			12	600	4,000	8	6	30
S112P11		Compact	X	Resin mold type with radiation fin (I_{ch})	○	○	12	400	2,500	—	—	—
S212P11		Compact	X	Resin mold type with radiation fin (I_{ch})	○	○	12	600	4,000	—	—	—
S116S01		compact, low cost		SIP 4-pin	○	○	16	400	4,000	8	12	30
S216S01		compact, low cost		SIP 4-pin			16	600	4,000	8	12	30
S116S02		compact, low cost	X	DIP 4-pin	○	○	16	400	4,000	8	6	30
S216S02		compact, low cost	X	DIP 4-pin			16	600	4,000	8	6	30
S116P11		compact	X	Resin mold type with radiation fin (I_{ch})	○	○	16	400	2,500	—	—	—
S216P11		compact	X	Resin mold type with radiation fin (I_{ch})	○	○	16	400	4,000	—	—	—
S116P41		4-output (built-in snubber circuit)		Resin mold type with radiation fin (4-ch)			16,5 3,3	400	1,500	10	6	30
S216P41		4-output (built-in snubber circuit)					16,3 3,3	600	4,000	15	6	30

*1 Tc≤95°C *2 Lead forming type is also available. ○ Approved △ Under preparation



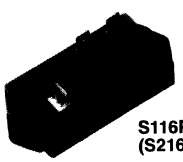
S101D01
(S101D02, S201D01, S201D02)



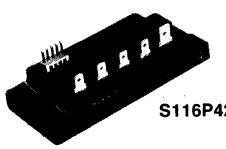
S102S03
(S102S02, S112S01~2, S116S01~2)



S102DS2
(S202DS2, S202DS4)



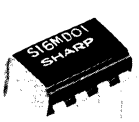
S116P21
(S216P21)



S116P42



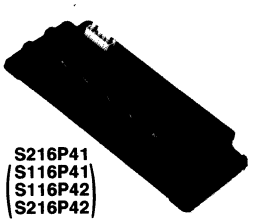
S101S01
(S101S02~4, S201S01~4)



S16MD01
(S16MD02, S26MD01~2)



S112P11
(S116P11, S212P11, S216P11)



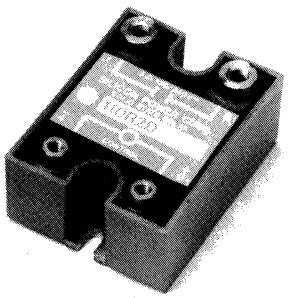
S216P41
(S116P41, S116P42, S216P42)

SHARP ELECTRONICS CORP., Micro Electronics Group, 5700 N.W. Pacific Rim Blvd., Camas, WA 98607 • 206-834-2500 • Fax 206-834-8903 • Telex 496-08472 (SHARP CAM)

SILICON POWER CUBE

SOLID STATE AC POWER RELAYS

UL Recognized/CSA Certified



FEATURES:

- SPC's Inverse-Parallel SCR Power Hybrid Technology provides highly efficient thermal management for greatly increased cyclic life.
- High performance/low cost circuit design.
- Logic compatible inputs.
- "Zero voltage", and phase controllable "random switching" versions.
- High voltage (1200 Vpk) versions for 480 V_{RMS} service.
- Industry standard "hockey puck" package.
- 4000 V_{RMS} optical isolation.

	Model Number	Output Current Rating Amps (RMS)	Output Voltage Rating VRMS	Output Voltage Rating PRV	AC Switching Mode (Input)
SCR OUTPUT	480D10SP	10	180-530	1200	Zero Voltage (4-32 VDC Input)
	480D25SP	25			
	480D45SP	50			
	480D80SP	80			
	480D110SP	110			
	480A10SP	10	180-530	1200	Zero Voltage (90-140 VAC Input)
	480A25SP	25			
	480A45SP	50			
	480A80SP	80			
	480A110SP	110			
	240D10SP	10	24-280	600	Zero Voltage (3-32 VDC Input)
	240D25SP	25			
	240D45SP	50			
	240D80SP	80			
	240D110SP	110			
	240D10-10SP	10	24-280	600	Random (Phase Controllable) (3.5-26 VDC Input)
	240D25-10SP	25			
	240D45-10SP	50			
	240D80-10SP	80			
	240D110-10SP	110			
	240A10SP	10	24-280	600	Zero Voltage (90-280 VAC Input)
	240A25SP	25			
	240A45SP	50			
	240A80SP	80			
	240A110SP	110			
	120D10SP	10	24-140	400	Zero Voltage (3-32 VDC Input)
	120D25SP	25			
	120D45SP	50			
	120D80SP	80			
	120D110SP	110			
	120A10SP	10	24-140	400	Zero Voltage (90-280 VAC Input)
	120A25SP	25			
	120A45SP	50			
	120A80SP	80			
	120A110SP	110			
	120D10-10SP	10	24-140	400	Random (Phase Controllable) (3.5-26 VDC Input)
	120D25-10SP	25			
	120D45-10SP	50			
	120D80-10SP	80			
	120D110-10SP	110			
TRIAC OUTPUT	MR240D10	10	24-280	600	Zero Voltage (3-32 VDC Input)
	MR240D25	25			
	MR240A10	10			Zero Voltage (90-280 VAC Input)
	MR240A25	25			
	MR120D10	10	24-140	400	Zero Voltage (3-32 VDC Input)
	MR120D25	25			
	MR120A10	10			Zero Voltage (90-280 VAC Input)
	MR120A25	25			

SILICON POWER CUBE CORP.

6015 OBISPO AVE. / LONG BEACH, CA 90805 / TEL: 213-634-9390 / FAX: 213-630-5338

SILICON POWER CUBE

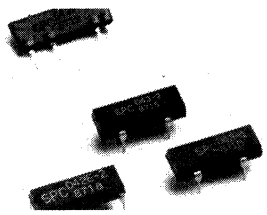
SPECIAL PURPOSE SOLID STATE AC POWER RELAYS

	Model Number	Output Current Rating Amps (RMS)	Output Voltage Rating VRMS	PRV	Type	AC Switching Mode
SPECIAL PURPOSE RELAYS	25DR1D	25	24-280	600	Dual SSR	Zero Voltage
	40DR1D	40				
	25DR2D	25				Random
	40DR2D	40				
	20QR1D	20	24-280	600	Quad SSR	Zero Voltage
	20QR2D					Random

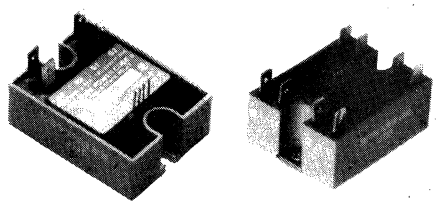
BOARD LEVEL SOLID STATE RELAYS

TO-116 DIP and 4-pin SIP packages employing thick film hybrid circuitry. Includes AC and DC switching versions from signal level to 1 amp output, with switching speeds as low as 1 µsec.

Three industry standard encapsulated PCB mount packages with AC output current ratings of 2.5 to 4 amps. Featuring 4000 Vrms optical isolation, logic compatible 3-32 Vdc input range, and either zero crossing or random phase controllable turn-on.



BOARD LEVEL RELAYS

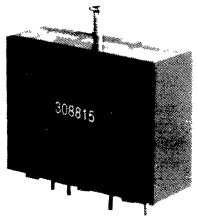


SPECIAL PURPOSE RELAYS

Part Number	Input Specifications Voltage (VDC)	Input Specifications Current (mA at 5V)	Output/Load Ratings (max.) Current	Output/Load Ratings (max.) Voltage	Output/Load Ratings (max.) AC/DC
D42E-2*	3.5–15	8	1A	280VRMS	AC
D42E-11*	N/A	5**	1A	280VRMS	AC
S42V-2*	3.5–15	8	1A	280VRMS	AC
S42V-11*	N/A	5**	1A	280VRMS	AC
S322 SP	3.5–8.0	22	2.5A	280VRMS	AC
MP240D3SP	3–32	1	3A	280VRMS	AC
MP240D4SP	3–32	1	4A	280VRMS	AC

* Add "H" suffix to P/N for 600V pk output voltage rating.
** Guaranteed turn-on at 5mA dc. No internal current limiting or regulation.
*** Part numbers shown are zero switching versions. Add suffix N for random turn-on.

IAC/IDC/OAC/ODC SERIES

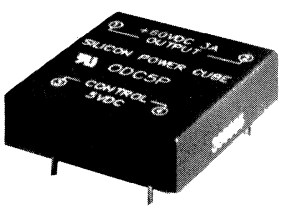


FEATURES

- Color-coded by Function
- 4000 Vrms Optical Isolation
- Industry Standard Package and Pin-out
- High Transient Noise Immunity
- Series Operation Compatibility
- UL Recognized, CSA Certified, SEV Approved Types Available

Industrial environments can subject sensitive microelectronic circuits to undesirable stresses in the form of voltage transients,electrical noise, shock, vibration, etc. These can result in permanent damage, spurious operations or false indications. SPC's I/O modules are designed to provide an electrically clean, photo-isolated, noise-free "output" interface from logic level control systems to external loads such as motors, valves, solenoids, etc., or, and "input" interface from the load or sensors to microprocessor or computer-based logic level systems. Used with SPC's I/O mounting boards, these solid-state modules exhibit long, reliable life in industrial environments.

IACP/IDCP/OACP/ODCP SERIES

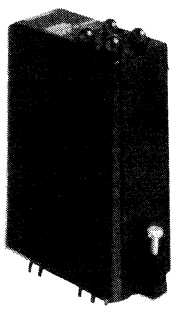


FEATURES

- Low Profile Permits 0.50 inch (12.70mm) PC Board Spacing
- Industry Standard Footprint
- Color-Coded by Function
- 4,000 Vrms Optical Isolation
- High Transient Noise Immunity
- Series Operation Compatibility
- UL Recognized, CSA Certified

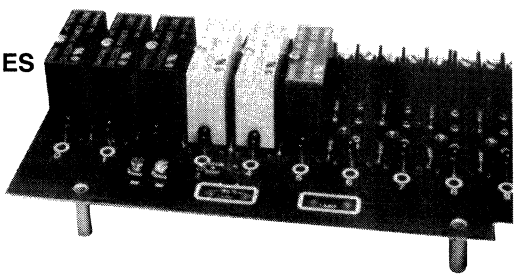
These flat pack modules offer reliable input-output interfacing in a low profile package outline that permits PC board spacing on half-inch centers.

IACQ/IDCQ/OACQ/ODCQ SERIES



Each quad module has four I/O channels of the same type. They provide a high packaging density means of reliably interfacing logic level control systems with external loads such as motors, valves, solenoids, etc., or as an interface from the load or sensors to microprocessor or computer-based logic level control systems.

PB SERIES



These mounting boards will accept input/output modules in any combination of input or output types of the same style (single or quad channel). Modules can be easily and quickly inserted, without disturbing field wiring. the single channel models provide an LED status indicator, plug-in 5 amp fuse and 3.3 Kohm pull-up resistor for each module.

SILICON POWER CUBE CORP.

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STANCOR

AC Relays

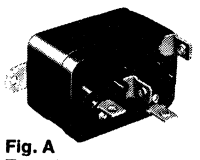


Fig. A
Type 84

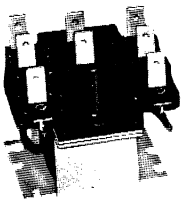


Fig. B. Type 91

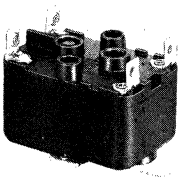


Fig. C. Type 184

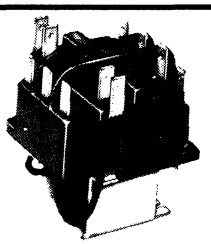


Fig. D. Type 192



Fig. E
Type 129

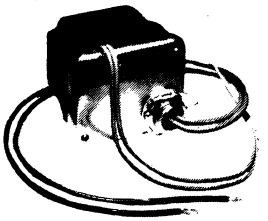


Fig. F. Type 129AR Add-A-Relay

AC GENERAL PURPOSE RELAYS

Operate in any position. Coils are for 60 Hz operation. Ratings listed are continuous unless noted otherwise. **Breakdown Voltage:** 1500 V rms, 60 Hz, opposite polarity or to ground: 1000 V rms, 60 Hz, open contacts same polarity. **Electrical Life:** 100,000 operations at rated load.

Fig. A. Type 84—Totally enclosed type with silver alloy contacts rated at 125-250 VAC. Models 84-922-928 rated 3 amps at 125 VAC or 1.5 amps at 250 VAC pilot duty. All others: SPNO—16 amps, resistive; 8 amps (25 amps inrush) inductive. SPDT—8 amps resistive; 8 amps (18 amps inrush) inductive. Models 84-901-908 have screw terminals; models 84-912-928 have 1/4" tab terminals. **Size:** 2 3/8" x 1 5/8" x 1 1/2" overall. Mounting hardware included in boxed quantity only.

Part No.	Contacts	Coil V (50 60 Hz)
84-901	SPNO	6
84-902	SPNO	24
84-903	SPNO	120
84-904	SPNO	208/240
84-905	SPDT	24
84-907	SPDT	120
84-908	SPDT	208/240
84-912	SPNO	24
84-913	SPNO	120
84-914	SPNO	208/240
84-916	SPDT	24
84-917	SPDT	120
84-918	SPDT	208/240
84-922	SPNO	24
84-923	SPNO	120
84-926	SPDT	24
84-927	SPDT	120
84-928	SPDT	208/240

Fig. B. Type 91—Solenoid action type with quick-connect terminals; operates in any position. DPDT contact arrangement. **Power Rating (A):** Enclosed fine silver contacts rated 15 amps, 277 VAC. max., resistive: 12 amps (60 amps inrush), 125 VAC or 6 amps (35 amps inrush), 250 VAC, inductive. **Pilot Rating (B):** Gold alloy crossbar contacts rated 3 amps, 277 VAC. max., resistive; 125 VA, 1/10 hp, 125/250 VAC, inductive.
Size: 2 1/8" x 1 7/8" x 2 3/8". Quick-connect wiring terminals included in boxed quantity only.

Part No.	Coil V ±	Circuit Rating #1*	Circuit Rating #2†
91-901	24	A	A
91-902	120	A	A
91-903	240§	A	A
91-905	120	A	B
91-906	240§	A	B
91-907	24	B	B

*Three terminals at the mounting hole side. † Three terminals at the coil terminal side. ‡50/60 Hz, §208/240 volts. #A, power rating; B, pilot rating.

Fig. C. Type 184—Totally enclosed type with mounting bracket; operates in any position. Models 184-902–918 rated 18 amps resistive at 277 VAC; 12 amps (60 amps inrush) inductive at 125 VAC; 8 amps (48 amps inrush) inductive at 250 VAC; 7 amps (42 amps inrush) inductive at 277 VAC. Models 184-922–928 rated 3 amps at 277 VAC; 125 VA at 125 VAC; 277 VA at 277 VAC. Models 184-902–907 have screw terminals; others have 1/4" quick-connect terminals. **Size:** 2 3/8" x 1 17/64" x 1 1/2".

Part No.	Contacts	Coil V (50/60 Hz)
184-902	SPNO	24
184-903	SPNO	120
184-906	SPDT	24
184-912	SPNO	24
184-914	SPNO	208/240
184-916	SPDT	24
184-922	SPNO	24

Fig. D. Type 192—Solenoid action type with quick-connect terminals; operates in any position. 3PDT contact arrangement. **Power Rating (A):** Fine silver enclosed contacts rated 15 amps, 277 VAC max., resistive; 12 amps (60 amps inrush), 125 VAC or 6 amps (35 amps inrush) 250 VAC, inductive. Models 192D-912, -913 rated 10 amps at 32 V max. **Size:** 2 3/8" x 2 3/8" x 2 3/4". Quick-connect wiring terminals included in boxed quantity only.

Part No.	Coil V†	Circuit Rating #1	Circuit Rating #2	Circuit Rating #3
192-901	24	A	A	A
192-902	120	A	A	A
192-903	240*	A	A	A
192D-912	12	.....	.....	.....
192D-913	24	.....	.....	.....

*208/240 volts. †50/60 Hz. #A power rating.

AC POWER RELAYS

Fig. E. Type 129—Totally enclosed; silver alloy contacts rated 18 amps resistive or 18 amps inductive at 250 VAC max., 1 hp at 125 V or 2 hp at 250 V. **Size:** 2 3/8" x 1 7/8" x 1 7/8" overall.

Part No.	Contacts	V Coil V‡
129-902	SPNO	24
129-903	SPNO	120
129-904	SPNO	208*
129-906†	SPDT	24
129-907†	SPDT	120
129-908†	SPDT	208*
129-911§	SPNO	24
129-912§	SPNO	120

*208/230 volts. †All contact terminals must be wired to same polarity. ‡50/60 Hz. §Quick-connect. 1/4" tab terminals.

Fig. F. Type 129AR Add-A-Relay—Same as Type 129 except has aluminum diecast base and bushing; rated 1 hp at 120 V. 1 1/2 hp at 250 V. High impact phenolic enclosure; 8" color-coded leads. **Size:** 2 3/4" x 2 9/16" x 3 1/16". Mounts in 1 1/2" dia. knock-out. Mounting hardware supplied. Meets standard code requirements. UL white card Listed.

Part No.	Contacts	V Coil V‡
129AR-901	SPNO	24
129AR-902	SPNO	120
129AR-905†	SPDT	120

†All contact terminals must be wired to same polarity. ‡50/60 Hz.

TYPE 91 QUICK CONNECT SOCKET

Polarized to prevent improper assembly.
Part No. 91-180-1—Net Each. Lots of 1-9 ..... $2.68
10-24 ..... $2.22; 25-49 ..... 1.97; 50-99 ..... $1.86

DC GENERAL PURPOSE RELAYS

Same as Types 84, 91 and 192 AC General Purpose Relays except for DC operation. See illustrations and specifications under AC General Purpose Relays.

Part No.	Coil VDC	Coil Resis. Ohms†	Contact Rating VDC	Contact Rating Amps	Contacts
84D-902	12	90.0	12	3	SPDT
84D-903	24	208.0	24	1.5	SPDT
91D-912	12	29.0	32	10	DPDT
91D-913	24	115.0	32	10	DPDT

*Inductive. †At 25°C. ‡Resistive rating.

STANCOR

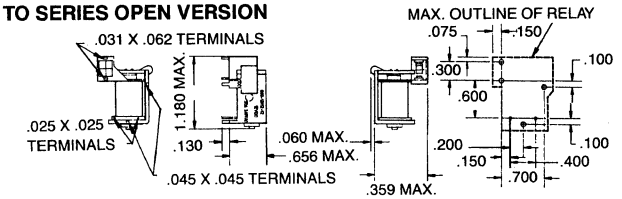
AC Relays

P.C. BOARD POWER RELAY

Switch loads up to 30 amps. Designed primarily for the appliance industry and heating, ventilating and air conditioning markets. Printed circuit board terminals. Operation temperature range: – 55 to + 85 C UL recognized, CSA certified. Direct placement for P & B T90 series, Omron G & P series, American Zetter AZ series, Aromat JT series, and White-Rogers 690 series.

Part Number	Coil V. DC	Ohms	Pole Form	Construction
TD-9005A	5	27	SPNO	Dust Cover
TD-9005B	5	27	SPNC	Dust Cover
TD-9005C	5	27	SPDT	Dust Cover
TD-9012A	12	155	SPNO	Dust Cover
TD-9012B	12	155	SPNC	Dust Cover
TD-9012C	12	155	SPDT	Dust Cover
TD-9024A	24	660	SPNO	Dust Cover
TD-9024B	24	660	SPNC	Dust Cover
TD-9024C	24	660	SPDT	Dust Cover
TO-9005A	5	27	SPNO	Open
TO-9005B	5	27	SPNC	Open
TO-9005C	5	27	SPDT	Open
TO-9012A	12	155	SPNO	Open
TO-9012B	12	155	SPNC	Open
TO-9012C	12	155	SPDT	Open
TO-9024A	24	660	SPNO	Open
TO-9024B	24	660	SPNC	Open
TO-9024C	24	660	SPDT	Open
TS-9005A	5	27	SPNO	Sealed
TS-9005B	5	27	SPNC	Sealed
TS-9005C	5	27	SPDT	Sealed
TS-9012A	12	155	SPNO	Sealed
TS-9012B	12	155	SPNC	Sealed
TS-9012C	12	155	SPDT	Sealed
TS-9024A	24	660	SPNO	Sealed
TS-9024B	24	660	SPNC	Sealed
TS-9024C	24	660	SPDT	Sealed

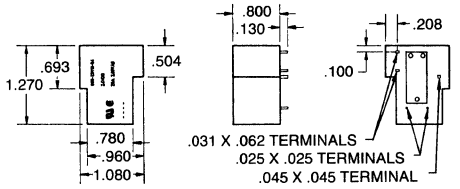
TO SERIES OPEN VERSION



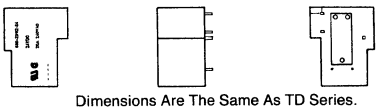
RECOMMENDED PC BOARD LAYOUT

All Terminal Dimensions Nominal

TD SERIES WITH DUST COVER



TS SERIES SEALED VERSION



Dimensions Are The Same As TD Series.

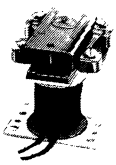


Fig. B

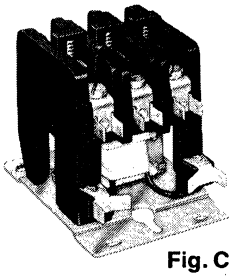


Fig. C

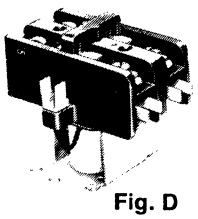


Fig. D

AC POWER CONTRACTORS

Fig. B. Type 75—DPNO: screw power terminals, #8 solid wire max. Quick connect or 13″ lead coil termination. Protective contact cover. Hardware included.
Size: 2 1/2″ × 2 1/8″ × 2 1/4″ overall.

Fig. C. Type 154—3PNO (40 amps type also with DPNO). 20 and 25 amps, screw connectors line and load side for #14 through #8 wire; 1/4″ double quick connect auxiliary and coil terminals. 30 and 40 amps, pressure connectors on line side for #14 through #4 wire: screw connectors on load side (pressure connectors for 40 amps): 1/4″ double quick connect auxiliary and coil terminals. Non-positional type 154 power contractors come with interchangeable mounting: low coil wattage and non-corroding structure. Type 154 has low temperature rise: riveted terminal assemblies. Hardware included in boxed quantity only. **Size:** 3 3/4″ × 3 1/8″ (3 1/4″ for 40 amps) × 2 3/4″ overall.

Fig. D. Type 143—DPNO: screw power terminals #10 solid wire max. Auxiliary quick-connect terminals: straight-thru wiring: double break contacts. Hardware included in boxed quantity only. **Size:** 3 1/4″ × 2 3/8″ × 2 1/2″.

AC Power Contractors

Contact amp ratings listed are continuous unless noted otherwise.

Type	Contact Rating (AC), Inductive
75	1 hp/pole, 115/230 V; 2 pole, 2 hp, 230 V or 18 amps cont. (90 amps inrush): 25 amps, 240 V, pole resistive.

Part No.	Contacts	Coil Volts
75-901	DPNO	24
75-902	DPNO	115 120
75-903	DPNO	208 240
75-904	DPNO	24″
75-905	DPNO	115 120
75-906	DPNO	208 240
154	Type 154-901 to 154-903, 20 amps (80 amps inrush), 600 V; 120 amps inrush, 277 V; 100 amps inrush, 480 V; 30 amps, 600 VAC resistive. Type 154-904 to 154-906, 25 amps (100 amps inrush), 600 V; 150 amps inrush, 277 V; 125 amps inrush, 480 V; 35 amps. 600 VAC resistive. Type 154-907 to 154-909, 30 amps (120 amps inrush), 600 V; 180 amps inrush, 277 V; 150 amps inrush 480 V; 40 amps, 600 VAC resistive. Type 154-910 to 154-915, 40 amps (160 amps inrush), 600 V; 240 amps, inrush, 277 V; 200 amps inrush, 480 V; 50 amps, 600 VAC resistive.	

Part No.	Contacts	Coil Volts
143-902	2PNO	120
143-903	2PNO	208/240
143-906	DPNO	24
143-907	DPNO	120
143-914	2PNO	24
143-915	2PNO	12
143-916	2PNO	208/240

*Quick-connect tab terminals; 75-901 to 75-903. 13″ leads.

STANCOR

AC-DC Relays

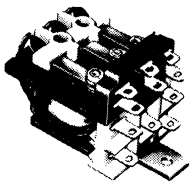


FIG. A

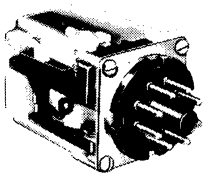


FIG. B

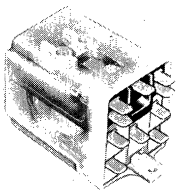


FIG. C

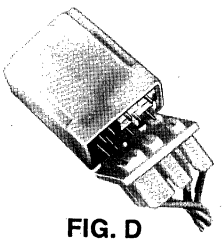


FIG. D

AC-DC GENERAL PURPOSE RELAYS

Contact Rating: Button: Fine silver contacts rated 1/6 hp. inductive. 10 amps, resistive at 120 VAC: 1/3 hp. inductive. 5 amps resistive at 240 VAC. Crossbar: Gold alloy contacts rated 1/10 hp. inductive. 5 amps, resistive at 120 VAC: 1/8 hp. inductive. 3 amps, resistive at 240 VAC. Both types rated 5 amps resistive at 28 VDC. **Breakdown Voltage:** 1500 V rms, 60 Hz. opposite polarity or to ground: 1500 V rms. 60 Hz, open contacts with same polarity. **Coil Rating:** 1.5 watts DC: 3.0 watts nominal AC (4 watts maximum, 4.5 watts inrush). **Pick-Up:** 75% DC, 85% AC. **Maximum Temperature:** 160°F ambient. **Electrical Life:** 100,000 operations at rated load. **Mechanical Life:** 10 million operations, no load (60 per minute).

OPEN TYPE SOLDER TERMINALS (FIG. A)

Designed for front mounting. Suitable also for single-hole screw or stud rear mounting. All terminals out front. One-piece molded bobbin and terminal board construction. Highly resistant to arc tracking. **Size:** 1 15/16" x 1 5/16" x 1 5/16".

WITH 10-AMP BUTTON CONTACTS

Part No.	Coil Voltages (50/60 Hz)	Contacts
93-905	24 VAC	DPDT
93-909	120 VAC	3PDT
93-911	208/240 VAC	DPDT
93-912	208/240 VAC	3PDT

ENCLOSED TYPE PLUG-IN TERMINALS (FIG. B)

With 8-pin octal base for SPDT and DPDT poles; 11-pin base for 3PDT poles. **Size:** 2 1/8" x 1 7/16" x 1 9/16".

WITH 10-AMP BUTTON CONTACTS

Part No.	Coil Voltages (50/60 Hz)	Contacts
93P-908	120 VAC	DPDT
93P-909	120 VAC	3PDT
93P-911	208/240 VAC	DPDT
93P-917	12 VDC	DPDT
93P-918	12 VDC	3PDT
93P-920	24 VDC	DPDT

WITH 5-AMP CROSSBAR CONTACTS

Part No.	Coil Voltages (50/60 Hz)	Contacts
93P-938	120 VAC	DPDT
93P-950	24 VDC	DPDT

ENCLOSED TYPE QUICK-CONNECT TERMINALS (FIG. C)

Enclosed relay designed for front mounting, or polarized mounting in Type 93-185-1 socket (listed on previous page). Quick-connect .20" x .187" terminals. Hi-impact case. **Size:** 2 1/8" x 1 7/16" x 1 9/16".

WITH 10-AMP BUTTON CONTACTS

Part No.	Coil Voltages (50/60 Hz)	Contacts
93Q-904	24 VAC	SPDT
93Q-905	24 VAC	DPDT
93Q-906	24 VAC	3PDT
93Q-907	120 VAC	SPDT
93Q-908	120 VAC	DPDT
93Q-909	120 VAC	3PDT
93Q-912	208/240 VAC	3PDT
93Q-920	24 VDC	DPDT

WITH 5-AMP CROSSBAR CONTACTS

Part No.	Coil Voltages (50/60 Hz)	Contacts
93Q-939	120 VAC	3PDT

TYPE 93 RELAY CONNECTOR (FIG. D)

Connector for Type 93 solder terminal, printed circuit. 8 and 11 pin plug-in and quick connect relays.

Part No. 93-185-11—
10-24
25-49
50-99

STANCOR

Relays

Heavy Duty Power Contactors
D.C. Power Contactors
Type 124

Terminal Hardware Supplied

Coil Voltage D.C.	Coil Resistance +8% 25°	SPNO 4 Terminal Isolated Coil
12 V	13.2	124-902
24 V	53	124-903
36 V	120	124-904

Contact Rating D.C. Inductive Load		
Voltage DC	Continuous	Inrush
12 V	100 Amps.	400 Amps.
24 V	100 Amps.	400 Amps.
36 V	100 Amps.	400 Amps.

Coil Voltage D.C.	Coil Resistance +8% 25°	SPNO 3 Terminal Grounded Coil
12 V	13.2	124-906
24 V	53	124-907
36 V	120	124-908

Coil Voltage D.C.	Coil Resistance +8% 25°	SPDT 6 Terminal Isolated Coil
12 V	13.2	124-910
24 V	53	124-911
36 V	120	124-912

- Max. Pick-Up 70% rated coil voltage.
- Design Ambient—40°C to 65°C
- Maximum Continuous coil watts. 12 @ rated voltage.
- Recommended Mounting Position: Unit in vertical plane with coil terminals up. Horizontal plane is acceptable.
- Design meets U.L. 583 Industrial Truck Standard. Dust and splash proof cover.
- Application: Controlling D.C. starting motors on gasoline engine driven auxilaries. Battery charging power circuits, motor reversing circuits as found in winch applications.
- The 124 is also applicable where ruggedness and high current capacity is required for D.C. mobile equipment such as: in-plant lifts, industrial equipment, recreational vehicle—golf carts, camp trailers, motor homes.
- Contact Termination: 5/16"-24 UNC-2A stud.
- Coil Termination: #10-32 UNF-2A tread.

TYPE 586

Sealed Solenoid is Dust and Splash Proof

4 TERMINAL Continuous Duty Coil Silver Contacts
Pole Form: SPNO, SPDT

Incorporates double-make or double-break contacts

Type 568 coil is rated approximately 12 watts continuous duty. Contact rating 200 Amps.

SINGLE POLE NORMALLY OPEN
SINGLE POLE DOUBLE THROW
4 TERMINAL

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Cat. No. S.P.N.O.	Cat. No. S.P.D.T.	Contact Material
6	3.3	586-901	589-910	
12	13.2	586-902	586-911	
15	21.0	586-903	586-912	
18	30.0	586-904	586-913	Silver
24	53	586-905	586-914	
36	120	586-906	586-915	
48	218	586-907	586-916	

Type 586 Sealed Contactors are designed for controlling DC starting-motors on gasoline engine driven auxilaries, battery-charging power circuits, low-voltage DC motor generator sets, golf carts, reversing circuits in winch applications, industrial lift trucks, to mention a few.

Type 70

CONTACT RATING
D.C. INDUCTIVE LOAD—36 V. MAX.

Voltage	Normally Open		Normally Closed	
	Continuous	Inrush	Continuous	Inrush
6	80 Amp.	300 Amp.	60 Amp.	100 Amp.
12	80 Amp.	150 Amp.	60 Amp.	60 Amp.
24-36	50 Amp.	50 Amp.	30 Amp.	30 Amp.

- Non-turning studs
- Drawn steel dust proof enclosure
- Copper stud power & coil terminals
- Double break rotating disc movable contact
- Solenoid actuated
- Suggested mounting—cap down

SINGLE POLE NORMALLY OPEN
4 TERMINAL

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-901	Copper
12	16	70-902	
24	60	70-903	
36	114	70-904	
6	4	70-905	Silver
12	16	70-906	
24	60	70-907	
36	114	70-908	

SINGLE POLE NORMALLY OPEN
3 TERMINAL

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-913	Copper — Coil Grounded to Case
12	16	70-914	
24	60	70-915	
6	4	70-917	Copper — Coil Grounded to Load
12	16	70-918	
24	60	70-919	

SINGLE POLE DOUBLE THROW
6 TERMINAL

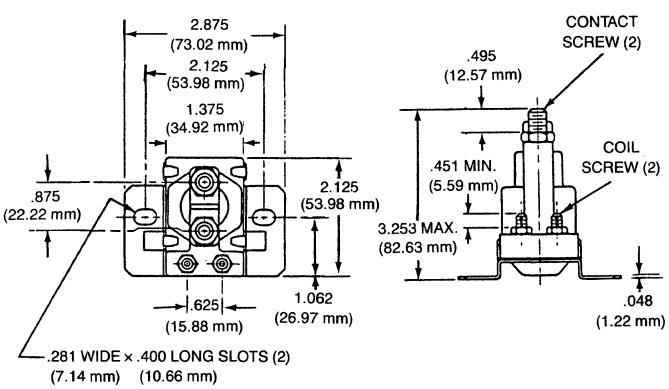
Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-909	N.O. and N.C. Silver
12	16	70-910	
24	60	70-911	
36	114	70-912	
12	16	70-922	N.O. Copper and N.C. Silver
24	60	70-923	

HEAVY DUTY D.C. POWER CONTACTOR
TYPE 120 SOLENOID

SINGLE POLE NORMALLY OPEN

Catalog Number Continuous Duty		Coil Volts DC	Coil Resistance Continuous Duty
Standard Bracket	L Bracket		
120-901	120-907	12	16.0
120-902	120-908	15	20.8
120-903	120-909	18	37.0
120-904	120-910	24	64.0
120-905	120-911	36	100.0
Intermittent Duty			
Standard Bracket	L Bracket	Coil Volts DC	Intermittent Duty
120-906	120-912	12	6.0

Rating	Full Load	Inrush	Elec. Life	Contact Material
Continuous	100A	400A	25,000	Silver Alloy
Intermittent	80A	400A	10,000	Copper



MILITARY/AEROSPACE RELAYS

STRUTHERS-DUNN RELAYS

MAGNETICALLY POLARIZED, SINGLE SIDE STABLE

10A-25A S.P.D.T. TO 6P.D.T.



FCA-125	MIL-R-6106/19	A-2
FCA-210	MS 27401	A-6
FCA-212		A-10
FCA-325	MS 27743	A-14
FCAC-325	MIL-R-6106/13	A-18
FCA-410	MS 27400	A-22
FCA-412		A-26
FCA-610	MIL-R-6106/8	A-30

MINIATURE MAGNETICALLY POLARIZED, SINGLE SIDE STABLE

5A-10A D.P.D.T. TO 4P.D.T.



FCB-210	MIL-R-6106/21/27	B-2
FCB-310	MIL-R-6106/24/29	B-6
FCB-410	MIL-R-6106/22/28	B-10

MAGNETICALLY POLARIZED, BI-STABLE LATCHING

10A-25A S.P.D.T. TO 4P.D.T.



FCAL-125		C-2
FCAL-210	MIL-R-6160/50	C-6
FCAL-325		C-10
FCACL-325		C-14
FCAL-410	MIL-R-6106/51	C-18

GENERAL PURPOSE

2A-25A D.P.D.T. TO 6P.D.T.



	FC-4	MIL-R-5757/7	D-2
	FC-6	MIL-R-5757/1	D-2
	FC-200	MS 24149	D-4
	FC-325	MS 27418 (3PST/N.O.)	D-6
*	FC-400	MIL-R-5757/18	D-8
	FC-402	MS 25273, MS 25323	D-10
**	FC-404	MIL-R-5757/15	D-12
***	FC-406	MIL-R-5757/16	D-14

DRY REED DIP & SIP RELAYS

10VA-FORMS 1A, 2A, 1B; 3VA-FORM 1C



MILD	M83516/1/4 QPL Pending	E-2
MILDL	LATCHING	E-2
MILQ	GENERAL PURPOSE	E-6
MILQ	LOW POWER	E-6

MERCURY WETTED REED RELAYS

7.5VA-FORMS 1A, 2A, 3A; 2VA FORMS 1C, 2C



MRRW	MIL-R-83407/3	F2

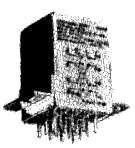
TRACKS AND SOCKETS

KEYED SOCKETS FOR RELAYS AND TIMERS		G-2
TRACKS	MIL-R-6106/25/3	G-6
SOCKETS	MIL-R-6106/23/4/5	G-6
PLUG	MIL-R-6106/35	G-6

S-D ELECTRONICS

TIME CONTROL RELAY OUTPUT

10A-25A D.P.D.T. TO 6P.D.T.



TDC	MIL-R-83726/30/31	H-2
TDD	MIL-R-83726/28/29	H-6
TDE		H-10
TDF		H-12
TDG		H-14

MIL SENSORS, CUSTOM DESIGNS

VOLTAGE SENSORS	I-1
CURRENT SENSORS	I-1
FREQUENCY SENSORS	I-1

* MS 25271, MS 25272, MS 25327, MS 25919
** MS 25267, MS 25268, MS 25325, MS 25917
*** MS 25269, MS 25270, MS 25329, MS 25918

SD/Hi-G Sales Headquarters, Lambs Rd., Pitman, NJ 08071-0901; Tel. 609-589-7500; EASY LINK 62287939; FAX 609-589-2619

MILITARY/AEROSPACE RELAYS

HI-G RELAYS

MILITARY MINIGRID

D.P.D.T., LOW LEVEL TO 1A

(J) MGA	MIL-R-39016/17/18/19	K-2
(J) MGAT	MIL-R-28776/6	K-4
(J) MGS	MIL-R-39016/41/42/43	K-6
(J) MGST	MIL-R-28776/7	K-8

MILITARY TO-5



S.P.D.T. AND D.P.D.T., LOW LEVEL TO 1A

(J) MGA	MIL-R-39016/9/15/20	L-2
(J) MAT	MIL-R-28776/1	L-2
(J) 1MA	MIL-R-39016/7/23/24	L-4
(J) 1MAT	MIL-R-28776/5	L-4
(J) MS	MIL-R-39016/11/16/21	L-6
(J) MST	MIL-R-28776/3	L-6
(J) 1MS	MIL-R-39016/10/25/26	L-8
(J) 1MST	MIL-R-28776/4	L-8

MILITARY BALANCED ARMATURE, CRYSTAL CAN TYPE

2A-10A S.P.D.T. TO D.P.D.T.



(J) 2G-4650	MIL-R-39016/13	M-2
(J) 2K-4730	MIL-R-39016/6	M-4
(J) 2K-4930	MIL-R-39016/22	M-6
2B-1506	MIL-R-5757/10	M-8
2BC-1510	MIL-R-5757/13	M-10
2T-2911	MIL-R-5757/23/28	M-12

GENERIC TO-5



D.P.D.T. LOW LEVEL TO 1A

CA	O-2
CS	O-4

GENERIC BALANCED ARMATURE, CRYSTAL CAN TYPE

S.P.D.T. TO 4P.D.T. LOW LEVEL TO 10A



G	P-2	BK	P-12	2BCN	P-22
K	P-4	BC	P-14	T(TR)	P-24
B(BR)	P-6	BA	P-16	FS-2	P-26
4B	P-8	HA	P-18	FS-3	P-27
KA	P-10	2BN	P-20	FS-5	P-28

RF CRYSTAL CAN

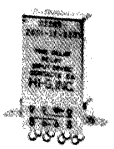
75W 500MHz S.P.D.T. AND D.P.D.T.



RFC	Q-2
RFK	Q-4
RFB	Q-6
RFBC	Q-8

HI-G ELECTRONICS

TIME CONTROL, RELAY OUTPUT



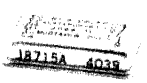
1600		R-2
1700		R-4
2400		R-6
4600		R-8
4700		R-10
5600		R-12
5700		R-14
6600	MIL-R-83726/7	R-16
6700	MIL-R-83026/8	R-18

TIME CONTROL, SOLID STATE OUTPUT



1800		S-2
1900		S-4
2600		S-6
4800		S-8
6001	MIL-R-83726/13	S-10
6150		S-12
6155		S-14
6800	MIL-R-83726/24	S-16
6900	MIL-R-83726/25	S-18

SOLID STATE RELAYS



JTS-5	MIL-R-28750/5	T-2
JTS-6	MIL-R-28750/6	T-4
JTS-7	MIL-R-28750/7	T-6
JDS-8	MIL-R-28750/8	T-8
JDS-9	MIL-R-28750/9	T-10
JPS-10	MIL-R-28750/10	T-12
CHARACTERISTIC CURVE CHART		T-15

POWER MONITORS, SENSORS

POWER MONITORS	9000	U-2
AC & DC VOLTAGE	1310	U-4
	1350	U-6
FREQUENCY SENSORS	7000	U-10
PHASE SENSORS	1400	U-14

INDUSTRIAL PRODUCTS

LQD	LIQUID LEVEL SENSORS	V-2
PS	PHASE SENSOR INDUSTRIAL	V-4
VS	AC/DC VOLT. LEVEL SENSOR	V-6
TDP	TIME DELAY PROGRAMMABLE	V-8
TD	TIME DELAY RELAYS	V-10
TDN	TIME DELAY INTERVAL	V-12
MCG/ CCG	TIMERS POWER-ON RESET	V-14
	INLINE TIMERS 6400	V-16
	ORDERING INFORMATION	V-17

MIL P/N CROSS REFERENCE

W-2

QUALIFIED PRODUCT LIST
Mil P/N CROSS REFERENCE
SD/Hi-G Company vs Military Part Numbers

The part numbers listed which refer to MIL-R-6106, and associated M.S. sheets, for Type I ER relays show current qualification levels at time of this publication.

The Part Numbers Listed refer to MIL-R-39016 and MIL-R-28776 Level "L". To specify Level "M" or Level "P" Relays, change the suffix "L" to both Hi-G Company and Military Part Numbers to "M" or "P". (Example: "M" Level version of M39016/7-013M, Hi-G P/N J1MAW-5XM)
Note: All Relays Listed are qualified to Levels "L", "M" and "P".

MIL. DESIG.	SD PART NO.	GENERIC EQUIV.*	MIL. DESIG.	SD PART NO.	GENERIC EQUIV.*	MIL. DESIG.	SD PART NO.	GENERIC EQUIV.*	MIL. DESIG.	SD PART NO.	GENERIC EQUIV.*
M5757/1			M6106/3			M6106/19 (cont'd)			M6106/28 (cont'd)		
M5757/1-013	FC-6-495		M6106/3-001	CXT-3936		M6106/19-015	FCA-125-15	FCA-125-BY4	M6106/28-003	FCB-410-3	FCB-410-BZ4
-014	-495		-002	-3937		-016	-16	-CY4	-004X	-4X	-BZ4
-015	-495		-003	-3938		-017	-17	-AY4	-005	-5	-CZ3
-019	-495		-004	-3939		-018	-18	-BX4	-006X	-6X	-CZ3
-020	-495		-005	-3940		-019	-19	-CX4	-007	-7	-CZ4
-021	-495		-006	-3941		-020	-20	-BY4	-008X	-8X	-CZ4
-027	-522		M6106/4			-021	-21	-CY4	-009	-9	-AZ3
-028	-524		M6106/4-001	CX-3927		-022	-22	-AY4	-010X	-10X	-AZ3
-103	-250		-002	-3925		-023	-23	-BX4	-011	-11	-AZ4
M5757/7			-003	-3929		-024	-24	-CX4	-012X	-12X	-AZ4
M5757/7-001	FC-4-250		M6106/5			-025	-25	-CX3	-013	-13	-BY3
M5757/15			M6106/5-001	CX-3926		M6106/21			-014X	-14X	-BY3
M5757/15-001	FC-404-60		-002	-3928		M6106/21-001[5]	FCB-210-21	FCB-210-AT4	-015	-15	-BY4
-003	-61		-003	-3931		-002[5]	-22	-AT4	-016X	-16X	-BY4
-005	-62		-004	-3932		-003X	-23X	-AT4	-017	-17	-CY3
M5757/16			-005	-3935		M6106/22			-018X	-18X	-CY3
M5757/16-001	FC-406-60		-006	-3934		M6106/22-001[6]	FCB-410-22	FCB-410-AT4	-019	-19	-CY4
-003	-61		M6106/8			-002[6]	-23	-AT4	-020X	-20X	-CY4
-005	-62		M6106/8-001	FCA-610-1	FCA-610-CY3	-003X	-24X	-AT4	-021	-21	-AY3
M5757/18			-002	-2	-AY3	M6106/24			-022X	-38X	-AY3
M5757/18-001	FC-400-60		-003	-3	-CY8	M6106/24-001[7]	FCB-310-24	FCB-310-AT4	-023	-39	-AY4
-003	-61		-004	-4	-DY8	-002[7]	-25	-AT4	-024X	-40X	-AY4
-005	-62		-005	-5	-CY3	-003U	-26U	-AT4	-025	-41	-BX3
-007	-173		-006	-6	-AY3	M6106/25			-026X	-42X	-BX3
M5757/23			-007	-7	-CY8	M6106/25-002[4]	CXT-3945B		-027	-43	-BX4
M5757/23-001	FC-215-350		-008	-8	-DY8	-003	C		-028X	-44X	-BX4
-002	-550		-009	-9	-CY4	M6106/27			-029	-45	-CX3
-003	-650		-010	-10	-AY4	M6106/27-001	FCB-210-1	FCB-210-BZ3	-030X	-46X	-CX3
-004	-750		-011	-11	-CY4	-002X	-2X	-BZ3	-031	-47	-CX4
-005	-850		-012	-12	-AY4	-003	-3	-BZ4	-032X	-48X	-CX4
-006	-506		-013	-13	-CY3	-004X	-4X	-BZ4	-037	-53	-BY2
-007	-507		-014	-14	-AY3	-005	-5	-CZ3	-038	-54	—
-008	-508		M6106/13			-006X	-6X	-CZ3	-039	-55	-CY2
-009	-509		M6106/13-001	FCAC325-1	FCAC-325-CY3	-007	-7	-CZ4	-040	-56	—
-010	-510		-002	-2	-AY3	-008X	-8X	-CZ4	-041	-57	-AY2
-011	-511		-003	-3	-CY8	-009	-9	-AZ3	-042	-58	—
-012	-512		-004	-4	-AV8	-010X	-10X	-AZ3	-043	-76	-BX2
-013	-513		-005	-5	-BY3	-011	-11	-AZ4	-044	-77	—
-014	-514		-006	-6	-BX3	-012X	-12X	-AZ4	-045	-78	-CX2
-015	-515		-007	-7	-CY4	-013	-13	-BY3	-046	-79	—
-016	-516		-008	-8	-AY4	-014X	-14X	-BY3	M6106/29		
-017	-517		-009	-9	-CX3	-015	-15	-BY4	M6106/29-001	FCB-310-1	FCB-310-BZ3
-018	-518		-010	-10	-BZ3	-016X	-16X	-BY4	-002U	-2U	-BZ3
-019	-519		-011	-11	-AZ3	-017	-17	-CY3	-003	-3	-BZ4
-020	-520		-012	-12	-BZ8	-018X	-18X	-CY3	-004U	-4U	-BZ4
-021[1]	-521		-013	-13	-AZ8	-019	-19	-CY4	-005	-5	-CZ3
-022[1]	-522		-014	-14	-BZ4	-020X	-20X	-CY4	-006U	-6U	-CZ3
-023[1]	-523		-015	-15	-AZ4	-021	-42	-AY3	-007	-7	-CZ4
-024[1]	-524		-016	-16	-BY4	-022X	-43X	-AY3	-008U	-8U	-CZ4
-025[1]	-525		-017	-17	-BY4	-023	-44	-AY4	-009	-9	-AZ3
-026	-526		-018	-18	-CX4	-024X	-45X	-AY4	-010U	-10U	-AZ3
-027	-527		M6106/19			-025	-46	-BX3	-011	-11	-AZ4
-028	-528		M6106/19-001[3]	FCA-125-1	FCA-125-CY3	-026X	-47X	-BX3	-012U	-12U	-AZ4
-029	-529		-002[3]	-2	-AY3	-027	-48	-BX4	-013	-13	-BY3
-030	-530		-003	-3	-CY3	-028X	-49X	-BX4	-014U	-14U	-BY3
M5757/28 Inactive for new design			-004	-4	-AY3	-029	-50	-CX3	-015	-15	-BY4
Superceded by M5757/23-001			-005	-5	-BY3	-030X	-51X	-CX3	-016U	-16U	-BY4
M6106/1			-006	-6	-CY3	-031	-52	-CX4	-017	-17	-CY3
M6106/1-001[2]	FCA-210-31		-007	-7	-AY3	-032X	-53X	-CX4	-018U	-18U	-CY3
-002[2]	-33		-008	-8	-BX3	-037	-90	-HX3	-019	-19	-CY4
-003[2]	-32		-009	-9	-CX3	-038X	-91X	-HX3	-020U	-20U	-CY4
M6106/2			-010	-10	-BY3	-039	-92	-HX4	-021	-21	-AY3
M6106/2-001[2]	FCA-410-31		-011	-11	-CY3	-040X	-93X	-HX4	-022U	-22U	-AY3
-002[2]	-33		-012	-12	-AY3	M6106/28			-023	-23	-AY4
-003[2]	-34		-013	-13	-BX3	M6106/28-001	FCB-410-1	FCB-410-BZ3	-024U	-29U	-AY4
			-014	-14	-CX3	-002X	-2X	-BZ3	-025	-30	-BX3

CONTACT FACTORY FOR QUALIFICATION LEVEL OF E-R RELAYS

1. Superceded by M5757/23-026, 027, 028, 029, 030 2. Track Mounted Relays
3. Superceded by M6106/19-11, 12 4. Superceded by M6106/25-003 5. Superceded by M6106/21-003
6. Superceded by M6106/22-003 7. Superceded by M6106/24-003

***"Generic equivalent" part numbers are comparable in form, fit and function to the respective Mil-Spec part numbers. These equivalent numbers are not "ER" screened devices.**

MIL. DESIG.	SD PART NO.	GENERIC EQUIV.*
M6106/29 (cont'd)		
M6106/29-026U	FCB-310-31U	FCB-310--BX3
-027	-32	-BX4
-028U	-33U	-BX4
-029	-34	-CX3
-030U	-35U	-CX3
-031	-36	-CX4
-032U	-37U	-CX4
M6106/35		
M6106/35-001	CXP-3985	
M6106/36		
M6106/36-001	FCAL-210-33	
M6106/50		
M6106/50-001	FCAL-210-230	FCAL-210-CY3
-002	-231	-AY3
-003	-232	-CX3
-004	-233	-CY4
-005	-234	-AY4
-006	-235	-CX4
-007	-236	-CY8
-008	-237	-AY8
-009	-238	-CX8
M6106/51		
M6106/51-001	FCAL-410-190	FCAL-410-CY3
-002	-191	-AY3
-003	-192	-CX3
-004	-193	-CY4
-005	-194	-AY4
-006	-195	-CX4
-007	-196	-CY8
-008	-197	-AY8
-009	-198	-CX8
MS24149		
MS24149-D1	FC-200-1	
MS25267		
MS25267-D1	FC-404-1	
-A1	-2	
MS25268		
MS25268-D1	FC-404-48	
-A1	-49	
MS25269		
MS25269-D1	FC-406-1	
-A1	-2	
MS25270		
MS25270-D1	FC-406-48	
-A1	-49	
MS25271		
MS25271-D1	FC-400-1	
-A1	-2	
MS25272		
MS25272-D1	FC-400-48	
-A1	-49	
MS25273		
MS25273-D1	FC-402-1	
-A1	-2	
-A2	-33	
MS25323		
MS25323-D2	FC-402-3	
-A2	-4	
-A3	-36	
MS25325		
MS25325-D1	FC-404-3	
-A1	-4	
-A2	-32	
MS25327		
MS25327-D1	FC-400-3	
-A1	-4	
MS25329		
MS25329-D1	FC-406-3	
-A1	-4	
MS25917		
MS25917-1	FC-404-41	
-2	-42	
MS25918		
MS25918-D2	FC-406-42	
MS25919		
MS25919-1	FC-400-41	
-2	-42	
MS27400		
MS27400-18	FCA-410-1	FCA-410-CY3
-28	-2	-AY3

MIL. DESIG.	SD PART NO.	GENERIC EQUIV.*
MS27400 (cont'd)		
MS27400-38	FCA-410-3	FCA-410-CY8
-48	-4	-DY8
-5X	-5X	-CY3
-6X	-6X	-AY3
-7X	**	-CY8
-8X	**	-DY8
-9	-9	-CY3
-10	-10	-AY3
-11	-11	-CY8
-12	-12	-DY8
-17	-17	-AY4
-18	-18	-AY5
-19X	-19X	-CX3
-20X	**	-CX8
-21	-41	-CX3
-22	-42	-CX8
-23	-43	-CY4
-24	-44	-CX4
-259	-45	-AY4
-26	-46	-CY9
-27	-47	-CX9
-28	-48	-DY9
-29X	-49X	-CY4
-30X	-50X	-CX4
-31X	**	-AY4
-32X	**	-CY9
-33X	**	-CX9
-34X	**	-DY9
-35	-124	-BY3
-36X	-125X	-BY3
-37	-126	-BY4
-38X	-127X	-BY4
-39	-114	-FY9
-40	-220	-CZ3
-41	-221	-BZ3
-42	-222	-CZ4
-43	-223	-BZ4
-44X	-224X	-CZ3
-45X	-225X	-BZ3
-46X	-226X	-CZ4
-47X	-227X	-BZ4
-48	**	-CZ9
-49	-229	-FZ9
-50X	**	-CZ9
-51X	**	-FZ9
MS27401		
MS27401-110	FCA-210-1	FCA-210-CY3
-210	-2	-AY3
-310	-3	-CY8
-410	-4	-DY8
-5X	-5X	-CY3
-6X	-6X	-AY3
-7X	**	-CY8
-8X	**	-DY8
-9	-9	–
-10	-10	–
-11	-11	–
-12	-12	–
-13	-13	-CY3
-14	-14	-AY3
-15	-15	-CY8
-16	-16	-DY8
-21X	-41X	-CX3
-22X	**	-CX8
-23	-43	-CX3
-24	-44	-CX8
-25	-45	-CY4
-26	-46	-CX4
-27	-47	-AY4
-28	-48	-CY9
-29	-49	-CX9
-30	-50	-DY9
-31X	-51X	-CY4
-32X	-52X	-CX4
-33X	-53X	-AY4
-34X	**	-CY9
-35X	**	-CX9
-36X	**	-DY9
-37	-57	-BX3
-38X	-58X	-BX3

MIL. DESIG.	SD PART NO.	GENERIC EQUIV.*
MS27401 (cont'd)		
MS27401-39	FCA-210-59	FCA-210-BX4
-40X	-60X	-BX4
-41	-119	-BY3
-42	-120X	-BY3
-43	-121	-BY4
-44X	-122X	-BY4
-45	-123	-FY9
-46	-220	-CZ3
-47	-221	-BZ3
-48	-222	-CZ4
-49	-223	-BZ4
-50X	-224X	-CZ3
-51X	-225X	-BZ3
-52X	-226X	-CZ4
-53X	-227X	-BZ4
-54	-228	-CZ9
-55	-229	-FZ9
-56X	-230X	-CZ9
-57X	-231X	-FZ9
-58X	-321X	-HX3
-59X	-332X	-HX4
MS27418		
MS27418-1A	FC-325-1	
-1B	-2	
-1C	-3	
-2A	-4	
-2B	-5	
-2C	-6	
-1D	-7	
-2D	-8	
MS27709		
MS27709-1	FCM-410-1	
-2	-3	
-3	-5	
-4	-60	
-5	-61	
-6	-2	
MS27743		
MS27743-111	FCA-325-1	FCA-325-CY3
-211	-2	-AY3
-311	-3	-CX3
-4	-4	-CY3
-5	-5	-CX3
-6	-6	-AY3
-7	-7	-CY8
-8	-8	-CX8
-9	-9	-AV8
-10	-10	-CY3
-11	-11	-CX3
-12	-12	-AY3
-13	-13	-CY8
-14	-14	-CX8
-15	-15	-AV8
-16	-16	-CY4
-17	-17	-CX4
-18	-18	-AY4
-19	-19	-CY9
-20	-20	-CX9
-21	-21	-AV9
-22	-22	-CY4
-23	-23	-CX4
-24	-24	-AY4
-25	-25	-CY9
-26	-26	-CX9
-27	-27	-AV9
-28	-28	-BY3
-29	-29	-BX3
-30	-30	-BY3
-31	-31	-BX3
-32	-32	-BY4
-33	-33	-BX4
-34	-34	-BY4
-35	-35	-BX4
M83407/3		
M83407/3-001	MRRW1A140	
-002	141	
-003	MRRW1C106	
-004	107	

MIL. DESIG.	SD PART NO.	GENERIC EQUIV.*
M83407/3 (cont'd)		
M83407/3-007	MRRW2C102	
-008	103	
-009	MRRW3A105	
-010	106	
-011	MRRW1A148	
-012	149	
-013	MRRW1C109	
-014	110	
-015	MRRW2A108	
-016	109	
-017	MRRW2C106	
-018	107	
-019	MRRW3A108	
-020	109	
M83516/1		
M83516/1-001	**	
-002	**	
-003	**	
-004	**	
-005	**	
-006	**	
-007	**	
-008	**	
-009	**	
-010	**	
-011	**	
-012	**	
-013	**	
-014	**	
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-020	**	
-021	**	
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-023	**	
-024	**	
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-026	**	
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-028	**	
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-031	**	
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-040	**	
-041	**	
-042	**	
-043	**	
-044	**	
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-046	**	
-047	**	
-048	**	
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-055	**	
-056	**	
-057	**	
-058	**	
-059	**	
-060	**	
-061	**	
-062	**	
-063	**	
-064	**	
-065	**	

CONTACT FACTORY FOR QUALIFICATION LEVEL OF E-R RELAYS

8. Superceded by MS27400/9/10/11/12 9. Superceded by MS27400-17 10. Superceded by MS27401/13/14/15/16 11. Superceded by MS27743/4/6/5 ** QPL Pending

MIL. DESIG.	SD PART NO.	GENERIC EQUIV.*
M83516/1 (cont'd)		
M83516/1-066	**	
-067	**	
-068	**	
-069	**	
-070	**	
-071	**	
-072	**	
-073	**	
-074	**	
-075	**	
-076	**	
-077	**	
-078	**	
-079	**	
-080	**	
-081	**	
-082	**	
-083	**	
-084	**	
-085	**	
-086	**	
-087	**	
-088	**	
-089	**	
-090	**	
-091	**	
-092	**	
-093	**	
-094	**	
-095	**	
-096	**	
M83516/4		
M83516/3-001	**	
-002	**	
-003	**	
-004	**	
-005	**	
-006	**	
-007	**	
-008	**	
-009	**	
-010	**	
-011	**	
-012	**	
-013	**	
-014	**	
-015	**	
-016	**	
M83726/3		
Cancelled. Use M83726/28.		
M83726/4		
Cancelled. Use M83726/29.		
M83726/7		
See Hi-G listing.		
M83726/8		
See Hi-G listing.		
M83726/13		
See Hi-G listing.		
M83726/24		
See Hi-G listing.		
M83726/25		
See Hi-G listing.		
M83726/27		
M83726/27-001	TDA-730	
M83726/28		
M83726/28-1000P	TDD-1379-1000P	TDD-AYOF-1000
Thru -5003P	Thru -5003P	Thru -5003
-1000S	-1000S	TDD-CYOF-1000
Thru -5003S	Thru -5003S	Thru -5003
M83726/29		
M83726/29-1000P	TDD-1380-1000P	TDD-AYRF-1000
Thru -5003P	Thru -5003P	Thru -5003
-1000S	-1000S	TDD-CYRF-1000
Thru -5003S	Thru -5003S	Thru -5003
M83726/30		
M83726/30-1000P	TDD-1396-1000P	TDD-AYOA-1000
Thru -5003P	Thru -5003P	Thru -5003
-1000S	-1000S	TDD-CYOA-1000
Thru -5003S	Thru -5003S	Thru -5003

MIL. DESIG.	SD PART NO.	GENERIC EQUIV.*
M83726/31		
M83726/31-1000P	TDD-1397-1000P	TDD-AYRA-1000
Thru -5003P	Thru -5003P	Thru -5003
-1000S	-1000S	TDD-CYRA-1000
Thru -5003S	Thru -5003S	Thru -5003

MILITARY DESIGNATION	HI-G PART NO.
M5757/10 Active	
M5757/10-015	2B-1506-15
-016	-16
-022	-22
-035	-35
-036	-36
-037	-37
-038	-38
-039	-39
-040	-40
-043	-43
-044	-44
-052	-52
-053	-53
-054	-54
-056	-56
-059	-59
-060	-60
-067	-67
M5757/10 Inactive. Use M39016/6	
M5757/10-001	J2K-4730-107L
-002	-108L
-005	-104L
-006	-105L
-007	-107L
-008	-108L
-011	-104L
-012	-105L
-013	-107L
-014	-108L
-017	-104L
-018	-105L
-019	-128L
-021	-128L
-061	-129L
-062	-109L
M5757/13	
M5757/13-011	2BC-1510-11
-012	-12
-013	-13
-014	-14
-015	-15
-016	-16
-017	-17
-018	-18
-019	-19
-020	-20
-026	-26
-027	-27
-028	-28
-029	-29
-030	-30
-031	-31
-032	-32
-033	-33
-034	-34
-036	-36
-037	-37
-038	-38
-039	-39
-040	-40

MILITARY DESIGNATION	HI-G PART NO.
M5757/13 (cont'd)	
M5757/13-036	2BC-1510-36
-037	-37
-038	-38
-039	-39
-040	-40
-041	-41
-042	-42
-043	-43
-044	-44
-045	-45
-046	-46
-047	-47
-048	-48
-049	-49
-050	-50
-051	-51
-052	-52
-053	-53
-054	-54
-055	-55
-056	-56
-057	-57
-058	-58
-059	-59
-060	-60
-061	-61
-062	-62
-063	-63
-064	-64
-065	-65
-066	-66
-067	-67
-068	-68
-069	-69
-070	-70
-072	-72
-073	-73
-074	-74
-075	-75
-076	-76
-077	-77
-078	-78
-079	-79
-080	-80
-081	-81
M5757/23	
M5757/23-001	2T-2911-1
-002	-2
-003	-3
-004	-4
-005	-5
-006	-6
-007	-7
-008	-8
-009	-9
-010	-10
-011	-11
-012	-12
-013	-13
-014	-14
-015	-15
-016	-16
-017	-17
-018	-18
-019	-19
-020	-20
-026	-26
-027	-27
-028	-28
-029	-29
-030	-30
-031	-31
-032	-32
-033	-33
-034	-34
-036	-36
-037	-37
-038	-38
-039	-39
-040	-40

MILITARY DESIGNATION	HI-G PART NO.
M5757/23 (cont'd)	
M5757/23-041	2T-2911-41
-042	-42
M5757/28 inactive for new design	
Superseded by M5757/23-001	
M28750/5	
M28750/5-001W, Y	JTS5-1W, Y
M28750/6	
M28750/6-001W, Y	JTS6-1W, Y
M28750/7	
M28750/7-001W, Y	JTS7-1W, Y
M28750/8	
M28750/8-001W, Y	JDS8-1W, Y
M28750/9	
M28750/9-001W, Y	JDS9-1W, Y
M28750/10	
M28750/10-001W, Y	JPS10-1W, Y
-002W, Y	-2W, Y
M28776/1	
M28776/1-013L, M, P	JMAWT-5XL, M, P
-014L	-6XL
-015L	-9XL
-016L	-12XL
-017L	-18XL
-018L	-26XL
-019L	JMAPT -5XL
-020L	-6XL
-021L	-9XL
-022L	-12XL
-023L	-18XL
-024L	-26XL
-025L	JMACT -5XL
-026L	-6XL
-027L	-9XL
-028L	-12XL
-029L	-18XL
-030L	-26XL
-031L*	JMACT -5XLS
-032L*	-6XLS
-033L*	-9XLS
-034L*	-12XLS
-035L*	-18XLS
-036L*	-26XLS
M28776/3	
M28776/3-017L, M, P	JMSWT-5XL, M, P
-018L	-6XL
-019L	-9XL
-020L	-12XL
-021L	-18XL
-022L	-26XL
-023L	-36XL
-024L	-48XL
-025L	JMSPT -5XL
-026L	-6XL
-027L	-9XL
-028L	-12XL
-029L	-18XL
-030L	-26XL
-031L	-36XL
-032L	-48XL
-033L	JMSCT -5XL
-034L	-6XL
-035L	-9XL
-036L	-12XL
-037L	-18XL
-038L	-26XL
-039L	-36XL
-040L	-48XL
-041L*	JMSCT -5XLS
-042L*	-6XLS
-043L*	-9XLS
-044L*	-12XLS
-045L*	-18XLS
-046L*	-26XLS
-047L*	-36XLS
-048L*	-48XLS
M28776/4	
M28776/4-017L, M, P	J1MSWT-5XL, M, P
-018L	-6XL
-019L	-9XL
-020L	-12XL

CONTACT FACTORY FOR RATE OF FAILURE ON E-R RELAYS

*Consult factory for these items

MILITARY DESIGNATION	HI-G PART NO.
M28776/4 (cont'd)	
M28776/4-021L	J1MSWT-18XL
-022L	-26XL
-023L	-32XL
-024L	-40XL
-025L	J1MSPT-5XL
-026L	-6XL
-027L	-9XL
-028L	-12XL
-029L	-18XL
-030L	-26XL
-031L	-32XL
-032L	-40XL
-033L	J1MSCT-5XL
-034L	-6XL
-035L	-9XL
-036L	-12XL
-037L	-18XL
-038L	-26XL
-039L	-32XL
-040L	-40XL
-041L*	J1MSCT-5XLS
-042L*	-6XLS
-043L*	-9XLS
-044L*	-12XLS
-045L*	-18XLS
-046L*	-26XLS
-047L*	-32XLS
-048L*	-40XLS
M28776/5	
M28776/5-013L, M, P	J1MAWT-5XL, M, P
-014L	-6XL
-015L	-9XL
-016L	-12XL
-017L	-18XL
-018L	-26XL
-019L	J1MAPT-5XL
-020L	-6XL
-021L	-9XL
-022L	-12XL
-023L	-18XL
-024L	-26XL
-025L	J1MACT-5XL
-026L	-6XL
-027L	-9XL
-028L	-12XL
-029L	-18XL
-030L	-26XL
-031L*	J1MACT-5XLS
-032L*	-6XLS
-033L*	-9XLS
-034L*	-12XLS
-035L*	-18XLS
-036L*	-26XLS
M28776/6	
M28776/6-001L, M	JMGAT-5L, M
-002L	-6L
-003L	-9L
-004L	-12L
-005L	-18L
-006L	-26L
-007L	-5LW
-008L	-6LW
-009L	-9LW
-010L	-12LW
-011L	-18LW
-012L	-26LW
M28776/7	
M28776/7-001L, M	JMGST-5L, M
-002L	-6L
-003L	-9L
-004L	-12L
-005L	-18L
-006L	-26L
-007L	-5LW
-008L	-6LW
-009L	-9LW
-010L	-12LW
-011L	-18LW
-012L	-26LW

MILITARY DESIGNATION	HI-G PART NO.
M39016/6	
M39016/6-104L, M, P	J2K-4730-104L, M, P
-105L	-105L
-106L	-106L
-107L	-107L
-108L	-108L
-109L	-109L
-110L	-110L
-111L	-111L
-112L	-112L
-113L	-113L
-114L	-114L
-115L	-115L
-116L	-116L
-117L	-117L
-118L	-118L
-119L	-119L
-120L	-120L
-121L	-121L
-122L	-122L
-123L	-123L
-124L	-124L
-125L	-125L
-126L	-126L
-127L	-127L
-128L	-128L
-129	-129L
-130L	-130L
-131L	-131L
-132L	-132L
-139L	-139L
-134L	-134L
-135L	-135L
-136L	-136L
-137L	-137L
-138L	-138L
-139L	-139L
-140L	-140L
-141L	-141L
-142L	-142L
-143L	-143L
-144L	-144L
-145L	-145L
-146L	-146L
-147L	-147L
-148L	-148L
-149L	-149L
-150L	-150L
-151L	-151L
-152L	-152L
-204L	-204L
-205L	-205L
-206L	-206L
-207L	-207L
-208L	-208L
-209L	-209L
-210L	-210L
-211L	-211L
-212L	-212L
-213L	-213L
-214L	-214L
-215L	-215L
-216L	-216L
-217L	-217L
-218L	-218L
-219L	-219L
-220L	-220L
-221L	-221L
-222L	-222L
-223L	-223L
-224L	-224L
-225L	-225L
-226L	-226L
-227L	-227L
-228L	-228L
-229L	-229L
-230L	-230L
-231L	-231L
-232L	-232L
-233L	-233L
-234L	-234L

MILITARY DESIGNATION	HI-G PART NO.
M39016/6 (cont'd)	
M39016/6-235L	J2K-4730-235L
-236L	-236L
-237L	-237L
-238L	-238L
-239L	-239L
-240L	-240L
-241L	-241L
-242L	-242L
-243L	-243L
-244L	-244L
-245L	-245L
-246L	-246L
-247L	-247L
-248L	-248L
-249L	-249L
-250L	-250L
-251L	-251L
-252L	-252L
M39016/7	
M39016/7-013L, M, P	J1MAW-5XL, M, P
-014L	J1MAP-5XL
-015L	J1MAW-6XL
-016L	J1MAP-6XL
-017L	J1MAW-9XL
-018L	J1MAP-9XL
-019L	J1MAW-12XL
-020L	J1MAP-12XL
-021L	J1MAW-18XL
-022L	J1MAP-18XL
-023L	J1MAW-26XL
-024L	J1MAP-26XL
-025L	J1MAC-5XL
-026L	-6XL
-027L	-9XL
-028L	-12XL
-029L	-18XL
-030L	-26XL
-031L*	J1MAC-5XLS
-032L*	-6XLS
-033L*	-9XLS
M39016/9	
M39016/9-013L, M, P	JMAW-5XL, M, P
-014L	-6XL
-015L	-9XL
-016L	-12XL
-017L	-18XL
-018L	-26XL
-019L	JMAP-5XL
-020L	-6XL
-021L	-9XL
-022L	-12XL
-023L	-18XL
-024L	-26XL
-051L	JMAW-30XL
-052L	JMAP-30XL
-057L	JMAC-5XL
-058L	-6XL
-059L	-9XL
-060L	-12XL
-061L	-18XL
-062L	-26XL
-063L	-30XL
-071L*	JMAC-5XLS
-072L*	-6XLS
-073L*	-9XLS
-074L*	-12XLS
-075L*	-18XLS
-076L*	-26XLS
-077L*	-30XLS
-085L*	JMACG-5L
-086L*	-6L
-087L*	-9L
-088L*	-12L
-089L*	-18L
-090L*	-26L
-091L*	-30L
-099L*	JMACG-5LS

MILITARY DESIGNATION	HI-G PART NO.
M39016/9 (cont'd)	
M39016/9-100L*	JMACG-6LS
-101L*	-9LS
-102L*	-12LS
-103L*	-18LS
-104L*	-26LS
-105L*	-30LS
M39016/10	
M39016/10-017L, M, P	J1MSW-5XL, M, P
-018L	J1MSP-5XL
-019L	J1MSW-6XL
-020L	J1MSP-6XL
-021L	J1MSW-12XL
-022L	J1MSP-12XL
-023L	J1MSW-26XL
-024L	J1MSP-26XL
-025L	J1MSW-32XL
-026L	J1MSP-32XL
-027L	J1MSW-40XL
-028L	J1MSP-40XL
-029L	J1MSW-9XL
-030L	J1MSP-9XL
-031L	J1MSW-18XL
-032L	J1MSP-18XL
-033L	J1MSC-5XL
-034L	-6XL
-035L	-12XL
-036L	-26XL
-037L	-32XL
-038L	-40XL
-039L	-9XL
-040L	-18XL
-041L*	J1MSC-5XLS
-042L*	-6XLS
-043L*	-12XLS
-044L*	-26XLS
-045L*	-32XLS
-046L*	-40XLS
-047L*	-9XLS
-048L*	-18XLS
M39016/11	
M39016/11-017L, M, P	JMSW-5XL, M, P
-018L	JMSP-5XL
-019L	JMSW-6XL
-020L	JMSP-6XL
-021L	JMSW-12XL
-022L	JMSP-12XL
-023L	JMSW-26XL
-024L	JMSP-26XL
-025L	JMSW-36XL
-026L	JMSP-36XL
-027L	JMSW-48XL
-028L	JMSP-48XL
-029L	JMSW-9XL
-030L	JMSP-9XL
-031L	JMSW-18XL
-032L	JMSP-18XL
-033L	JMSC-5XL
-034L	-6XL
-035L	-12XL
-036L	-26XL
-037L	-36XL
-038L	-48XL
-039L	-9XL
-040L	-18XL
-041L*	JMSC-5XLS
-042L*	-6XLS
-043L*	-12XLS
-044L*	-26XLS
-045L*	-36XLS
-046L*	-48XLS
-047L*	-9XLS
-048L*	-18XLS
M39016/13	
M39016/13-055L, M, P	J2G-4650-55L, M, P
-056L	-56L
-057L	-57L
-058L	-58L
-059L	-59L
-060L	-60L
-061L	-61L

CONTACT FACTORY FOR RATE OF FAILURE ON E-R RELAYS

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MILITARY DESIGNATION	HI-G PART NO.
M39016/13 (cont'd)	
M39016/13-062L	J2G-4650-62L
-063L	-63L
-064L	-64L
-065L	-65L
-066L	-66L
-067L	-67L
-068L	-68L
-069L	-69L
-070L	-70L
-071L	-71L
-072L	-72L
-073L	-73L
-074L	-74L
-075L	-75L
-076L	-76L
-077L	-77L
-078L	-78L
-079L	-79L
-080L	-80L
-081L	-81L
-082L	-82L
-083L	-83L
-084L	-84L
-085L	-85L
-086L	-86L
-087L	-87L
-088L	-88L
-089L	-89L
-090L	-90L
-091L	-91L
-092L	-92L
-093L	-93L
-094L	-94L
-095L	-95L
-096L	-96L
-097L	-97L
-098L	-98L
-099L	-99L
-100L	-100L
-101L	-101L
-102L	-102L
-103L	-103L
-104L	-104L
-105L	-105L
-106L	-106L
-107L	-107L
-108L	-108L
-109L	-109L
-110L	-110L
-111L	-111L
-112L	-112L
-113L	-113L
-114L	-114L
-115L	-115L
-116L	-116L
-117L	-117L
-118L*	-118L
-119L*	-119L
-120L*	-120L
-121L*	-121L
-122L*	-122L
-123L*	-123L
-124L*	-124L
M39016/15	
M39016/15-029L, M, P	JMAWD-6XL, M, P
-030L	-9XL
-031L	-12XL
-032L	-18XL
-033L	-26XL
-034L	-5XL
-035L	JMAPD-6XL
-036L	-9XL
-037L	-12XL
-038L	-18XL
-039L	-26XL
-040L	-5XL
-065L	JMAWDG-6XL
-066L	-9XL
-067L	-12XL
-068L	-18XL

MILITARY DESIGNATION	HI-G PART NO.
M39016/15 (cont'd)	
M39016/15-069L	JMAWDG-26XL
-070L	-5XL
-077L	JMACD-6XL
-078L	-9XL
-079L	-12XL
-080L	-18XL
-081L	-26XL
-082L	-5XL
-089L	JMACDG-6XL
-090L	-9XL
-091L	-12XL
-092L	-18XL
-093L	-26XL
-094L	-5XL
-101L*	JMACD-6XLS
-102L*	-9XLS
-103L*	-12XLS
-104L*	-18XLS
-105L*	-26XLS
-106L*	-5XLS
-113L*	JMACDG-6XLS
-114L*	-9XLS
-115L*	-12XLS
-116L*	-18XLS
-117L*	-26XLS
-118L*	-5XLS
-125L*	JMACD-6XLS2
-126L*	-9XLS2
-127L*	-12XLS2
-128L*	-18XLS2
-129L*	-26XLS2
-130L*	-5XLS2
M39016/16	
M39016/16-017L, M, P	JMSWD-5XL, M, P
-018L	-6XL
-019L	-12XL
-020L	-26XL
-021L	-36XL
-022L	-48XL
-023L	-9XL
-024L	-18XL
-025L	JMSPD-5XL
-026L	-6XL
-027L	-12XL
-028L	-26XL
-029L	-36XL
-030L	-48XL
-031L	-9XL
-032L	-18XL
-033L	JMSCD-5XL
-034L	-6XL
-035L	-12XL
-036L	-26XL
-037L	-36XL
-038L	-48XL
-039L	-9XL
-040L	-18XL
-041L*	JMSCD-5XLS
-042L*	-6XLS
-043L*	-12XLS
-044L*	-26XLS
-045L*	-36XLS
-046L*	-48XLS
-047L*	-9XLS
-048L*	-18XLS
M39016/17	
M39016/17-025L, M, P	JMGAP-5L, M, P
-026L	-6L
-027L	-9L
-028L	-12L
-029L	-18L
-030L	-26L
-031L	-36L
-032L	-48L
-033L	-9L
-034L	-12L
-035L	-18L
-036L	-26L
-037L*	JMGAC-5L
-038L*	-6LW

MILITARY DESIGNATION	HI-G PART NO.
M39016/17 (cont'd)	
M39016/17-039L*	JMGAC-9LW
-040L*	-12LW
-041L*	-18LW
-042L*	-26LW
-043L*	JMGACG-5L
-044L*	-6L
-045L*	-9L
-046L*	-12L
-047L*	-18L
-048L*	-26L
-049L*	JMGACG-5LW
-050L*	-6LW
-051L*	-9LW
-052L*	-12LW
-053L*	-18LW
-054L*	-26LW
M39016/18	
M39016/18-025L, M, P	JMGAPD-5L, M, P
-026L	-6L
-027L	-9L
-028L	-12L
-029L	-18L
-030L	-26L
-031L	JMGACD-5L
-032L	-6L
-033L	-9L
-034L	-12L
-035L	-18L
-036L	-26L
-037L*	JMGACD-5LW
-038L*	-6LW
-039L*	-9LW
-040L*	-12LW
-041L*	-18LW
-042L*	-26LW
-043L*	JMGACDG-5L
-044L*	-6L
-045L*	-9L
-046L*	-12L
-047L*	-18L
-048L*	-26L
-049L*	JMGACDG-5LW
-050L*	-6LW
-051L*	-9LW
-052L*	-12LW
-053L*	-18LW
-054L*	-26LW
M39016/19	
M39016/19-025L, M, P	JMGAPDD-5L, M, P
-026L	-6L
-027L	-9L
-028L	-12L
-029L	-18L
-030L	-26L
-031L	JMGACDD-5L
-032L	-6L
-033L	-9L
-034L	-12L
-035L	-18L
-036L	-26L
-037L*	JMGACDD-5LW
-038L*	-6LW
-039L*	-9LW
-040L*	-12LW
-041L*	-18LW
-042L*	-26LW
-043L*	JMGACDDG-5L
-044L*	-6L
-045L*	-9L
-046L*	-12L
-047L*	-18L
-048L*	-26L
-049L*	JMGACDDG-5LW
-050L*	-6LW
-051L*	-9LW
-052L*	-12LW
-053L*	-18LW
-054L*	-26LW
M39016/20	
M39016/20-007L, M, P	JMAWDD-5XL, M, P

MILITARY DESIGNATION	HI-G PART NO.
M39016/20 (cont'd)	
M39016/20-008L	JMAWDD-6XL
-009L	-9XL
-010L	-12XL
-011L	-18XL
-012L	-26XL
-037L	JMAPDD-6XL
-038L	-6XL
-039L	-9XL
-040L	-12XL
-041L	-18XL
-042L	-26XL
-049L	JMACDD-5XL
-050L	-6XL
-051L	-9XL
-052L	-12XL
-053L	-18XL
-054L	-26XL
-061L*	JMACDD-5XLS
-062L*	-6XLS
-063L*	-9XLS
-064L*	-12XLS
-065L*	-18XLS
-066L*	-26XLS
-079L*	JMACDDG-5L
-080L*	-6L
-081L*	-9L
-082L*	-12L
-083L*	-18L
-084L*	-26L
-091L*	JMACDDG-5LS
-092L*	-6LS
-093L*	-9LS
-094L*	-12LS
-095L*	-18LS
-096L*	-26LS
M39016/21	
M39016/21-007L, M, P	JMSWDD-5XL, M, P
-008L	-6XL
-009L	-9XL
-010L	-12XL
-011L	-18XL
-012L	-26XL
-019L	JMSPDD-5XL
-020L	-6XL
-021L	-9XL
-022L	-12XL
-023L	-18XL
-024L	-26XL
-029L	JMSWDD-36XL
-030L	-48XL
-031L	JMSPDD-36XL
-032L	-48XL
-033L	JMSCDD-5XL
-034L	-6XL
-035L	-9XL
-036L	-12XL
-037L	-18XL
-038L	-26XL
-039L	-36XL
-040L	-48XL
-041L*	JMSCDD-5XLS
-042L*	-6XLS
-043L*	-9XLS
-044L*	-12XLS
-045L*	-18XLS
-046L*	-26XLS
-047L*	-36XLS
-048L*	-48XLS
M39016/22	
M39016/22-004L, M, P	J2K-4940-004L, M, P
-005L	-005L
-006L	-006L
-007L	-007L
-008L	-008L
-009L	-009L
-010L	-010L
-011L	-011L
-012L	-012L
-013L	-013L
-014L	-014L

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MILITARY DESIGNATION	HI-G PART NO.
M39016 22 (cont'd)	
M39016/22-015L	J2K-4840-015L
-016L	-016L
-017L	-017L
-018L	-018L
-019L	-019L
-020L	-020L
-021L	-021L
-022L	-022L
-023L	-023L
-024L	-024L
M39016 23	
M39016/23-013L, M, P	J1MAWD-5XL, M, P
-014L	-6XL
-015L	-9XL
-016L	-12XL
-017L	-18XL
-018L	-26XL
-019L	J1MAPD-5XL
-020L	-6XL
-021L	-9XL
-022L	-12XL
-023L	-16XL
-024L	-26XL
-025L	J1MACD-5XL
-026L	-6XL
-027L	-9XL
-028L	-12XL
-029L	-18XL
-030L	-26XL
-031L*	J1MACD-5XLS
-032L*	-6XLS
-033L*	-9XLS
-034L*	-12XLS
-035L*	-18XLS
-036L*	-26XLS
M39016 24	
M39016/24-013L, M, P	J1MAWDD-5XL, M, P
-014L	-6XL
-015L	-9XL
-016L	-12XL
-017L	-18XL
-018L	-26XL
-019L	J1MAPDD-5XL
-020L	-6XL
-021L	-9XL
-022L	-12XL
-023L	-18XL
-024L	-26XL
-025L	J1MACDD-5XL
-026L	-6XL
-027L	-9XL
-028L	-12XL
-029L	-18XL
-030L	-26XL
-031L*	J1MACDD-5XLS
-032L*	-6XLS
-033L*	-9XLS
-034L*	-12XLS
-035L*	-18XLS
-036L*	-26XLS
M39016 25	
M39016/25-017L, M, P	J1MSWD-5XL, M, P
-018L	-6XL
-019L	-12XL
-020L	-26XL
-021L	-32XL
-022L	-40XL
-023L	-9XL
-024L	-18XL
-025L	J1MSPD-5XL
-026L	-6XL
-027L	-12XL
-028L	-26XL
-029L	-32XL
-030L	-40XL
-031L	-9XL
-032L	-18XL
-033L	J1MSCD-5XL
-034L	-6XL
-035L	-12XL

MILITARY DESIGNATION	HI-G PART NO.
M39016 25 (cont'd)	
M39016/25-036L	J1MSCD-26XL
-037L	-32XL
-038L	-40XL
-039L	-9XL
-040L	-18XL
-041L*	-5XLS
-042L*	-6XLS
-043L*	-12XLS
-044L*	-26XLS
-045L*	-32XLS
-046L*	-40XLS
-047L*	-9XLS
-048L*	-18XLS
M39016 26	
M39016/26-017L, M, P	J1MSWDD-5XL, M, P
-018L	-6XL
-019L	-12XL
-020L	-26XL
-021L	-32XL
-022L	-40XL
-023L	-9XL
-024L	-18XL
-025L	J1MSPDD-5XL
-026L	-6XL
-027L	-12XL
-028L	-26XL
-029L	-32XL
-030L	-40XL
-031L	-9XL
-032L	-18XL
-033L	J1MSCDD-5XL
-034L	-6XL
-035L	-12XL
-036L	-26XL
-037L	-32XL
-038L	-40XL
-039L	-9XL
-040L	-18XL
-041L*	-6XLS
-042L*	-12XLS
-043L*	-26XLS
-044L*	-32XLS
-045L*	-40XLS
-046L*	-9XLS
-047L*	-18XLS
M39016 41	
M39016/41-033L, M, P	JMGSC-5L, M, P
-034L	-6L
-035L	-12L
-036L	-26L
-037L	-36L
-038L	-48L
-039L	-9L
-040L	-18L
-041L	JMGSP-5L
-042L	-6L
-043L	-12L
-044L	-26L
-045L	-36L
-046L	-48L
-047L	-9L
-048L	-18L
-049L*	JMGSC-5LW
-050L*	-6LW
-051L*	-12LW
-052L*	-26LW
-053L*	-36LW
-054L*	-48LW
-055L*	-9LW
-056L*	-18LW
-057L*	JMGSCG-5L
-058L*	-6L
-059L*	-12L
-060L*	-26L
-061L*	-36L
-062L*	-48L
-063L*	-9L
-064L*	-18L
-065L*	JMGSCDG-5LW
-066L*	-6LW
-067L*	-12LW
-068L*	-26LW
-069L*	-36LW
-070L*	-48LW
-071L*	-9LW
-072L*	-18LW
M39016 42	
M39016/42-033L, M, P	JMGSCD-5L, M, P
-034L	-6L
-035L	-12L
-036L	-26L
-037L	-36L
-038L	-48L
-039L	-9L
-040L	-18L
-041L	JMGSPD-5L
-042L	-6L
-043L	-9L
-044L	-12L
-045L	-18L
-048L	-26L
-047L	-36L
-048L	-48L
-049L*	JMGSCD-5LW
-050L*	-6LW
-051L*	-9LW
-052L*	-12LW
-053L*	-18LW
-054L*	-26LW
-055L*	-36LW
-056L*	-48LW
-057L*	JMGSCDDG-5L
-058L*	-6L
-059L*	-9L
-060L*	-12L
-061L*	-18L
-062L*	-26L
-063L*	-36L
M39016 43	
M39016/43-033L, M, P	JMGSCDD-5L, M, P
-034L	-6L
-035L	-9L
-036L	-12L
-037L	-18L
-038L	-26L
-039L	-36L
-040L	-48L
-041L	JMGSPDD-5L
-042L	-6L
-043L	-9L
-044L	-12L
-045L	-18L
-048L	-26L
-047L	-36L
-048L	-48L
-049L*	JMGSCDD-5LW
-050L*	-6LW
-051L*	-9LW
-052L*	-12LW
-053L*	-18LW
-054L*	-26LW
-055L*	-36LW
-056L*	-48LW
-057L*	JMGSCDDG-5L
-058L*	-6L
-059L*	-9L
-060L*	-12L
-061L*	-18L
-062L*	-26L
-063L*	-36L

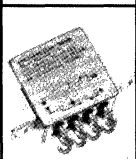
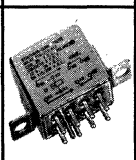
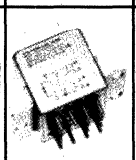
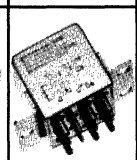
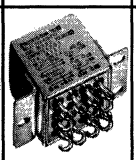
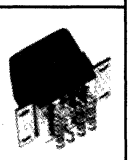
MILITARY DESIGNATION	HI-G PART NO.
M39016 43 (cont'd)	
M39016/43-064L*	JMGSCDDG-48L
-065L*	JMGSCDDG-5LW
-066L*	-6LW
-067L*	-9LW
-068L*	-12LW
-069L*	-18LW
-070L*	-26LW
-071L*	-36LW
-072L*	-48LW
M83726 3	
See SD listing.	
M83726 4	
See SD listing.	
M83726 7	
M83726/7-0600W	6600-0600W
*thru	*thru
M83726/7-3003W	6600-3003W
*Qualification has been granted for all	
dash numbers from 0600 thru 3003.	
example: 6600-1001W, 1 sec	
6600-1002W, 10 sec	
6600-3003W, 300 sec	
M83726 8	
M83726/8-1000W	6700-1000W
*thru	*thru
M83726/8-3003W	6700-3003W
*Qualification has been granted for all	
dash numbers from 1000 thru 3003.	
example: 6700-2001W, 2 sec	
6700-2002W, 20 sec	
6700-2003W, 200 sec	
M83726 13	
M83726/13-0500W	6001-0500W
*thru	*thru
M83726/13-6003W	6001-6003W
*Qualification has been granted for all	
dash numbers from 0500 thru 6003.	
example: 6001-0500W, 05 sec	
6001-5002W, 50 sec	
6001-6003W, 500 sec	
M83726 24	
M83726/24-0500W	6800-0500W
*thru	*thru
M83726/24-5003W	6800-5003W
*Qualification has been granted for all	
dash numbers from 0500 thru 5003.	
example: 6800-3001W, 3 sec	
6800-2002W, 20 sec	
6800-1503W, 150 sec	
M83726 25	
M83726/25-0500W	6900-0500W
*thru	*thru
M83726/25-5003W	6900-5003W
*Qualification has been granted for all	
dash numbers from 0500 thru 5003.	
example: 6900-1001W, 1 sec	
6900-1002W, 10 sec	
6900-4003W, 400 sec	
M83726 27	
See SD listing.	
M83726 28	
See SD listing.	
M83726 29	
See SD listing.	
M83726 30	
See SD listing.	
M83726 31	
See SD listing.	

*Consult factory for these items

SDM2348-10M-591-CP

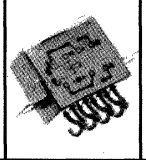
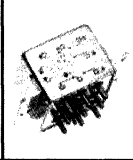
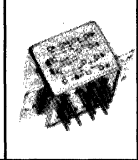
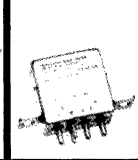
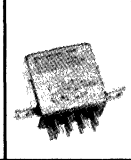
Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

MAGNETICALLY POLARIZED, SINGLE SIDE STABLE 10A-25A, S.P.D.T. to 6P.D.T.

SERIES	FCA-125	FCA-210	FCA-212	FCA-325	FCAC-325	FCA-410	FCA-412	FCA-610
								
Applicable Mil-Spec	MIL-R-6106 MIL-R-6106/19	MIL-R-6106 MS 27401	—	MIL-R-6106 MS 27743	MIL-R-6106 MIL-R-6106/13	MIL-R-6106 MS 27400	—	MIL-R-6106 MIL-R-6106/8
FEATURES	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available
ELEC. Contact Rating	25 amps. @ 28 Vdc 115V/400 Hz 1ϕ	10 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	12 amps @ 28 Vdc 115/400 Hz 1ϕ	25 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	Main: 25 amps. Aux: 2 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	12 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ
Contact Form	S.P.D.T.	D.P.D.T.	D.P.D.T.	3P.D.T.	3P.S.T.-N.O./1P.D.T.	4P.D.T.	4P.D.T.	6P.D.T.
Rated Coil Voltages	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac
MECH. Dimensions (LxWxH)	1.025″ x 0.525″ x 1.010″ DC (1.125″ AC)	1.025″ x 0.525″ x 1.010″ DC (1.125″ AC)	1.025″ x 0.525″ x 1.010″ DC (1.125″ AC)	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.	1.053″ x 1.483″ x 1.010″ max.
Weight	1.6 oz. (45.4g) max.	1.6 oz. (45.4g) max.	1.6 oz. (45.4g) max.	2.89 oz. (82g) max.	2.89 oz. (82g) max.	2.72 oz. (77g) max.	2.72 oz. (77g)	4.16 oz. (117.94g) max.
Terminals	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks
ENVIR. Temperature	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C
Shock	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	50G, 6 ms.
Vibration	30G, 10 to 3,000 Hz	30G, 33 to 3,000 Hz	30G, 33 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 33 to 3,000 Hz	30G, 33 to 3,000 Hz	20G, 10 to 2,000 Hz

MINIATURE MAGNETICALLY POLARIZED, SINGLE SIDE STABLE 5A-10A, D.P.D.T. TO 4P.D.T.

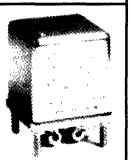
MAGNETICALLY POLARIZED, BI-STABLE LATCHING 10A-25A S.P.D.T. TO 4P.D.T.

SERIES	FCB-210	FCB-310	FCB-410	FCAL-125	FCAL-210	FCAL-325	FCACL-325	FCAL-410
								
Applicable Mil-Spec	MIL-R-6106 MIL-R-6106/21/27	MIL-R-6106 MIL-R-6106/24/29	MIL-R-6106 MIL-R-6016/22/28	—	MIL-R-6106 MS 27744 superseded by MIL-R-6106/50	—	—	MIL-R-6106 MS 27745 superseded by MIL-R-6106/51
FEATURES	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet latching • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet latching • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet latching • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet latching • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet latching • Suppression available
ELEC. Contact Rating	5 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps. @ 28 Vdc 115V 400 Hz 3ϕ	5 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	25 amps. @ 28 Vdc 115/400 Hz 1ϕ	10 amps. @ 28 Vdc 115V/200V 400 Hz 3ϕ	25 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	Main: 25 amps. Aux: 2 amps. @ 28 Vdc 115/200V 400Hz 3ϕ	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ
Contact Form	D.P.D.T.	3P.D.T.	4P.D.T.	S.P.D.T	D.P.D.T.	3P.D.T.	3P.S.T.-N.O./1P.D.T.	4P.D.T.
Rated Coil Voltages	28 Vdc	28 Vdc	28 Vdc	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac
MECH. Dimensions (HxWxL)	0.810″ x 0.410″ x 0.610″ max.	0.810″ x 0.810″ x 0.640″ max.	0.810″ x 0.810″ x 0.640″ max.	1.025″ x 0.525″ x 1.010″ DC (1.125″ AC)	1.025″ x 0.525″ x 1.010″ (1.125″ AC)	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.
Weight	.544 oz. (154g) max.	.93 oz. (26.4g) max.	.93 oz. (26.4g) max.	1.6 oz. (45.4g) max.	1.6 oz. (45.4g) max.	2.87 oz. (82g) max.	2.87 oz. (82g) max.	2.72 oz. (77.2g) max.
Terminals	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket pins Circuit Board Pins Solder Hooks
ENVIR. Temperature	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C
Shock	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.
Vibration	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz

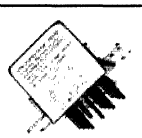
Struthers-Dunn/HI-G Sales Headquarters, Lambs Rd., Pitman, NJ 08071-0901; Tel. 609-589-7500: EASY LINK 62287939; FAX: 609-589-2619

Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

GENERAL PURPOSE
2A-25A D.P.D.T. TO 6P.D.T.

SERIES	FC-4	FC-6	FC-200	FC-400	FC-402	FC-404	FC-406	FC-325
								
Applicable Mil-Spec	MIL-R-5757/7	MIL-R-5757/1	MIL-R-6106 MS 24149	MIL-R-6106 MIL-R-5757/18	MIL-R-6106	MIL-R-6106 MIL-R-5757/15	MIL-R-6106 MIL-R-5757/16	MIL-R-6106 MS 27418
FEATURES	• Hermetically sealed • Balanced rotary armature • Suppression available	• Hermetically sealed • Balanced rotary armature • Suppression available	• Hermetically sealed • Balanced armature • Suppression available	• Hermetically sealed • Balanced armature • Bifurcated contacts • Suppression available	• Hermetically sealed • Balanced armature • Bifurcated contacts • Suppression available	• Hermetically sealed • Balanced armature • Bifurcated contacts • Suppression available	• Hermetically sealed • Balanced armature • Bifurcated contacts • Suppression available	• Hermetically sealed • Balanced armature • Suppression available
ELEC. Contact Rating	Low level to 2 amps @ 28 Vdc	Low level to 2 amps @ 28 Vdc	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps @ 28 Vdc 115V/200V 400 Hz 3ϕ	10 amps @ 28 Vdc 115/400 Hz 1ϕ	5 amps @ 28 Vdc 115/400 Hz 1ϕ	5 amps @ 28 Vdc 115/400 Hz 1ϕ	25 amps @ 28 Vdc 115/200V 50 to 60 & 400 Hz 3ϕ
Contact Form	4P.D.T.	6P.D.T.	D.P.D.T.	4P.D.T	D.P.D.T.	4P.D.T.	6P.D.T.	3P.S.T./N.O.
Rated Coil Voltages	26.5 Vdc 115 Vac	26.5 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac
MECH. Dimensions (LxWxH)	1.84″ x 1.060″ dia. max.	1.94″ x 1.20″ dia. max.	2.600″ x 2.500″ x 1.625″ max.	1.531″ x 1.531″ x 1.812″ max.	1.531″ x 1.100″ x 1.781″ max.	1.531″ x 1.130″ x 1.781″ max.	1.531″ x 1.531″ x 1.812″ max.	1.531″ x 1.531″ x 1.680″ max.
Weight	3.2 oz. (90.8g) max.	4.32 oz. (122.6g) max.	7.0 oz. (200g) max.	7.2 oz. (204g) max.	5.10 oz. (144g) max.	4.8 oz. (136g) max.	6.0 oz. (170g) max.	8.18 oz. (232g max.
Terminals	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Screw Terminals	Socket Pins Solder Hooks	Socket Pins Solder Hooks	Socket Pins Solder Hooks	Socket Pins Solder Hooks	Solder Hooks Screw Terminals
ENVIRON. Temperature	–65°C to +125°C	–65°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C	–70°C to +125°C
Shock	100G, 11 ms.	100G, 11 ms.	25G, 11 ms.	50G, 11 ms.	50G, 11 ms.	50G, 11 ms.	50G, 11 ms.	50G, 11 ms.
Vibration Sine	15G, 10 to 2,000 Hz	15G, 10 to 2,000 Hz	10G, 10 to 1,500 Hz	10G, 10 to 1,500 Hz	10G, 55 to 1,500 Hz	10G, 55 to 1,500 Hz	10G, 55 to 1,500 Hz	10G, 5 to 1,000 Hz

TIME CONTROL, RELAYS OUTPUT—
10A-25A, D.P.D.T. to 6P.D.T.

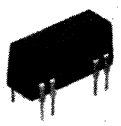
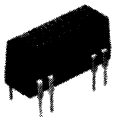
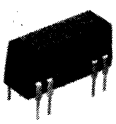
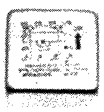
SERIES	TDC	TDD	TDE	TDF	TDG
					
Applicable Mil-Spec	MIL-R-83726/30 MIL-R-83726/31	MIL-R-83726/28 MIL-R-83726/29	Designed to meet the requirements of MIL-R-83726	Designed to meet the requirements of MIL-R-83726	Designed to meet the requirements of MIL-R-83726
FEATURES	• Adjustable delay on operate or release • Hermetically sealed • Polarity protected	• Fixed delay on operate or release • Hermetically sealed • Polarity protected	• Fixed or adjustable delay on operate or release • Hermetically sealed • Polarity protected	• Fixed or adjustable delay on operate or release • Hermetically sealed • Polarity protected	• Fixed or adjustable delay on operate or release • Hermetically sealed • Polarity protected
ELEC. Contact Rating	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	25 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ
Contact Form	D.P.D.T.	D.P.D.T	4P.D.T., 3P.D.T. (Adj.) 4P.S.T./N.O. (Adj.)	3P.D.T, 2P.D.T. (Adj), 3P.S.T./N.O. (Adj.)	6P.D.T., 5P.D.T. & 1P.S.T./N.O. (Adj.)
Input Voltage	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal
Control Voltage	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal
Operating Current	110 ma. max.	110 ma. max.	110 ma. max.	110 ma. max.	190 ma. max.
TIMING Timing Mode					
Delay on Operate	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.
Delay on Release	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.
MECH. Dimensions(LxWxH)	1.025″x1.025″x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.500″ max.	1.025″ x 1.025″ x 1.500″ max.	1.053″ x 1.483″ x 1.500″ max.
Weight	2.5 oz. (71g) max.	2.5 oz. (71g) max.	3.0 oz. (85g) max.	3.0 oz. (85g) max.	3.88 oz. (110g) max.
Terminals	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks
ENVIRON. Temperature	–55°C to +125°C	–55°C to +125°C	–55°C to +125°C	–55°C to +125°C	–55°C to +125°C
Shock	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	100G, 6 ms.	50G, 6 ms.
Vibration Sine	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	20G, 10 to 2,000 Hz	20G, 10 to 2,000 Hz

Struthers-Dunn/HI-G Sales Headquarters, Lambs Rd., Pitman, NJ 08071-0901; Tel. 609-589-7500; EASY LINK 62287939; FAX: 609-589-2619

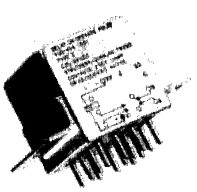
Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

DRY REED DIP RELAYS, 10VA-FORMS A&B; 3VA-FORM C

MERCURY WETTED RELAYS 7.5VA-FORMS; 3VA-FORM C

SERIES	MILD	MILDL	MILD	MILQ	MILQ	MRRW	MRRW
							
Applicable Mil-Spec	MIL-R-83516/1 General Purpose **QPL Pending	Latching	MIL-R-83516/4 Low Power Coil **QPL Pending	General Purpose	Low Power	MIL-R-83407 MIL-R-83407/3	MIL-R-83407 MIL-R-83407/3
FEATURES	• Epoxy Molded • 8 or 14 Pin Designs • 14 Pin DIP Socket Compatible • DTL, TTL and HNIL Compatible • Magnetic Shielding • Low Cost • Suppression Available	• Epoxy Molded • 8 or 14 Pin Designs • 14 Pin DIP Socket Compatible • DTL, TTL and HNIL Compatible • Magnetic Shielding • Low Cost • Suppression Available	• Epoxy Molded • 8 or 14 Pin Designs • 14 Pin DIP Socket Compatible • DTL, TTL and HNIL Compatible • Magnetic Shielding • Low Cost • Suppression Available	• Epoxy Molded • DTL, TTL and HNIL Compatible • Low Cost • Form A, Form B Contacts • Suppression Available	• Epoxy Molded • DTL, TTL and HNIL Compatible • Low Cost • Form A, Form B Contacts • Suppression Available	• Mercury wetted contacts • Hermetically sealed • Welded construction • Coils have back EMF suppression • Electrostatic shielded • Suppression Available	• Mercury wetted contacts • Hermetically sealed • Welded construction • Coils have back EMF suppression • Electrostatic shielded • Suppression Available
ELEC.							
Contact Form	1A, 2A, 1B, 1C	1A	1A, 1C	1A, 1B	1A, 1B	1A, 1C	2A, 3A, 2C
Contact Rating	Form A/B / Form C	Form A	Form A / Form C	Form A/B	Form A/B	Form A / Form C	Form A / Form C
Volts max.	100 / 28	100	100 / 28	100	100	500 / 150	500 / 150
Amps max.	.500 / .250	.500	.500 / .250	.500	.500	1.0 / 1.0	1.0 / 1.0
Watts max.	10 / 3	10	10 / 3	10	10	7.5 / 2.0	7.5 / 2.0
Coil Data							
DC Volts	5 to 24	5 to 24	5/6	5 to 24	5/12	4.5 & 12.0	4.5 & 12.0
Power DC mW	70 to 285	70 to 100	50 to 170	125 to 288	50 to 145	—	—
MECH.							
Dimensions (LxWxH)	0.750″ x 0.300″ x 0.290″ max. 0.750″ x 0.300″ x 0.375″ max.	0.750″ x 0.300″ x 0.350″ max.	0.750″ x 0.300″ x 0.290″ max.	0.750″ x 0.250″ x 0.260″ max.	0.750″ x 0.290″ x 0.260″ max. 0.750″ x 0.350″ x 0.260″ max.	1.100″ x 0.515″ x 0.410″ max.	1.100″ x 1.062″ x 0.410″ max.
Weight	0.12 oz. (3.3g) max.	0.12 oz. (3.3g) max.	0.12 oz. (3.3g) max.	0.12 oz. (3.3g) max.	0.12 oz. (3.3g) max.	.42 oz. (12g) max.	.70 oz. (20g) max.
TIMING							
Ambient Temp.	−40°C to +105°C	−40°C to +105°C	−40°C to +105°C	−40°C to +105°C	−40°C to +105°C	−38°C to +105°C	−38°C to +105°C
Operate Time (Nominal)	Form A—1.0 ms. Form B—0.5 ms. Form C—2.0 ms.	1.0 ms.	Form A—1.0 ms. Form C—2.0 ms.	Form A—1.0 ms. Form B—0.5 ms.	Form A—1.0 ms. Form B—0.5 ms.	3.0 ms. max.	3.0 ms. max
Release Time (Nominal)	Form A—1.0 ms. Form B—0.5 ms. Form C—2.5 ms.	—	Form A—1.0 ms. Form C—2.5 ms.	Form A—1.0 ms. Form B—0.5 ms.	Form A—1.0 ms. Form B—0.5 ms.	3.0 ms. max.	3.0 ms. max.

MIL SENSORS FOR VOLTAGE, CURRENT OR FREQUENCY



Struthers-Dunn custom designs and manufactures various sensors, to monitor AC and DC circuits and detect and signal when the parameters of voltage, or current, or frequency deviate from the required nominal range. All are designed to meet the environmental specifications for military and aerospace applications.

These sensors typically employ some appropriate version of our extensive line of MIL-approved relays, combined with the sensing and relay control circuitry. A time-delay option can be added, to hold off relay operation when an abnormal condition is transient or can be tolerated for some longer preset time.

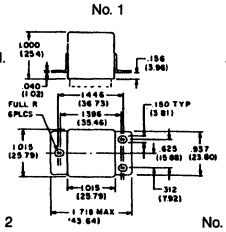
Sensor relay contacts are available in many configurations, from S.P.D.T. reed contacts, suitable for control of signal lights, to 4-pole 10 amp or 3-pole 25 amp power contacts, to control 3-phase circuits. Magnetic latching relays can be provided for all contact arrangements.

Enclosures are hermetically sealed with terminals for socket plug-in, circuit-board mounting, or solder hooks.

Three enclosure types suitable for sensor assemblies are dimensioned below: No. 1 can provide up to D.P.D.T., 10 amps; Nos. 2 and 3 up to 4PDT, 10 amps; and No. 3 3 PST-NO, 25 amps plus auxiliary S.P.D.T. 2 ampere contacts, or 3PDT, 25 amps.

Dimensions in inches ± .010 and (MM ± .25) except as noted.

No. 1



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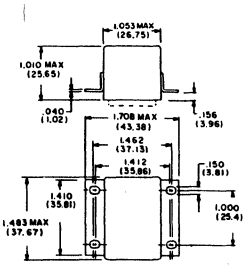

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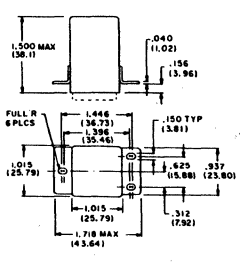
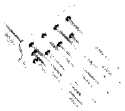
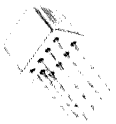


Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

MILITARY MINIGRID/ LOW LEVEL TO 1 AMP D.P.D.T.

MILITARY TO-5 LOW LEVEL TO 1 AMP D.P.D.T.

	SERIES	(J) MGA	(J) MGS	(J) MGAT	(J) MGST	(J) MA	(J) MS
							
	Applicable Mil-Spec	MIL-R-39016/17 MIL-R-39016/18 MIL-R-39016/19	MIL-R-39016/41 MIL-R-39016/42 MIL-R-39016/43	MIL-R-28776/6	MIL-R-28776/7	MIL-R-39016/9 MIL-R-39016/15 MIL-R-39016/20	MIL-R-39016/11 MIL-R-39016/16 MIL-R-39016/21
FEATURES		• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature • MOSFET driver	• Hermetically sealed • All welded construction • Balanced armature • MOSFET driver	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature
ELEC.	Contact Rating Contact Form Rated Coil Voltages	1 amp. @ 28 Vdc D.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 48 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 30 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 48 Vdc
MECH.	Dimensions (LxWxH) Weight Terminals	0.370″ sq. max. x 0.280″ max. ht. 0.09 oz. (2.55g) max. Straight Pins 0.187 and 0.500	0.370″ sq. max. x 0.375″ max. ht. 0.12 oz. (3.40g) max. Straight Pins 0.187 and 0.500	0.470″ x 0.370″ x 0.280″ max. 0.11 oz. (3.12g) max. Straight Pins 0.500	0.470″ x 0.370″ x 0.375″ max. 0.18 oz. (5.11g) max. Straight Pins 0.500	0.370″ dia. x 0.280″ max. ht. 0.09 oz. (2.55g) 0.10 oz. (2.80g) with mounting pad Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.375″ max. ht. 0.15 oz. (4.25g) 0.16 oz. (4.50g) with mounting pad Straight Pins 0.187, 0.500 and 1.5
OPTIONS	Suppression Mounting Styles	Available for DC units Mounting pad available.	Available for DC units. Mounting pad available.	All DC units. Mounting pad available.	All DC units. Mounting pad available.	Available for DC units. Mounting pads available.	Available for DC units. Mounting pads available.
ENVIRON.	Temperature Shock Vibration Sine	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz

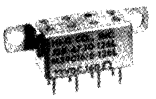
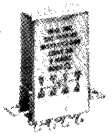
MILITARY TO-5 LOW LEVEL TO 1 AMP S.P.D.T. AND D.P.D.T.

	SERIES	(J) MAT	(J) MST	(J) 1MA	(J) 1MS	(J) 1MAT	(J) 1MST
							
	Applicable Mil-Spec	MIL-R-28776/1	MIL-R-28776/3	MIL-R-39016/7 MIL-R-39016/23 MIL-R-39016/24	MIL-R-39016/10 MIL-R-39016/25 MIL-R-39016/26	MIL-R-28776/5	MIL-R-28776/4
FEATURES		• Hermetically sealed • All welded construction • Balanced armature • Transistor driver	• Hermetically sealed • All welded construction • Balanced armature • Transistor driver	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature • Transistor driver	• Hermetically sealed • All welded construction • Balanced armature • Transistor driver
ELEC.	Contact Rating Contact Form Rated Coil Voltages	1 amp. @ 28 Vdc D.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 48 Vdc	1 amp. @ 28 Vdc S.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc S.P.D.T. 5 to 40 Vdc	1 amp. @ 28 Vdc S.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc S.P.D.T. 5 to 40 Vdc
MECH.	Dimensions (LxWxH) Weight Terminals	0.370″ dia. x 0.280″ max. ht. 0.09 oz. (2.55g) max. Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.375″ max. ht. 0.15 oz. (4.26g) max. Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.280″ max. ht. 0.08 oz. (2.27g) max. 0.09 oz. (2.5g) with mounting pad Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.375″ max. ht. 0.10 oz. (2.84g) max. 0.11 oz. (3.09g) with mounting pad Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.280″ max. ht. 0.09 oz. (2.55g) max. Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.375″ max. ht. 0.14 oz. (3.98g) max. Straight Pins 0.187, 0.500 and 1.5
OPT.	Suppression Mounting Styles	All DC units Mounting pad available.	All DC units. Mounting pad available.	Available for DC units. Mounting pad available.	Available for DC units. Mounting pad available.	All DC units. Mounting pad available.	All DC units. Mounting pad available.
ENVIRON.	Temperature Shock Vibration Sine	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz

Struthers-Dunn/HI-G Sales Headquarters, Lambs Rd., Pitman, NJ 08071-0901; Tel. 609-589-7500; EASY LINK 62287939; FAX: 609-589-2619

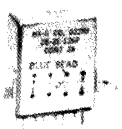
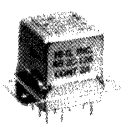
Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

MILITARY BALANCED ARMATURE, CRYSTAL CAN TYPE 2A-10A, D.P.D.T.

SERIES	(J) 2G	(J) 2K	2B	2BC	2T
					
Applicable Mil-Spec	MIL-R-39016 MIL-R-39016/13	MIL-R-39016/6 MIL-R-39016/22	MIL-R-5757/10	MIL-R-5757/13	MIL-R-5757/23
FEATURES	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature • Coil suppression available	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature
ELEC. Contact Rating No. of Cycles Contact Form Rated Coil Voltages	2 amps. @ 28 Vdc 100K min. D.P.D.T. 5 to 36 Vdc	2 amps. @ 28 Vdc 100K min. D.P.D.T. 5 to 26 Vdc for /6 6 to 26 Vdc for /22	2 amps. @ 28 Vdc 100K min. D.P.D.T. 6 to 26 Vdc	2 amps. @ 28 Vdc 100K min. D.P.D.T. 6 to 40 Vdc	10 amps. @ 28 Vdc 50K min. D.P.D.T. 6 to 120 Vdc
MECH. Dimensions (LxWxH) Weight Terminals	0.310″ x 0.610″ x 0.320″ max. 0.17 oz. (4.82g) max. Circuit Board Pins Solder Hooks	0.410″ x 0.810″ x 0.410″ max. 0.35 oz. (9.92g) max. Straight Pins 0.187 Solder Hooks 0.190 Wire Leads 3.000 Plug-In 0.187	0.400″ x 0.800″ x 0.875″ max. 0.8 oz. (22.68g) max. Pin .187 Solder Lug	0.400″ x 0.800″ x 1.271″ max. 1.1 oz. (31.2g) max. Pin .187 Solder Lug	0.625″ x 1.075″ x 1.300″ max. 2.0 oz. (56.7g) max. Circut Board Pins Solder Hooks
OPTIONS Suppression Mounting Styles	— Bracket mounting available.	M39016/22 only Bracket & stud mounting available.	— Bracket, stud and laydown mounting available.	— Bracket, stud and laydown mounting available.	— Bracket mounting available.
ENVIRON. Temperature Shock Vibration	−65°C to +125°C 100G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 100G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms. 15G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6ms. 20G, 10 to 2,000 Hz

GENERIC TO-5 LOW LEVEL TO 1 AMP D.P.D.T.

GENERIC BALANCED ARMATURE, CRYSTAL CAN TYPE LOW LEVEL TO 10 AMP., S.P.D.To TO 4P.D.T.

SERIES	CA	CS	G	K	B (BR)	4B	KA
							
FEATURES	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature
ELEC. Contact Rating Contact Form Rated Coil Voltages	1 amp. @ 28 Vdc D.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 48 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 36 Vdc	2 amps. @ 28 Vdc D.P.D.T. 6 to 26 Vdc	2 amps. @ 28 Vdc D.P.D.T. 6 to 76 Vdc 26 to 115 Vac (BR)	2 amps. @ 28 Vdc 4P.D.T. 6 to 125 Vdc	2 amps. @ 28 Vdc D.P.D.T. 6 to 48 Vdc
MECH. Dimensions (LxWxH) Weight Terminals	0.370″ dia. x 0.280″ max. ht. 0.09 oz. (2.54g) max. Straight Pins 0.5 min.	0.370″ dia. x 0.375″ max. ht. 0.12 oz. (3.39g) max. Straight Pins 0.5 min.	0.310″ x 0.610″ x 0.320″ max. 0.17 oz. (4.82g) max. Circuit Board Pins Solder Hooks	0.410″ x 0.810″ x 0.410″ max. 0.35 oz. (9.9g) max. Straight Pins 0.187 Solder Hook 0.195 Wire Leads 1.500 Plug-in 0.187	0.410″ x 0.810″ x 0.900″ max. 1.0 oz. (28.3g) max. Pin 0.187 Solder Lug	0.810″ sq. max. x 0.875″ max. ht. 1.0 oz. (28.3g) max. Circit Board Pins Solder Hooks	0.410″ x 0.810″ x 0.500″ max. 0.4 oz. (11.3g) max. Straight Pins 0.187 Solder Hook 0.195 Wire Leads 1.500 Plug-in 0.187
OPTIONS Suppression Mounting Styles	Available for DC units Mounting pad available.	Available for DC units. Mounting pad available.	Available for DC units. Bracket mounting available.	Available for DC units. Bracket & stud mounting available.	Available for DC units. Bracket, stud and laydown mounting available	Available for DC units. Bracket & stud mounting available	Available for DC units. Bracket & stud mounting available
ENVIRON. Temperature Shock Vibration	−55°C to +125°C 30G, 6 ms. 10G, 10 to 500 Hz	−55°C to +125°C 30G, 6 ms. 10G, 10 to 500 Hz	−65°C to +125°C 100G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 3,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms 20G, 10 to 3,000 Hz

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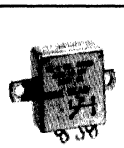
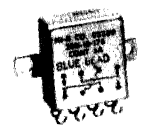
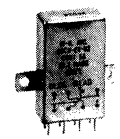
Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

GENERIC BALANCED ARMATURE, CRYSTAL CAN TYPE LOW LEVEL TO 10 AMP, S.P.D.T. TO 4P.D.T.

	SERIES	BK	BC	BA	HA	2BN	1BCN
							
FEATURES		• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature
ELEC.	Contact Rating Contact Form Rated Coil Voltages	2 amps. @ 28 Vdc S.P.D.T. and D.P.D.T. 1.8 to 32.0 Vdc	2 amps. @ 28 Vdc S.P.D.T. and D.P.D.T. 1.8 to 40 Vdc	2 amps. @ 28 Vdc D.P.D.T. 6 to 26 Vdc	4 amps. @ 28 Vdc D.P.D.T. 6 to 26 Vdc	5 amps. @ 28 Vdc D.P.D.T. 6 to 76 Vdc	5 amps. @ 28 Vdc D.P.D.T. 6 to 40 Vdc
MECH.	Dimensions (LxWxH) Weight Terminals	0.410″ x 0.810″ x 0.900″ max. 0.95 oz. (26.8g) max. Pin 0.187 Solder Lug Circuit Lead 1.500	0.400″ x 0.800″ x 1.281″ max. 1.1 oz. (31.1g) max. Pin 0.187 Solder Lug	0.410″ x 0.810″ x 0.900″ max. 0.95 oz. (26.8g) max. Pin 0.187 Solder Lug Circuit Lead 1.500	0.410″ x 0.810″ x 0.450″ max. 0.35 oz. (9.9g) max. Straight Pins 0.187 Solder Hook 0.195	0.410″ x 0.810″ x 0.910″ max. 0.95 oz. (26.8g) max. Pin 0.187 Solder Lug	0.410″ x 0.810″ x 1.281″ max. 1.1 oz. (31.2g) max. Pin 0.187 Solder Lug
OPTIONS	Suppression Mounting Styles	Available for DC units. Bracket, stud and laydown mounting available.	Available for DC units. Bracket, stud and laydown mounting available.	Available for DC units. Bracket, stud and laydown mounting available.	Available for DC units. Bracket & stud mounting available	Available for DC units. Bracket, stud and laydown mounting available	Available for DC units. Bracket, stud and laydown mounting available
ENVIR.	Temperature Shock Vibration	–65°C to +125°C 100G, 6 ms. 15G, 10 to 2,000 Hz	–65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	–65°C to +125°C 100G, 6 ms. 15G, 10 to 2,000 Hz	–65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	–65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	–65°C to +125°C 100G, 6 ms. 15G, 10 to 2,000 Hz

GENERIC BALANCED ARMATURE, CRYSTAL CAN TYPE LOW LEVEL TO 10 AMP, S.P.D.T. TO 4P.D.T.

	SERIES	T (TR)	FS2	FS3	FS5
					
FEATURES		• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature
ELEC.	Contact Rating Contact Form Rated Coil Voltages	10 amps. @ 28 Vdc D.P.D.T. 6 to 115 Vdc 115 Vac (TR)	2 amps. @ 28 Vdc D.P.D.T. 5 to 48 Vdc	2 amps. @ 28 Vdc D.P.D.T. 5 to 48 Vdc	5 amps. @ 28 Vdc D.P.D.T. 5 to 48 Vdc
MECH.	Dimensions (LxWxH) Weight Terminals	0.625″ x 1.075″ x 1.300″ max. 2.0 oz. (56.7g) max. Circuit Board Pins Solder Hooks	0.410″ x 0.810″ x 0.410″ max. 0.35 oz. (10g) max. Straight Pins 0.187 Solder Hook 0.190	0.410″ x 0.810″ x 0.500″ max. 0.4 oz. (11.3g) max. Straight Pins 0.187 Solder Hook 0.190	0.410″ x 0.810″ x 0.460″ max. 0.38 oz. (10.8g) max. Straight Pins 0.187 Soldre Hook 0.190
OPTIONS	Suppression Mounting Styles	Available for DC units. Bracket mounting available.	Available for DC units. Bracket & stud mounting available.	Available for DC units. Bracket & stud mounting available.	Available for DC units. Bracket & stud mounting available.
ENVIR.	Temperature Shock Vibration	–65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	–55°C to +125°C 30G, 6 ms. 10G, 10 to 500 Hz	–55°C to +125°C 30G, 6 ms. 20G, 10 to 500 Hz	–55°C to +125°C 30G, 6 ms. 10G, 10 to 500 Hz

RF, CRYSTAL CAN, 75W 500 MHz, S.P.D.T. & D.P.D.T.

	SERIES	RFC	RFK	RFB/C
				
FEATURES		• Hermetically sealed • All welded relay construction • 150 mW	• Hermetically sealed • All welded relay construction • 250 mW	• Hermetically sealed • All welded relay construction • 250 mW (RFB) 40 mW (RFBC)
ELEC.	Aux. Contact Rating Power Capacity Power Switching Contact Form Rated Coil Voltages	2 amps. @ 28 Vdc 150 W 75 W S.P.D.T. 6 to 26.5 Vdc	2 amps. @ 28 Vdc 150 W 75 W D.P.D.T. 6 to 26.5 Vdc	2 amps. @ 28 Vdc 150 W 75 W D.P.D.T. 6 to 76 Vdc
RF CHARACTERISTICS	Frequency Range Voltage Standing Wave Ratio (VSWR) Characteristic Impedance Isolation	0 to 500 MHz < 1.1:1 typical @100 MHz < 1.2:1 typical @ 500 MHz 50 ohms standard 50 dB typical @ 100 MHz 40 dB typical @ 500 MHz	0 to 500 MHz < 1.1:1 typical @ 100 MHz < 1.2:1 typical @ 500 MHz 50 ohms standard 50 dB typical @ 100 MHz 40 dB typical @ 500 MHz	0 to 500 MHz < 1.1:1 typical @ 100 MHz < 1.2:1 typical @ 500 MHz 50 ohms standard 50 dB typical @ 100 MHz 40 dB typical @ 500 MHz
MECH.	Dimensions (LxWxH) Termination	0.500″ x 0.500″ x 0.510″ max. 6″ RG 196A/U standard	0.410″ x 0.810″ x 0.410″ max. 6″ RG 196A/U standard	0.410″ x 0.810″ x 0.900″ max. 6″ RG 196A/U standard (RFB) 0.410″ x 0.810″ x 1.281″ max. (RFBC)
ENVIR.	Temperature Shock Vibration	–65°C to +85°C 100G, 6 ms. 20G, 10to2,000 Hz	–65°C to +85°C 100G, 6 ms. 20G, 10to2,000 Hz	–65°C to +85°C 100G, 6 ms. 20G, 10to2,000 Hz

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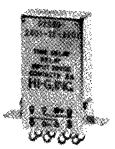
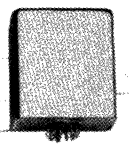
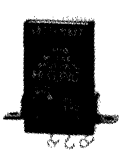
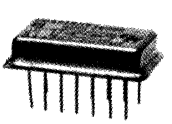
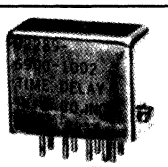
Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

TIME CONTROL, RELAY OUTPUT

	SERIES	1600 & 1700	2400	4600 & 4700	5600 & 5700	6600 & 6700
						
	Applicable Mil-Spec	Designed to meet environmental requirements of MIL-R-83726	Designed to meet environmental requirements of MIL-R-83726	Designed to meet environmental requirements of MIL-R-83726	Designed to meet environmental requirements of MIL-R-83726	MIL-R-83726/7 MIL-R-83726/8
FEATURES		• Delay on Operate • Fixed, 1600 series • Adjustable, 1700 series • Multiple mounting styles • AC or DC units	• Delay on Operate—Fixed • Multiple mounting styles Consult factor for custom units.	• Interval Timer • Fixed, 4600 series • Adjustable, 4700 series • AC or DC units	• Delay on Release • Fixed, 5600 series • Adjustable, 5700 series • Multiple mounting styles	• Delay on Operate, 6600 series • Delay on Release, 6700 series
ELEC.	Contact Rating Input Voltage Control Voltage Operating Current Control Current Operating Voltage min.-max. Contact Form	4A or 10A res @ 28 Vdc 28 Vdc nominal — 200 ma. max. — 18 to 31 Vdc 1,2,3 or 4P.D.T.	2A res @ 28 Vdc 28 Vdc nominal — 85 ma. max. — 18 to 31 Vdc 2P.D.T.	4A or 10A res @ 28 Vdc 28 Vdc nominal — 200 ma. max. — 18 to 31 Vdc 1,2,3 or 4P.D.T.	2A, 5A, or 10A res @ 28 Vdc 28 Vdc nominal 10 to 31 Vdc 250 ma. max. 25 ma. max. 18 to 31 Vdc 2P.D.T.	2A res @ 28 Vdc 28 Vdc nominal 18 to 31 Vdc (6700 only) 80 ma. max. 2 ma. max. (6700 only) 18 to 31 Vdc 2P.D.T.
TIMING	Timing Mode Delay on Operate Delay on Release % Accuracy Recycle Time	0.05 to 600 sec. — ±10% of nominal value 10 ms. (DC), 50 ms. (AC)	0.05 to 600 sec. — ±10% of nominal value 20 ms. max.	0.10 to 600 sec. — ±10% of nominal value 10 ms. (DC), 50 ms. (AC)	— 0.05 to 600 sec. ±10% of nominal value 10 ms. (DC), 50 ms. (AC)	0.06 to 300 sec. 0.10 to 300 sec. ±10% of nominal value 10 ms. max.
MECH.	Dimensions (LxWxH) Weight Terminals	1.790″ x 1.284″ x 2.419″ max. 8.5 oz. (240g) max. “J” type solder hooks	0.809″ x 0.406″ x 1.500″ max. 1.2 oz. (30g) max. “J” type solder hooks or P.C. board mount	1.790″ x 1.284″ x 2.419″ max. 8.5 oz.(240g) max. “J” type solder hooks	1.812″ x 1.812″ x 2.500″ max. 8.5 oz. (240g) max. “J” type solder hooks	1.750″ x 1.590″ x 1.000″ max. 4 oz. (100g) max. “J” type solder hooks
ENVIR	Temperature Shock Vibration	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 80 to 3,000 Hz

TIME CONTROL, SOLID STATE OUTPUT

	SERIES	1800 & 1900	2600	4800	6001 & 6155		6800 & 6900
							
	Applicable Mil-Spec	Designed to meet environmental requirements of MIL-R-83726	Designed to meet environmental requirements of MIL-R-83726	Designed to meet environmental requirements of MIL-R-83726	Designed to meet environmental requirements of MIL-R-83726/13(6001only) 6155 Designed to meet environmental requirements of MIL-R-83726		MIL-R-83726/24 MIL-R-83726/25
FEATURES		• Delay on Operate • Fixed, 1800 series • Adjustable, 1900 series • Several packaging styles	• Repeat Cycle—Fixed • Frequency selectable • Duty cycle selectable	• Interval—Fixed • Several packaging styles	• Delay on Operate—Fixed • Solid State Output • 14 pin D.I.P.		• Delay on Operate—Fixed MIL-R-83726/24 • Delay on Release—Fixed MIL-R-83726/25 • Plug-in crystal can module
ELEC.	Contact Rating Input Voltage Control Voltage Operating Current Control Current Operating Voltage min.-max. Contact Form	300 ma. @ 25°C 28 Vdc nominal — 10 ma. max. — 18 to 31 Vdc S.P.S.T./N.O.	300 ma. @ 25°C, 28 Vdc nominal — 30 ma. — 18 to 31 Vdc S.P.S.T./N.O.—Closure to Ground	300 ma. @ 25°C 28 Vdc nominal — 40 ma. max. — 18 to 31 Vdc S.P.S.T.N.O.	300 ma. @ 25°C 28 Vdc nominal — 10 ma. max. — 18 to 31 Vdc S.P.S.T.N.O. Closure to Ground	20 ma @ 25°C 5 Vdc nominal — 25 ma. max. — 4.5 to 5.5 Vdc S.P.S.T/N.O. Closure to Ground	150 ma. max. 28 Vdc nominal 28 Vdc nominal (/25 only) 10 ma. max. 2 ma. max. (/25 only) 20 to 32 Vdc S.P.S.T.—To Input Voltage
TIMING	Timing Mode Delay on Operate Delay on Release % Accuracy Recycle Time	0.05 to 600 sec. — ±10% of nominal value 10 ms. min.	0.05 to 600 sec., ON-time 0.05 to 600 sec, OFF-time ±10% of nominal value —	0.05 to 100 sec. (time interval) — ±10% of nominal value 10 ms. min.	0.05 to 600 sec. ±10% of nominal value 10 ms. min. 100 ms. min.		0.05 to 500 sec. (/24 only) 0.05 to 500 sec. (/25 only) ±10% of nominal value 10 ms. min.
MECH.	Dimensions (LxWxH) Weight Terminals	0.809″ x 0.406″ x 0.892″ 1 oz. (28g) max. “J” hook or P.C. board mount	1.790″ x 1.284″ x 2.419″ 8 oz. (200g) max. “J” type hook	0.809″ x 0.400″ x 1.500″. 2 oz.(50g) max. “J” hook or P.C. board mount	0.920″ x 0.580″ x 0.420″ 0.42 oz. (12g) max. 14 pins, D.I.P., 0.28″ long		0.810″ x 0.410″ x 0.640″ 0.56 oz. (16g) max. 8 pin, plug-in
ENVIR	Temperature Shock Vibration	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 150G, 1 ms. 20G, 80 to 3,000 Hz		−55°C to +125°C 1,100G, 0.5 ms. 20G, 500 to 3,000 Hz

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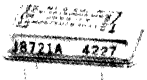
Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

SOLID STATE RELAYS

SERIES	JTS-5	JTS-6	JTS-7	JDS-8	JDS-9	JPS-10
						
Applicable Mil-Spec	MIL-R-28750/5	MIL-R-28750/6	MIL-R-28750/7	MIL-R-28750/8	MIL-R-28750/9	MIL-R-28750/10
FEATURES	• Transformer isolated, AC or DC • TO-5 package • "W" or "Y" level screening available.	• Transformer isolated • TO-5 package • "W" or "Y" level screening available.	• Transformer isolated • TO-5 package • "W" or "Y" level screening available.	• 1,000 Vrms optical isolation • D.I.P. package • "W" or "Y" level screening available.	• 1,500 Vrms optical isolation • D.I.P. package • "W" or "Y" level screening available.	• 1,500 Vrms optical isolation • Heavy duty die cast construction • "W" or "Y" level screening available.
ELEC. **Input Data**						
Input Voltage Range	4.0 to 7.0 Vdc	4.0 to 7.0 Vdc	4.0 to 7.0 Vdc	3.0 to 16.0 Vdc	3.8 to 32 Vdc	4.0 to 32.0 Vdc
Input Current	22 ma. DC max. @ rated voltage	22 ma. DC max. @ rated voltage	22 ma. DC max. @ rated voltage	18 ma. DC max. @ rated voltage	18 ma. DC max. @ rated voltage	16 ma. DC max. @ rated voltage
Rated Output Voltage	±40V, AC or DC	40 Vdc	250 Vdc	50 Vdc	250 Vrms AC	25 to 220 Vrms AC
Contact Form	S.P.S.T. N.O.	S.P.S.T. N.O.	S.P.S.T. N.O.	S.P.S.T. N.O.	S.P.S.T. N.O.	S.P.S.T. N.O.
MECH. Dimensions (LxWxH)	0.370" dia. max. x 0.275" max.	0.370" dia. max. x 0.275" max.	0.370" dia. max. x 0.275" max.	0.883" x 0.530" x 0.190" max.	0.883" x 0.530" x 0.190" max.	2.410" x 1.570" x 1.845" max.
Weight	0.18 oz. (5g) typical	0.18 oz. (5g) typical	0.18 oz. (5g) typical	0.18 oz. (5g) typical	0.18 oz. (5g) typical	6 oz. (170g) typical
Terminals	P.C. Board mounting, 0.50" min. leads	P.C. Board mounting, 0.50" min. leads	P.C. Board mounting, 0.50" min. leads	0.25" min. leads	0.25" min. leads	"J" type solder hooks
ENVIR Temperature	–55°C to +125°C	–55°C to +125°C	–55°C to +125°C	–65°C to +125°C	–55°C to +110°C	–55°C to +110°C
Shock	50G, 11 ms.	50G, 11 ms.	50G, 11 ms.	100G	100G	100G
Vibration	20G, 10 to 2,000 Hz	20G, 10 to 2,000 Hz	50G, 10 to 3,000 Hz	50G, 10 to 3,000 Hz	20G, 10 to 2,000 Hz	30G, 10 to 3,000 Hz

POWER MONITORS

SERIES	9000
	
Applicable Mil-Spec	Designed to meet environmental requirements of MIL-T-28800, Class 4
FEATURES	• Independent voltage, (9001), frequency (9002) & phase sensors (9003) modules are also available • Transformerless design • B.I.T. mode
ELEC. **Input Data**	
Voltage Range	80 to 140 Vac
Frequency Range	40 to 480 Hz
Phase Detection	Phase loss, reversal or missing neutral
Input	3φ WYE with neutral
Input current	30 ma./phase max.
Auxiliary Voltage	28 Vdc (B.I.T.)
Trip Value Accuracies	
Over Voltage	± 1% of set point
Under Voltage	± 1% of set point
Over Frequency	± 1% of set point
Under Frequency	± 1% of set point
Hysteresis	0.25% of setpoint
Output Data	
Contact Rating	1.0A res. @ 28 Vdc
Contact Form	D.P.D.T. relays, one per function
MECH. Dimensions (LxWxH)	5.500" x 4.000" x 3.250" max.
Weight	3.0 lbs. (1400g) max.
Terminals	Plug-in connector Winchester MRE-26P-G
ENVIR Temperature	*–10°C to +85°C
Shock	—
Vibration	—

AC & DC VOLTAGE SENSORS

SERIES	1310 & 1350
	
Applicable Mil-Spec	Designed to meet environmental requirements of MIL-R-83726
FEATURES	• AC 1350 Series • DC 1310 Series
ELEC.	
Pull-In Voltage	50 to 150 Vac, 10 to 150 Vdc
Drop Out Voltage	1.5 Vac, 0.25 Vdc below pull-in
Sensing Function	Relay energized above pull-in voltage
Current Drain	100 ma. AC, 15 ma. DC max. @ 25°C
% Accuracy	±2.5%
Max. Voltage	150% of pull-in voltage
Auxiliary Voltage	—
Operate Time	50 ms. max.
Release Time	50 ms. max.
Contact Rating	2A res. @ 30 Vdc
No. of Cycles	100K
Contact Form	D.P.D.T.
Dielectric Strength	1,000 Vrms, 60 Hz, all terminals to case
MECH. Dimensions (LxWxH)	1.250" x 1.000" x 2.000" max.
Weight	3.5 oz. (99g) max.
Terminals	J-type solder hooks
ENVIR Temperature	*–55°C to +125°C
Shock	50G, 1 ms.
Vibration	20G, 10 to 2,000 Hz

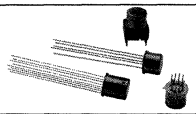
FREQUENCY SENSORS

SERIES	7000
	
Applicable Mil-Spec	Designed to meet environmental requirements of MIL-R-83726
FEATURES	—
ELEC.	
Input Voltage	95 to 135 Vac
Input Frequency Range	40 to 480 Hz
% Accuracy	±2%
Contact Form	D.P.D.T.
No. of Cycles	100K min.
Contact Rating	4A res. @ 30 Vdc
Dielectric Strength	1,000 Vrms, 60 Hz, all terminals to case
Insulation Res.	1,000 MΩ min. @ 500 Vdc
Current Drain	150 ma. max.
Hysteresis	0.5% from Trip Point
Sensing Function	Relay energizes above frequency set point
	S.P.D.T. available, 125°C Frequency Band Sensing available.
MECH. Dimensions (LxWxH)	1.790" x 1.284" x 2.419" max.
Weight	8.5 oz. (241g)
Terminals	J-type solder hooks
ENVIR Temperature	*–55°C to +85°C
Shock	50G, 1 ms.
Vibration	20G, 10 to 2,000 Hz

PHASE SENSORS

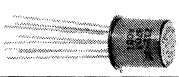
SERIES	1400
	
Applicable Mil-Spec	Designed to meet environmental requirements of MIL-R-83726
FEATURES	• P-type for static loads • Q-type for motor loads • Available in commercial plug-in unit • Consult factory for custom units
ELEC.	
Input Voltage	115 or 208 Vac
Input Frequency	50, 60 or 400 Hz
Operate Time	75 ms. max.
Release Time	100 ms. max.
Contact Form	S.P.D.T.
No. of Cycles	100K
Contact Rating	2A res. @ 30 Vdc
Dielectric Strength	1,000 Vrms, 60 Hz, all terminals to case.
Insulation Res.	1,000 MΩ min. @ 500 Vac
Sensing Function	Relay energizes for phase sequence A, B & C
MECH. Dimensions (LxWxH)	2.640" x 1.740" x 4.000" max.
Weight	12 oz. (350) max.
Terminals	"J" type solder hooks
ENVIR Temperature	*–55°C to +85°C
Shock	50G, 1 ms.
Vibration	20G, 10 to 2,000 Hz

Struthers-Dunn/HI-G Sales Headquarters, Lambs Rd., Pitman, NJ 08071-0901; Tel. 609-589-7500; EASY LINK 62287939; FAX: 609-589-2619



TELEDYNE RELAYS
Military TO-5 Relays

SERIES		CONTACT DATA: ARRANGEMENT	CONTACT DATA: MAX. RATING (AMPS @ 28 VDC)	COIL DATA: NOMINAL VOLTAGE (VDC)	COIL DATA: NOMINAL RESISTANCE (Ω)	COIL DATA: NOMINAL OPERATING POWER (mW) AT RATED VDC	APPLICABLE MIL SPEC. SHEET MIL -R-
411		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	39016/7
411D		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	39016/23
411DD		1 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 280, 500, 1130, 2000	300	39016/24
411T		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	28776/5
412		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/9
412D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/15
412DD		2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	39016/20
412T		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	28776/1
431	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	39016/10
431D	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	39016/25
431DD	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	100, 200, 630, 1025, 2300, 4000, 6500, 11000	150	39016/26
431T	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	28776/4
432	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	39016/11
432D	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	39016/16
432DD	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 850, 1600, 3300, 6500, 11000	200	39016/21
432T	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	28776/3
421	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/8
421D	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/27
421DD	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	290	39016/28
420/422	MAGNETIC LATCHING	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/12
420D/422D	MAGNETIC LATCHING	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/29
420DD/422DD	MAGNETIC LATCHING	2 FORM C	1	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	290	39016/30



High Current (2 Amperes) Military TO-5 Relays

SERIES	CONTACT DATA: ARRANGEMENT	CONTACT DATA: MAX. RATING (AMPS @ 28 VDC)	COIL DATA: NOMINAL VOLTAGE (VDC)	COIL DATA: NOMINAL RESISTANCE (Ω)	COIL DATA: NOMINAL OPERATING POWER (mW) AT RATED VDC	APPLICABLE MIL SPEC. SHEET MIL -R-
212	2 FORM C	2	5, 12, 26.5	28, 200, 800	820	–



Commercial/Industrial TO-5 Relays

SERIES		CONTACT DATA: ARRANGEMENT	CONTACT DATA: MAX. RATING (AMPS @ 28 VDC)	COIL DATA: NOMINAL VOLTAGE (VDC)	COIL DATA: NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
712		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
712D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
712TN		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
732	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
732D	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
732TN	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
720/722	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
720D/722D	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

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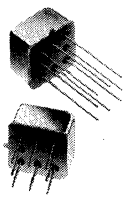
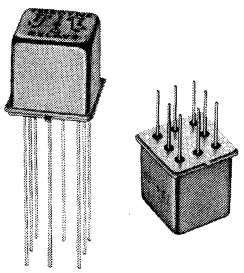


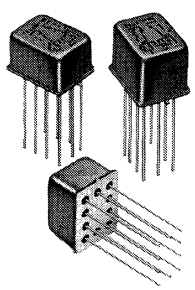


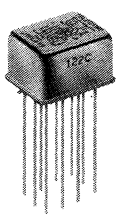
Centigrid® Military Relays

- **General purpose 114 Series**
- **Sensitive 134 Series**

The Centigrid® 114 Series relays are subminiature, hermetically sealed, armature relays featuring low profile, .275" (6.99mm) high by .370" (9.4mm) square, with .100" grid spaced terminals. The sensitive 134 Series is .375" (9.5mm) high and features ultra-low coil power dissipation. Both Centigrids® feature all-welded construction, hermetic sealing, and high force/mass ratios for excellent resistance to environmental extremes. Gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability well into the UHF spectrum. The 114 Series and 134 Series are qualified to L, M and P levels of MIL-R-39016.

SERIES	CONTACT DATA		COIL DATA			APPLICABLE MIL SPEC. SHEET MIL -R-
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE	NOMINAL RESISTANCE	NOMINAL OPERATING POWER (mW) AT RATED VDC	
114	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/17
114D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/18
114DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	39016/19
134	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200	39016/41
134D	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200	39016/42
134DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 800, 1600, 3200, 6500, 11000	200	39016/43





CMOS Compatible Centigrid® Military Relays

- **CMOS compatible general purpose 116C Series**
- **CMOS compatible sensitive 136C Series**
- **CMOS compatible magnetic latching 122C Series**

CMOS compatible Centigrid® relays are subminiature, hermetically sealed, armature relays capable of being directly driven by most IC logic families. Their low profile height and .100" grid spaced terminals, which precludes the need for spreader pads, make them ideal for applications where extreme packaging density and/or close PC board spacing are required. The 116C and 136C Series are qualified to L and M levels of MIL-R-28776 and incorporate internal silicon planar epitaxial type diodes for coil suppression, zener diodes to protect the MOSFET gate inputs, and N-channel enhancement-mode MOSFET chips. The 122C, which incorporates the same interface circuitry as the 116C and 136C, is a magnetic latching relay which is actuated by a short duration voltage pulse. The magnetic "memory" of this device precludes the need for constant bias and or battery backup in the event of system power failure.

SERIES	CONTACT DATA		COIL DATA			APPLICABLE MIL SPEC. SHEET MIL -R-
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC	
116C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	28776/6
136C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 800, 1600, 3200	200	28776/7
122C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	48, 120, 280, 500, 1130, 2000	335	–

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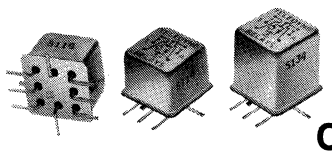
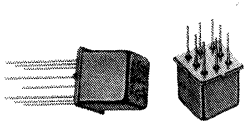


Surface Mount Centigrid® Military Style Relays

- **General purpose S114 Series**
- **Sensitive S134 Series**

Teledyne Relays' S114 and S134 Series are subminiature, hermetically sealed, surface mountable relays, which combine the proven reliability of the Centigrid® Series relays with pre-tinned leads specifically formed in compliance with MIL-STD-454 to make them ideal for all types of surface mount reflow processes. The basic design and internal construction are identical to the 114 & 134 Series Centigrid® relays (as described on Page 2) and meet the requirements of MIL-R-39016.

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
S114	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
S114D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
S114DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450
S134	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200
S134D	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200
S134DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 800, 1600, 3200, 6500, 11000	200



Low Cost 172 Series Centigrid® Commercial/Industrial Relays

Low cost commercial versions of the DPDT MIL qualified Centigrid® relays. Hermetic sealing, all welded construction, and gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability well into the UHF spectrum.

	GENERIC PART NUMBERS	172-5 172D-5	172-12 172D-12	172-26 172D-26
Coil Voltage (VDC)	Nom.	5.0	12.0	26.5
	Max.	5.8	16.0	32.0
Coil Resistance (ohms ± 20%)		64	400	1600
Pick-up Voltage (VDC, max.) Pulse Operation		3.8	9.0	18.0
Coil Operating Power at Nominal Voltage (Milliwatts)		405	360	440
Diode P.I.V. (VDC, min.) 172D			100	
Negative coil transient (VDC, max.) 172D			2.0	

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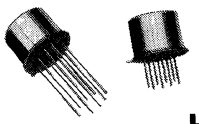
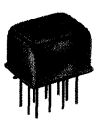


High Environmental Military Style TO-5 Relays

Designed to withstand severe environmental conditions of shock, vibration, or elevated temperature in excess of normal military specification levels. The following versions are available, all of which meet other requirements of MIL-R-39016:

412H Series—High Temperature (200°C)
412K Series—High Shock (4000 g's/0.5ms)
412V Series—High Vibration (380 g's @ 200 Hz)
432H Series—High Temperature (200°C)
432V Series—High Vibration (380 g's @ 200 Hz)
422H Series—High Temperature (200°C)
422K Series—High Shock (2000 g's/0.5ms)

SERIES		CONTACT DATA		COIL DATA		
		ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
412H		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
412K		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 80, 160, 300, 600, 1350	500
412V		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 70, 155, 235, 610, 1130	525
432H	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
432V	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	80, 120, 240, 480, 950, 1900	370
422H	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
422K	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290



RF Relays

- **RF120 Series Military Style Centigrid® Relays**
- **RF170 Series Commercial Centigrid® Relays**

The RF120 and RF170 Series relays are subminiature, hermetically sealed Centigrid® relays featuring extremely low intercontact capacitance that have been optimized to provide exceptional RF performance over the full UHF spectrum. These Series combine microwave switching capability with Teledyne Relays' superior all-welded construction, proven magnetic-latching design, and high force/mass ratios for ruggedness and performance stability in severe environments. Gold plated precious metal contacts ensure reliable DC switching from low-level to ½ amp, as well as low, stable insertion loss.

SERIES	CONTACT DATA			TYPICAL RF DATA AT 1GHZ			COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	INTERCONTACT CAPACITANCE (pF, TYP.)	ISOL. (dB)	INS. LOSS (dB)	VSWR	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL POWER (mW)
RF120 RF170	2 FORM C	0.5	0.02	45	.15	1.10:1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

TELEDYNE RELAYS

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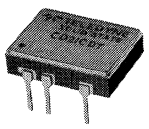
Detailed specifications on any of our products or a complete catalog are available on request.

TELEDYNE SOLID STATE

Military Solid State Relays

CD Series — Low Cost — Short Circuit Protected
Status Indication — Optically Isolated — 60 Vdc Power FET Output



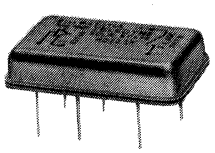
The CD Series is a family of low cost military solid state relays with all the features of our standard solid state relays.

PART NUMBER*	DESC DRAWING NUMBER	RELAY TYPE	MAXIMUM LOAD CURRENT (25°C)
CD00CFW	90091-007	Basic Solid State Relay (SSR)	2.0 Adc
CD00CFY	90091-008		
CD01CFW	90091-005	SSR with Control Status	2.0 Adc
CD01CFY	90091-006		
CD20CDW	90091-003	SSR with Short Circuit Protection	1.0 Adc
CD20CDY	90091-004		
CD21CDW	90091-001	SSR with Short Circuit Protection and Control Status	1.0 Adc
CD21CDY	90091-002		

* The W or Y suffix denotes the screening level of MIL-R-28750.

- **TTL/CMOS Logic Compatible Control**
- **Integrated Short Circuit/Current Overload Protection**
- **Status Indication Provides System Built-In-Test Capability**
- **Low Profile Hermetically Sealed Ceramic Package**
- **Meets MIL-STD-704 Surge and Spike Requirements for 28 Vdc Systems**

HD Series — Short Circuit/Current Overload Protected
True Output Status Feedback — Optically Isolated



PART NUMBER*	DESC DRAWING NUMBER	RELAY TYPE	MAXIMUM LOAD CURRENT (25°C)
HD00CFW	88062-007	Basic Solid State Relay (SSR)	2.1 Adc
HD00CFY	88062-008		
HD02CFW	88062-005	SSR with Switch Status	2.1 Adc
HD02CFY	88062-006		
HD20CFW	88062-003	SSR with Short Circuit Protection	2.1 Adc
HD20CFY	88062-004		
HD22CFW	88062-001	SSR with Short Circuit Protection and Switch Status	2.1 Adc
HD22CFY	88062-002		
HD24CFW		SSR with Short Circuit Protection and Trip Status	2.1 Adc
HD24CFY			

* The W or Y suffix denotes the screening level of MIL-R-28750.

- **TTL/CMOS Logic Compatible Control**
- **Optically Isolated Switch Status Indicates True Output State**
- **Integrated Short Circuit/Current Overload Protection**
- **60 Vdc Power FET Output**
- **Low Profile Hermetic Package**
- **Meets MIL-STD-704 Surge and Spike Requirements for 28 Vdc Systems**
- **Available with Short Circuit Trip Status (HD24CF)**

TELEDYNE SOLID STATE
A Division of Teledyne Relays
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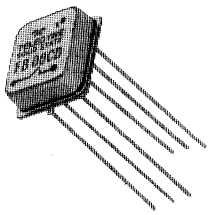
TELEDYNE SOLID STATE

Military Solid State Relays

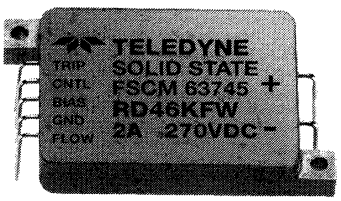
FB Series — Bi-directional Power FET Output
Low Leakage — Optically Isolated — Fast Switching Speed

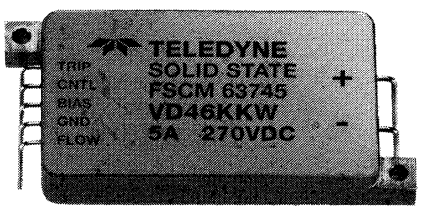


PART NUMBER*	DESC DRAWING NUMBER	RELAY DESCRIPTION	MAXIMUM TURN-ON TIME	MAXIMUM TURN-ON TIME
FB00CDW	89116-005	Basic Solid State Relay ±1.0 A @ ±80 Vdc Output	800 μs	500 μs
FB00CDY	89116-006			
FB00FCW	89116-001	Basic Solid State Relay ±0.5 A @ ±180 Vdc Output	800 μs	500 μs
FB00FCY	89116-002			
FB00KBW	89116-003	Basic Solid State Relay ±250 mA @ ±350 Vdc Output	500 μs	500 μs
FB00KBY	89116-004			

* The W or Y suffix denotes the screening level of MIL-R-28750.

- **High Voltage Power FET Output**
- **Low Leakage Current (< 200 Nanoamperes)**
- **Third Output Pin Doubles Load Current Capability**
- **Adjustable Turn-on Times**
- **Low Profile 6 Pin Mini-DIP Package**





RD/VD Series — Solid State Relays
28 and 270 Vdc Remote Power Controllers

PART NUMBER*	RELAY DESCRIPTION
RD46CF	Solid State Relay 28 Vdc, 2A Power Controller
RD46CK	Solid State Relay 28 Vdc, 5A Power Controller
RD46CL	Solid State Relay 28 Vdc, 7.5A Power Controller
VD46CM	Solid State Relay 28 Vdc, 10A Power Controller
VD46CN	Solid State Relay 28 Vdc, 15A Power Controller
RD46KD	Solid State Relay 270 Vdc, 1A Power Controller
RD46KF	Solid State Relay 270 Vdc, 2A Power Controller
VD46KK	Solid State Relay 270 Vdc, 5A Power Controller

* A suffix, W or Y, denoting the screening level of MIL-R-28750 must be added to the part number.

- **Temperature-independent Current Rating and Overload Protection**
- **Integrated Short Circuit Protection**
- **Surge Tolerant Overcurrent Protection Prevents Nuisance Tripping**
- **Optically Isolated Output and Status Lines**
- **Output Capable of Sourcing and Sinking Load Current**
- **Extremely Low ON Resistance**
- **Flow and Trip Status**
- **TTL-CMOS Compatible Control**
- **Meets Surge and Spike Requirements of MIL-STD-704**
- **Low Profile Hermetic Package Designed for MIL-STD-2000 compliance**

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TELEDYNE SOLID STATE

Commercial/Industrial Solid State Relays

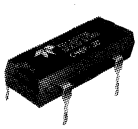
Subminiature Solid State Relays in Standard DIP Packages



Features all solid state circuitry with hybrid microcircuit construction, and high input/output isolation (up to 2500 Volts/10^9 Ohms). Fourteen models available providing choice of output: bi-directional, AC (zero or non-zero switch) and DC. The 640 Series, 643 Series and C46/47 Series are direct pin-for-pin replacements for standard TO-116 DIP reed relays.

- **641/645 Series and 645V-2H are UL recognized (File #55197) and CSA certified (File #31043)**
- **645V-2H is VDE approved to VDE 0883/6.80**
- **645 Series meets VDE and FCC Class A conducted emission limits**
- **C46/C47, and 645 Series are patented**

TELEDYNE PART NUMBER	CONTROL RATINGS		ISOLATION	MAXIMUM LOAD RATINGS			
	VOLTAGE (Vdc)	MAXIMUM CURRENT (mAdc @ 5V)	TRANSFORMER/ OPTICAL	TYPE (AC/DC)	CURRENT @ MAXIMUM INPUT VOLTAGE	VOLTAGE CONTINUOUS	VOLTAGE TRANSIENT (PEAK)
640-1	4-10	22	Transformer	Bi-directional	±80 mA	±50 Vpk	±50 Vpk
641-1	4-10	16	Transformer	AC	0.5 A	140 Vrms	200 Vpk
641-2	4-10	16	Transformer	AC	0.5 A	250 Vrms	400 Vpk
643-1	3.8-10	15	Transformer	DC	0.4 A	60 Vdc	60 Vdc
643-2	3.8-10	15	Transformer	DC	0.1 A	250 Vdc	250 Vdc
643-3	3.8-10	15	Transformer	DC	0.6 A	130 Vdc	130 Vdc
645-1	3.8-32	12	Optical	AC	1 A	140 Vrms	200 Vpk
645-2	3.8-32	12	Optical	AC	1 A	250 Vrms	400 Vpk
645-2H	3.8-32	12	Optical	AC	1 A	250 Vrms	550 Vpk
645V-2H	3.8-32	15.5	Optical	AC	1 A	250 Vrms	550 Vpk



Serendip Power FET Relays

C46F-10	3.8-32	12	Optical	Bi-Directional	1.0 A	± 50 Vdc	± 50 Vdc
C46F-20	3.8-32	12	Optical	Bi-Directional	0.75 A	± 90 Vdc	± 90 Vdc
C46F-30	3.8-32	12	Optical	Bi-Directional	0.4 A	±180 Vdc	±180 Vdc
C46F-40	3.8-32	12	Optical	Bi-Directional	0.25 A	±360 Vdc	±360 Vdc
C47F-10	3.8-32	12	Optical	DC	1.75 A	50 Vdc	50 Vdc
C47F-20	3.8-32	12	Optical	DC	1.0 A	90 Vdc	90 Vdc
C47F-30	3.8-32	12	Optical	DC	0.6 A	180 Vdc	180 Vdc
C47F-40	3.8-32	12	Optical	DC	0.4 A	360 Vdc	360 Vdc

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TELEDYNE SOLID STATE

Commercial/Industrial Solid State AC Power Relays

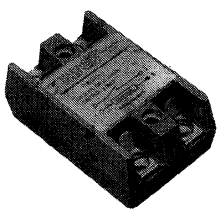
601 Series — Optically Isolated, Zero Voltage Turn-On 5 and 10 Amps




UL Recognized — File #E59547
CSA Certified — File #31043

CONTROL VOLTAGE RANGE	MAXIMUM LOAD VOLTAGE		MAXIMUM LOAD CURRENT RATING & PART NUMBERS	
	CONTINUOUS Vrms	TRANSIENT Vpk	5 A	10 A
3-32 Vdc	250	500	601-1	601-2
	250	600	601-1H	601-2H

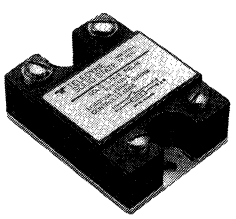
611 Series — Optically Isolated, Zero Voltage Turn-On 10 to 40 Amps



UL Recognized — File #E55197
CSA Certified — File #31043
(611-11 thru 611-16)

CONTROL VOLTAGE RANGE	MAXIMUM LOAD VOLTAGE		OUTPUT CURRENT RATING & PART NUMBERS			
	CONTINUOUS (RMS)	TRANSIENT (PEAK)	10 A	15 A	25 A	40 A
3-28 Vdc	140	200	611-7	611-3	611-1	611-5
	250	400	611-8	611-4	611-2	611-6
	250	600	611-8H	611-4H	611-2H	611-6H
90-250 Vac (47-70 Hz)	140	200	611-17	611-13	611-11	611-15
	250	400	611-18	611-14	611-12	611-16
	250	600	611-18H	611-14H	611-12H	611-16H

615, 615V Series — Optically Isolated, Zero Voltage Turn-On 10, 25, and 40 Amps



- TTL Logic Compatible Input
- High Dielectric Isolation

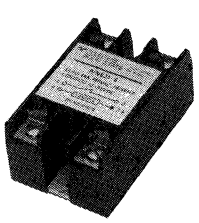
615 Series
CSA Certified
File #31043
UL Recognized
File #E55197

615V Series
VDE Approved
TO 0806/8.81

CONTROL VOLTAGE RANGE	OUTPUT (LOAD) CURRENT RATING & PART NUMBER			MAXIMUM LOAD VOLTAGE	
	10A	25 A	40 A	CONTINUOUS (RMS)	TRANSIENT (PEAK)
3-32 Vdc	615-1	615-3	615-5	140	200
	615-2	615-4	615-6	250	400
	615-2H	615-4H	615-6H	250	600
3.8-32 Vdc	615V-2H	615V-4H	615V-6H	250	600

621 Series — High Voltage, Optically Isolated, Zero Voltage Turn-On

Designed to meet safety requirements of UL, CSA, VDE and IEC and dielectric requirements of VDE.



- CSA Certified File #31043 (621-1 thru 621-6)
- UL Recognized File #E55197 (621-1 thru 621-6)
- 3750 Vrms Isolation
- 480 Vrms, 800 Vpk High Voltage Output

CONTROL VOLTAGE RANGE	MAXIMUM LOAD CURRENT RATING & PART NUMBERS		
	15 A	25 A	40 A
3-14 Vdc	621-1	621-3	621-5
12-32 Vdc	621-2	621-4	621-6
90-250 Vac (45-70 Hz)	621-11	621-13	621-15

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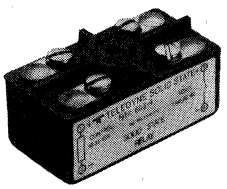
TELEDYNE SOLID STATE

Commercial/Industrial Solid State DC Power Relays

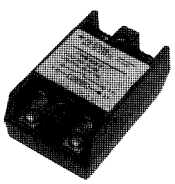
603 Series — Optically/Transformer Isolated



MAXIMUM LOAD CURRENT RATING AND PART NUMBERS		CONTROL VOLTAGE RANGE	ISOLATION	MAXIMUM LOAD VOLTAGE
2 Adc	5 Adc			
603-1	603-2	3-32 Vdc	Optical	50 Vdc
603-21*	603-22*	3-32 Vdc	Optical	50 Vdc
—	603-3	4-10 Vdc	Transformer	250 Vdc
—	603-4	10-32 Vdc	Transformer	250 Vdc
603-11	603-12	90-250 Vac	Optical	50 Vdc

*** Note: 603-21, -22 have controlled rise and fall time.**

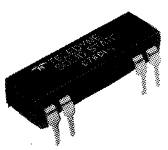
613 Series — High Current, Transformer Isolated



TELEDYNE PART NUMBER	CONTROL VOLTAGE RANGE	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT
613-1	4-10 Vdc	50 Vdc	20 Adc
613-2	10-32 Vdc		

Solid State Computer Input/Output Interface Modules

C76 DIP I/O™ System
Optically Isolated — TTL/CMOS Logic Compatible Control

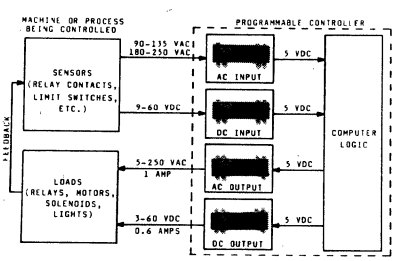


- **Enable Function on Inputs**
- **High Noise Immunity**
- **Meets VDE Voltage and Spacing Requirements**
- **TO-116 DIP Package (16 pin)**

PART NUMBER	TYPE	CHARACTERISTICS
C76AO-1	AC Output	3.8-16 Vdc Input 5-250 Vrms, 1 A Output
C76AI-1	AC Input	90-135 Vrms and 180-250 Vrms Inputs
C76DO-1	DC Output	3.8-16 Vdc Input 3-60 Vdc, 0.6 A Output
C76DI-1	DC Input	9-60 Vdc Input

Teledyne Solid State C76 DIP I/O™ Modules are designed for use in computerized control systems for noise-free isolated interfacing of computer logic elements to harsh industrial environments. Modules employ custom microcircuits in a TO-116 DIP. Eliminates mounting tracks for low "per-point" cost. Meets VDE requirements. Features CMOS and TTL compatibility, optical isolation, high noise immunity and an ENABLE function on input modules. For use in robotics, computerized process control, machine tool control, programmable controllers and ATE.

C76 I/O INTERFACE SYSTEM



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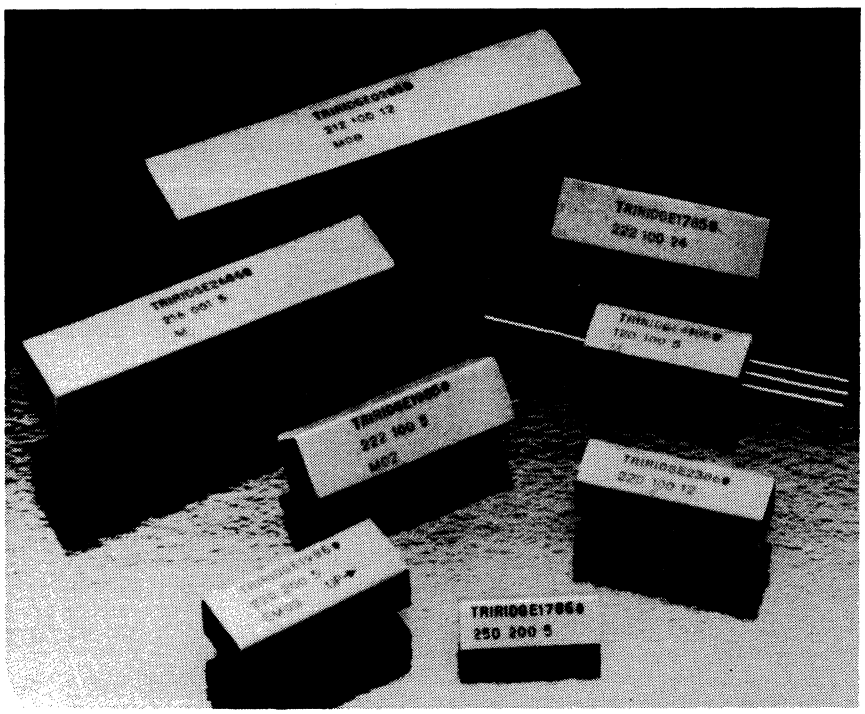
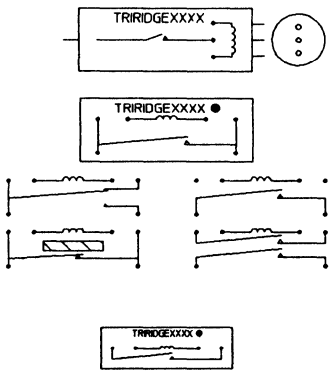
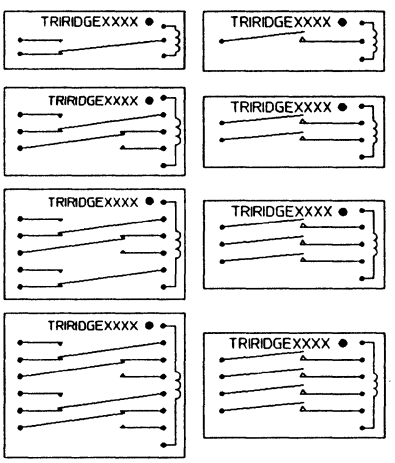
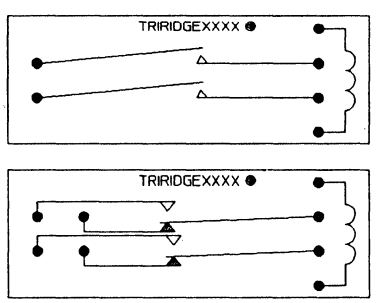




SCHEMATICS - TOP VIEW





Axial Lead Small:
101 - High Sensitivity - 1 thru 3 Pole
Radial Lead Small:
203 - High Sensitivity - 1.0 x .15(25.4 x 3.81)
205 - High Sensitivity - 1.0 x .13(25.4 x 3.17)
220 - High Sensitivity - 1.0 x .10(25.4 x 2.54)
222 - High Dielectric - .4 (10.16) C to C
230 - 1-4 Pole True 100 VDC Switching Form C
1.0 x .10(25.4 x 2.54)
260 - Like 220 Series, Parallel Coil Pins
Radial Lead Miniature:
226 & 228 Dip Pluggable .30 x .10(25.4 x 7.62)
250 - High Sensitivity - 1.0 x .10(25.4 x 2.54)
Radial Lead Large:
216 - General Purpose - Options To 50 W
212 - GP High Sensitivity - Options To 50 W

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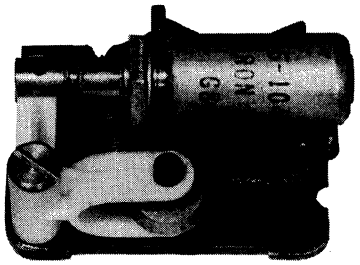
SOLENOIDS

Manufacturer	Starting EEM Page No.	Model/Series	Linear			Rotary	Proportional (Servo)	Stepping	
			Frame Type					Unidirectional	Bidirectional
			C	D	Tubular				
Bicron	B•1615		√	√	box				
Deltrol Controls	B•1616	C-1, C-2, C-3, C-6, C-7, C-8, C-9, D-11, D-22, D-28, D-3HD, D-4, D-4HD, MED	√	√	√				
Detroit Coil Co.	B•1620	O, TEEN, 20, 50 Oil Immersed M-LINE 28	√ √ √		√				
Dormeyer Ind.	B•1621	B, P 1000-3000 C	√	√	box				
Electro-Mechanisms	B•1624	SP; PO TSP; TPO	√		√				
Electronic Specialty	B•1626	SA			√				
Liberty Controls	B•1627	+ Magnetic Matching Solenoid	√	√	box				
Linear Motions	B•1628	ALL			√				
Lucas Ledex Inc.	B•1629	Rotary, Tubular, Brushless Torque Actuator, Magnetic Latching		√	√ √	√ √			
Oak Switch	B•1633	2E, 3B, 3E, 5B, 5E, 5S, 6E, 6S, 34, 35, 36, 37, 38, 39, 40, 41, 42, C17-18, C8-14, C8-32, C12-24, C16-18, C16-32, C24-26, C24-38			box √	√		√ √	
Regdon	B•1634	312,5u5, 827 R7x9, R8x7 GDAY GRFY	√	√	box √	√	√		

LINEAR MOTION SOLENOIDS

INFORMATION



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IMPORTANT ADVANTAGES FOR YOUR PRODUCT

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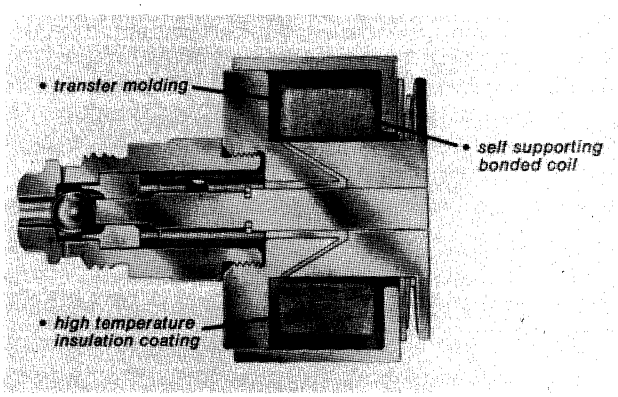
- Tough—Durable—Dependable
- Exceptional Force vs. Size
- Harsh Environment Applications
- Mil-S-4040 Capability
- Value Priced
- ISO 9001 Quality System

QUALITY/RELIABILITY DESIGNED INTO BICRON SOLENOIDS:



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  - Power
  - Envelope
  - Temperature
  - Submersible
- Your Construction
  - Box Frames
  - C Frames
  - Tubular Frames
  - Poppet Valves
- Your Insulation Systems
  - Including Class H

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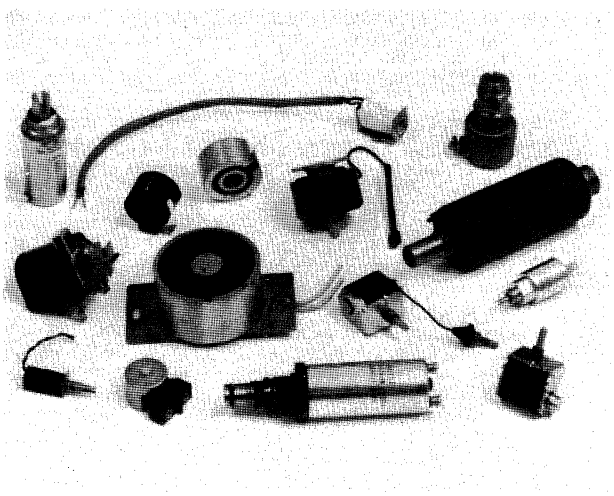

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Application and Design Notes
Specification Guidelines

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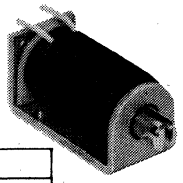
DELTROL SOLENOIDS

MADE IN U.S.A. SEE SECTION 4500 FOR RELAYS

C-1 PULL TYPE

L = 13/16
H = 7/16
W = 23/64
WIRE LEADS



NOTE: Standard intermittent duty at nominal voltage is 25%, maximum on time is 30 seconds. Approx. 35 sq. in. heat sink is required.

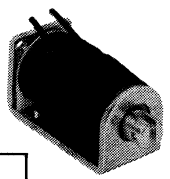
Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53704-82	12VDC	Cont.	50	3W
53704-83	24VDC	Cont.	200	3W
53704-88	12VDC	Int.	12.2	12W
53704-89	24VDC	Int.	50	12W

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8
DC Cont.	1-1/4	3/4	1/2	7/16	1/4
DC Int.	4	2-3/4	2	1-3/4	1

C-2 PULL TYPE

L = 63/64
H = 17/32
W = 31/64
WIRE LEADS



NOTE: Standard intermittent duty at nominal voltage is 25%, maximum on time is 30 seconds. Approx. 50 sq. in. heat sink is required.

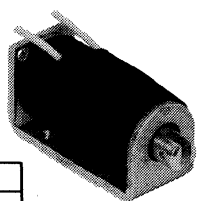
Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53702-82	12VDC	Cont.	32	4.5W
53702-83	24VDC	Cont.	128	4.5W
53702-88	12VDC	Int.	8	18W
53702-89	24VDC	Int.	32	18W

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	3-3/4	1-3/4	1-1/4	1	1/4
DC Int.	12	6-1/2	5	4	1-1/4

C-3 PULL TYPE

L = 7/32
H = 11/16
W = 19/32
WIRE LEADS

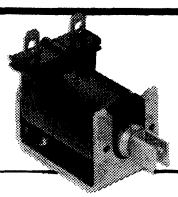


NOTE: Standard intermittent duty at nominal voltage is 25%, maximum on time is 30 seconds. Approx. 65 sq. in. heat sink is required.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53725-82	12VDC	Cont.	25	6W
53725-83	24VDC	Cont.	100	6W
53725-88	12VDC	Int.	6.2	24W
53725-89	24VDC	Int.	25	24W

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	8	3-1/4	2-1/4	1-3/4	1
DC Int.	30	13	9	8	4



C-6 PULL TYPE

L = 1-1/8
W = 55/64
H = 1-17/64
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is one (1) minute on and three (3) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53685-83	24VDC	Cont.	124	4.7W
53686-83	24VDC	Int.	50.8	12W
53687-94	120VAC	Cont.	776	6.8VA
53688-94	120VAC	Int.	327	19.6VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	7	3	2	1-1/2
DC Int.	15	8	5	3-1/2
AC Cont.	10	7	5	4
AC Int.	21	13	11	8



C-7 PULL TYPE

L = 1-9/64
W = 1-1/16
H = 1-13/32
.187 QUICK CONNECT/ SOLDER TERMINALS

STROKE (INCHES) FORCE (OUNCES

	1/16	1/8	3/16	1/4
DC Cont.	19	8	5	3
DC Int.	28	12	8	5
AC Cont.	17	12	10	8
AC Int.	30	22	19	17

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53634-83	24VDC	Cont.	118	5W
53635-83	24VDC	Int.	50.5	11.5W
53637-94	120VAC	Cont.	509	7.8VA
53638-94	120VAC	Int.	220	21VA

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

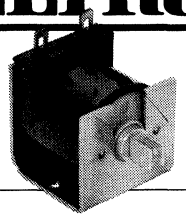
ALL DIMENSIONS ARE NOMINAL

DELTROL controls DIVISION OF DELTROL CORP
2745 S. 19th Street, Milwaukee, Wisconsin 53215
Phone (414) 671-6800, Telex 2-6871, Fax (414) 671-6809

DELTROL SOLENOIDS

MADE IN U.S.A.

SEE SECTION 4500 FOR RELAYS



C-8 PULL TYPE

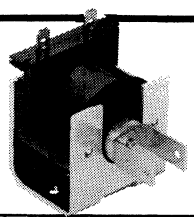
L = 1-3/16
W = 1-9/32
H = 1-11/16
.187 QUICK CONNECT/ SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

			Coil	
Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53713-82	24VDC	Cont.	93.3	6.5W
53713-88	24VDC	Int.	37.5	16W
53712-84	120VAC	Cont.	346	9.5VA
53712-90	120VAC	Int.	151	25VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	20	11	7	5
DC Int.	42	27	19	14
AC Cont.	16	11	10	9
AC Int.	32	24	21	20



C-9 PULL TYPE

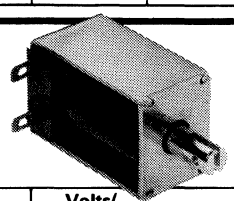
L = 1-1/16
W = 1-3/8
H = 1-13/16
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off. AC intermittent duty cycle is one (1) minute on and four (4) minutes off. Approx. 10 sq. in. heat sink required.

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53676-83	24VDC	Cont.	66.5	8.6W
53677-83	24VDC	Int.	37.6	15.5W
53673-94	120VAC	Cont.	240	13.7VA
53674-94	120VAC	Int.	84.1	52VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	26	17	12	9	3
DC Int.	42	28	22	16	5
AC Cont.	21	16	15	14	10
AC Int.	54	43	39	37	27



D-11 PULL TYPE

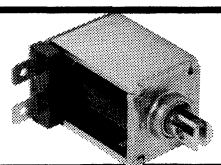
L = 1-27/32
W = 15/16
H = 1-3/16
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53736-81	12VDC	Cont.	18	8W
53736-82	24VDC	Cont.	72	8W
53736-87	12VDC	Int.	8	18W
53736-88	24VDC	Int.	32	18W
53738-84	120VAC	Cont.	200	12VA
53738-90	120VAC	Int.	85	42VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	38	28	16	11	4	3
DC Int.	55	40	24	22	10	6
AC Cont.	14	12	9	8	7	6
AC Int.	45	25	20	18	15	14



D-22 PULL TYPE

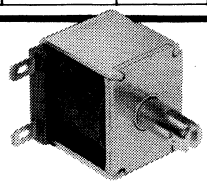
L = 1-1/4
W = 3/4
H = 3/4
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is 25% with three (3) minutes max. on and nine (9) minutes min. off in a repetitive cycle. Approx. 10 sq. in. heat sink required.

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53723-81	12VDC	Cont.	35	4.2W
53723-82	24VDC	Cont.	141	4.2W
53723-87	12VDC	Int.	14.8	9.6W
53723-88	24VDC	Int.	60	9.6W
53724-84	120VAC	Cont.	1,090	6.5VA
53724-90	120VAC	Int.	724	8.5VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8
DC Cont.	9	4	2-1/2	1-3/4	1
DC Int.	20	10	6	4	2
AC Cont.	6	3-1/2	2-3/4	2-1/2	1-3/4
AC Int.	8-1/2	5-1/2	4	3-1/2	2-1/2



D-28 PULL TYPE

L = 1-1/4
W = 1
H = 1-7/32
.187 QUICK CONNECT/ SOLDER TERMINALS

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53708-81	12VDC	Cont.	27.1	5.5W
53708-82	24VDC	Cont.	108	5.5W
53708-87	12VDC	Int.	12.7	11.5W
53708-88	24VDC	Int.	51	11.5W
53706-84	120VAC	Cont.	420	8VA
53706-90	120VAC	Int.	220	21VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	20	10	6	4	2
DC Int.	35	19	12	8	3
AC Cont.	16	12	10	8	4
AC Int.	29	20	17	14	6

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

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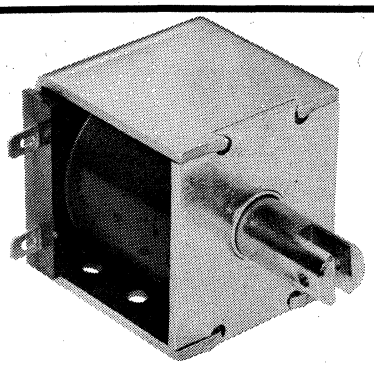
D-2 PULL TYPE



L = 1-9/16
W = 1-7/16
H = 1-5/8

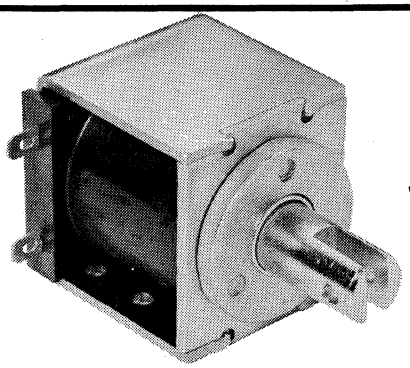
NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53728-81	12VDC	Cont.	13.6	10.5W
53728-82	24VDC	Cont.	54.7	10.5W
53728-87	12VDC	Int.	4.92	29W
53728-88	24VDC	Int.	20.0	29W
53729-84	120VAC	Cont.	139	13VA
53729-90	120VAC	Int.	47.0	44VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	84	50	34	23	8	4
DC Int.	122	97	74	56	21	9
AC Cont.	27	20	17	16	14	5
AC Int.	69	56	50	45	36	15

D-3HD PULL TYPE



L = 1-3/4
W = 1-7/16
H = 1-5/8

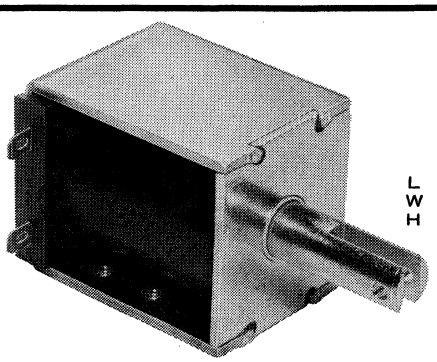
NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53732-81	12VDC	Cont.	12.8	11.2W
53732-82	24VDC	Cont.	51.5	11.2W
53732-87	12VDC	Int.	5.3	27W
53732-88	24VDC	Int.	21.4	27W
53733-84	120VAC	Cont.	109	20VA
53733-90	120VAC	Int.	27	115VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	110	72	45	31	10	4
DC Int.	150	124	96	72	25	10
AC Cont.	35	26	23	22	21	13
AC Int.	112	88	80	78	68	40

D-4 PULL TYPE



L = 2
W = 1-7/16
H = 1-5/8

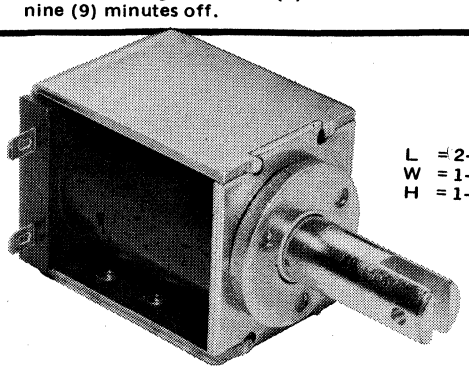
NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53717-81	12VDC	Cont.	12.3	11.5W
53717-82	24VDC	Cont.	50.4	11.5W
53717-87	12VDC	Int.	3.0	47.6W
53717-88	24VDC	Int.	12.3	47:6W
53718-84	120VAC	Cont.	133	11.5VA
53718-90	120VAC	Int.	37	60VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	94	66	46	34	14	7
DC Int.	142	122	106	92	52	30
AC Cont.	12	10	9	9	10	13
AC Int.	44	38	34	32	38	46

D-4HD PULL TYPE



L = 2-3/16
W = 1-7/16
H = 1-5/8

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53719-81	12VDC	Cont.	12.1	11.7W
53719-82	24VDC	Cont.	49.2	11.7W
53719-87	12VDC	Int.	3.8	38W
53719-88	24VDC	Int.	15.2	38W
53720-84	120VAC	Cont.	72.4	32VA
53720-90	120VAC	Int.	19.1	170VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	116	85	60	42	16	8
DC Int.	160	136	114	98	46	26
AC Cont.	24	20	19	18	21	24
AC Int.	84	72	64	60	66	76

ALL DIMENSIONS ARE NOMINAL.

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DELTROL SOLENOIDS

MADE IN U.S.A. SEE SECTION 4500 FOR RELAYS

MED-8 x 1

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53762-81	12VDC	Cont.-Pull	36	4W
53762-87	12VDC	Int.-Pull	12	12W
53762-82	24VDC	Cont.-Pull	139	4W
53762-88	24VDC	Int.-Pull	48	12W
53766-82	24VDC	Cont.-Push	139	4W
53766-88	24VDC	Int.-Push	48	12W



PUSH TYPE PULL TYPE

Dia. = 1/2
L = 1

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/8 — 32 x 1/4" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	4	2	1-1/4	1
DC Int.	7	4	3	2-1/2

MED-8 x 1-1/2

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53764-81	12VDC	Cont.-Pull	29	5W
53764-87	12VDC	Int.-Pull	9.6	15W
53764-82	24VDC	Cont.-Pull	115	5W
53764-88	24VDC	Int.-Pull	38.4	15W
53768-82	24VDC	Cont.-Push	115	5W
53768-88	24VDC	Int.-Push	38.4	15W



PUSH TYPE PULL TYPE

Dia. = 1/2
L = 1-1/2

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/8 — 32 x 1/4" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	5/16
DC Cont.	4-1/2	2-1/2	2	1-3/4	1-1/2
DC Int.	9	6	4-1/2	4	3-1/2

MED-12 x 1-1/2

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53751-81	12VDC	Cont.-Pull	25	6W
53751-87	12VDC	Int.-Pull	10	15W
53751-82	24VDC	Cont.-Pull	100	6W
53751-88	24VDC	Int.-Pull	40	15W
53761-81	12VDC	Cont.-Push	25	6W
53761-87	12VDC	Int.-Push	10	15W
53761-82	24VDC	Cont.-Push	100	6W
53761-88	24VDC	Int.-Push	40	15W



PUSH TYPE PULL TYPE

Dia. = 3/4
L = 1-1/2

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 9/16 — 18 x 3/8" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8	1/2
DC Cont.	18	10	6-1/2	5	3	2
DC Int.	32	22	15	12	7-1/2	5-1/2

MED-16 x 1-1/8

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53754-81	12VDC	Cont.-Pull	19	8W
53754-87	12VDC	Int.-Pull	7.5	19W
53754-82	24VDC	Cont.-Pull	75	8W
53754-88	24VDC	Int.-Pull	30	19W
53759-82	24VDC	Cont.-Push	75	8W
53759-88	24VDC	Int.-Push	30	19W



PUSH TYPE PULL TYPE

Dia. = 1
L = 1-1/8

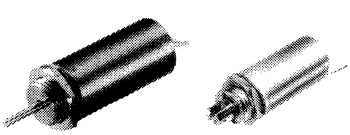
NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/4 — 16 x 3/8" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8
DC Cont.	38	17	10	7	4
DC Int.	77	46	25	16	6

MED-16 x 2

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53753-81	12VDC	Cont.-Pull	15	10W
53753-87	12VDC	Int.-Pull	6	24W
53753-82	24VDC	Cont.-Pull	60	10W
53753-88	24VDC	Int.-Pull	24	24W
53757-81	12VDC	Cont.-Push	15	10W
53757-87	12VDC	Int.-Push	6	24W
53757-82	24VDC	Cont.-Push	60	10W
53757-88	24VDC	Int.-Push	24	24W



PUSH TYPE PULL TYPE

Dia. = 1
L = 2

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/4 — 16 x 3/8" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8	1/2	5/8
DC Cont.	57	35	24	17	11	8	6
DC Int.	80	58	46	37	27	20	15

ALL DIMENSIONS ARE NOMINAL.

DELTROL controls / DIVISION OF DELTROL CORP
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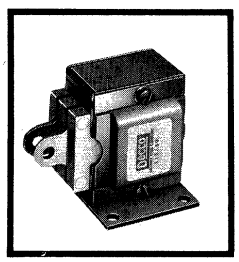
Decco® Solenoids

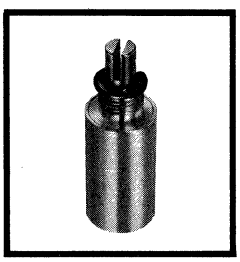
The standard by which all others are measured!

Today's leading designers and manufacturers of high-tech machinery and equipment look to Decco for top quality solenoids that perform flawlessly and dependably. Detroit Coil Company is a pioneer in the development of AC, DC, push and pull solenoids for use in virtually every conceivable industrial application. Solenoids are our only product, and we're proud of our technological advances. Our experienced staff's many years of accumulated know-how is yours for the asking. Standard models or specials, we'll help you solve your actuation problems.

INDUSTRIAL AC SOLENOIDS

Our "O" Series, Teen Series, 20 & 50 Series AC solenoids generate forces from 1.7 to 30 lbs. with strokes up to 1 inch. Push or pull models, horizontal or vertical mounting.



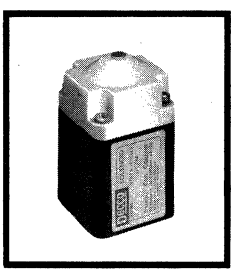


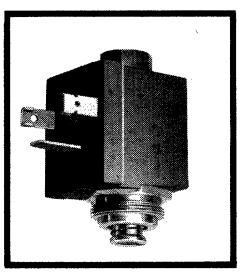
TUBULAR DC SOLENOIDS

For limited space applications. Fast and powerful, 3 sizes, 3 duty cycles, push or pull. 5/8", 7/8" & 1-1/8" diameter. Customized models available on request.

M-LINE AC SOLENOIDS

These sealed, molded "O" and "OO" Series push solenoids dissipate heat quickly for cooler operation. 2.6 to 4.2 lbs. force. .25 inch max. stroke. 6" leads are standard; plug-in connections optional on "O" Series.



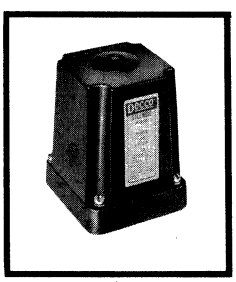


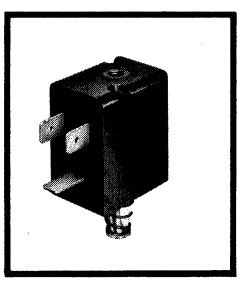
THE "PILOT" VALVE OPERATOR

For OEM valves. Compact, low wattage, long service life. AC or DC models. DIN, Pipe spud or wire lead connections. Threads into valve body.

"PACKAGED" AC SOLENOIDS

Our Series 710 solenoids are standard Teen Series models in a die cast zinc alloy cover. Forces from 4.50 to 10.25 lbs. Max. stroke .50 inch. Plug-in connection.



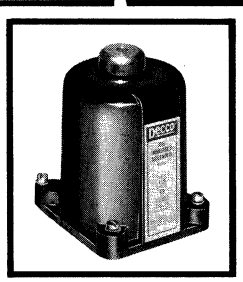


ECONOMY PILOT

An improved valve operator — simple in design, easy to install, economically priced. AC or DC. Standard ISO electrical connections.

OIL IMMERSED AC SOLENOIDS

Sealed in oil within a die cast housing. Provides high power and cool performance in dirty or corrosive atmospheres. 7 models. .31 to .50 inch max. strokes. 4.5 to 10.25 lb. force.



CUSTOMIZED SOLENOIDS

We will gladly give you experienced assistance in developing special AC or DC models to meet your special requirements.

DETROIT COIL COMPANY
2435 Hilton Road • Ferndale, Michigan 48220
Phone: (313) 398-5600 • Fax: (313) 398-0481

Decco®

MADE IN USA

DORMEYER INDUSTRIES

3418 N. Milwaukee Ave., Chicago, IL 60641 / Tel: (1-312) 283-4000 Fax: (1-312) 283-4927

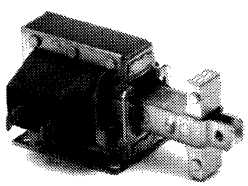
Laminated AC Solenoids

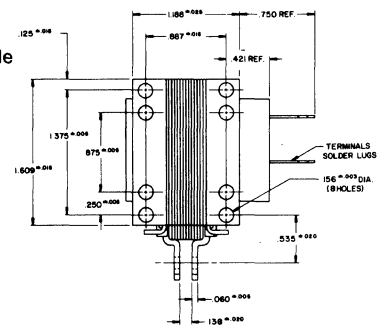
Standard Voltages 24 to 480 VAC
Stroke Length 0 to 1¼"
Pull Force up to 23 lbs.

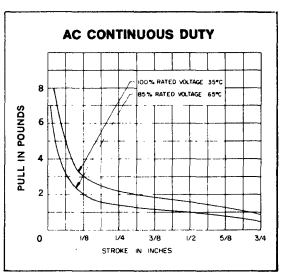
Super "T" Laminated Solenoids are designed to meet high pull force AC applications.

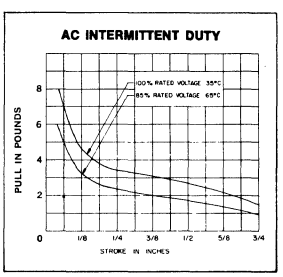
SERIES 1000 – 1/2" STACK

Standard Voltages:
AC: 240, 120, 48 and 24
Other AC voltages available on request.



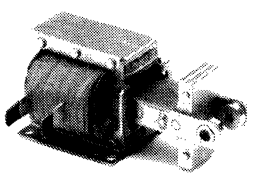


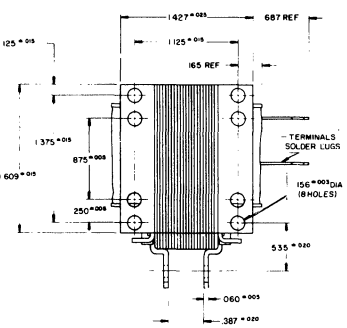


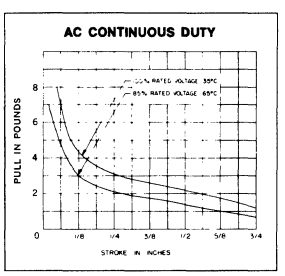


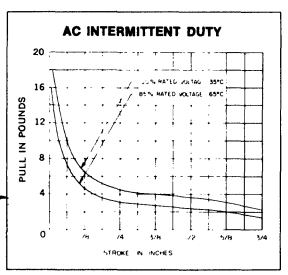
SERIES 1000 – 3/4" STACK

Standard Voltages:
AC: 240, 120, 48 and 24
Other AC voltages available on request.



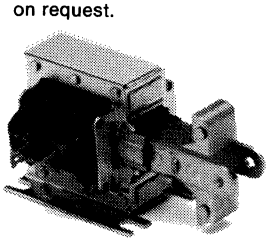


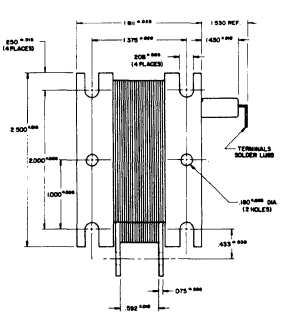


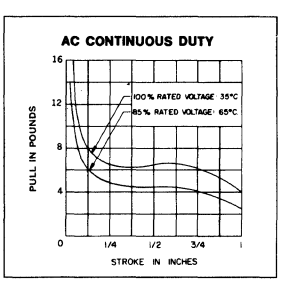


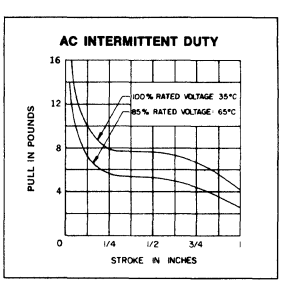
SERIES 2000 – 3/4" STACK

Standard Voltages:
AC: 240, 120, 48 and 24
Other AC voltages available on request.



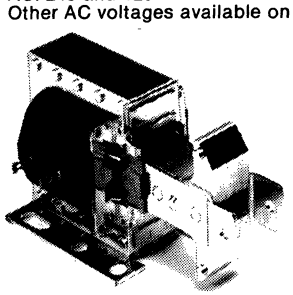


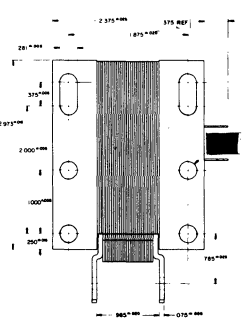


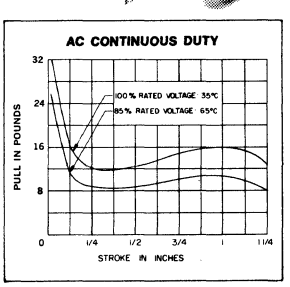


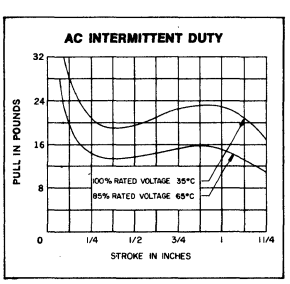
SERIES 3000 – 1" STACK

Standard Voltages:
AC: 240 and 120
Other AC voltages available on request.









DORMEYER INDUSTRIES

3418 N. Milwaukee Ave., Chicago, IL 60641 / Tel: (1-312) 283-4000 Fax: (1-312) 283-4927

DC Tubular Solenoids

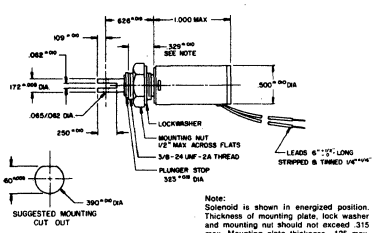
Standard Voltages: 12 to 24 VDC
Stroke Length: 0 to ½" pull,
0 to 3/16" push
Force - pull: up to 70 oz.
Force push: up to 50 oz.

Tubular solenoids are designed to offer very high reliability and exceptionally high cycle life. Both push and pull models are available.

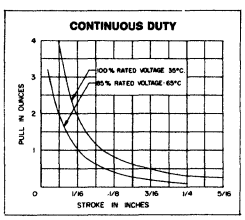
P-2 PULL TYPE

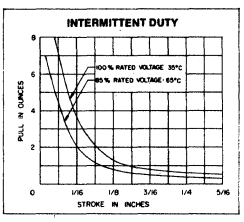
Standard Voltages:
DC: 12 and 24
Other DC voltages available on request.

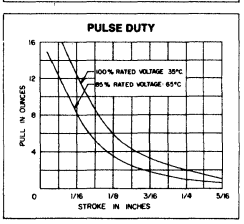




Note:
Solenoid is shown in energized position. Thickness of mounting plate, lock washer and mounting nut should not exceed .315 max. Mounting plate thickness, .125 max.

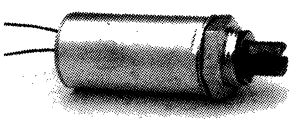


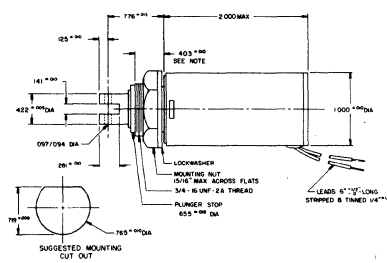




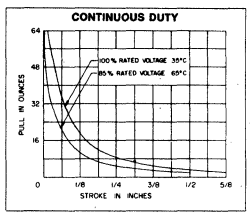
P-6 PULL TYPE

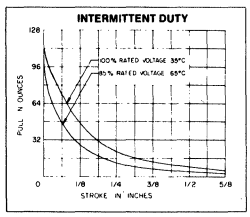
Standard Voltages:
DC: 12 and 24
Other DC voltages available on request.

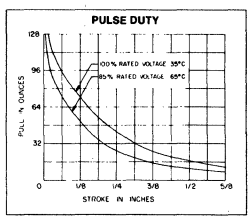




Note:
Solenoid is shown in energized position. Thickness of mounting plate, lock washer and mounting nut should not exceed .390 max. Mounting plate thickness, .125 max.



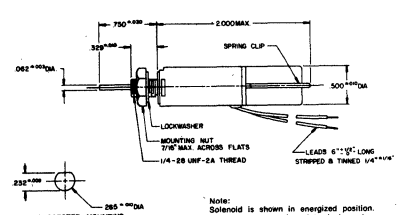




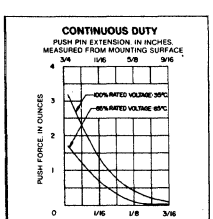
P-8 PUSH TYPE

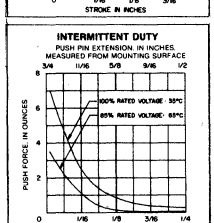
Standard Voltages:
DC: 12 and 24
Other DC voltages available on request.

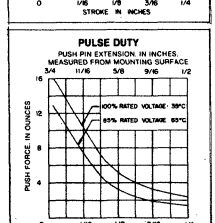




Note:
Solenoid is shown in energized position. Thickness of mounting plate, lock washer and mounting nut should not exceed .315 max. Mounting plate thickness, .125 max. Solenoid stroke .250: intermittent and pulse duty. Solenoid stroke .187: continuous duty.

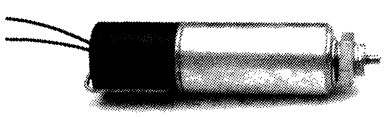


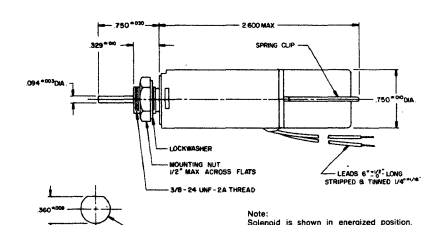




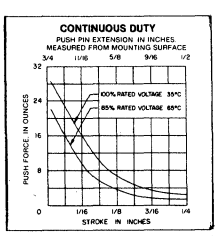
P-10 PUSH TYPE

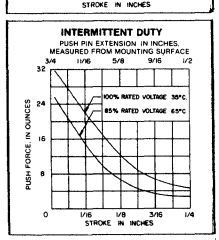
Standard Voltages:
DC: 12 and 24
Other DC voltages available on request.

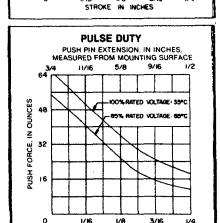




Note:
Solenoid is shown in energized position. Thickness of mounting plate, lock washer and mounting nut should not exceed .315 max. Mounting plate thickness, .125 max. Solenoid stroke .250







OTHER SIZES ALSO AVAILABLE

DORMEYER INDUSTRIES

3418 N. Milwaukee Ave., Chicago, IL 60641 / Tel: (1-312) 283-4000 Fax: (1-312) 283-4927

Frame Solenoids

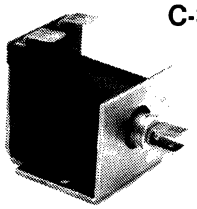
Dormeyer SOLENOIDS

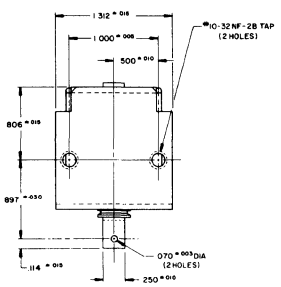
C FRAME SERIES

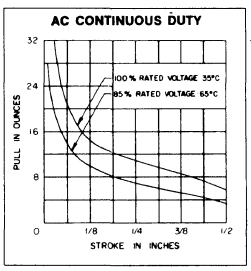
Standard Voltages: 12 to 240 VAC and 6 to 115 VDC
Stroke Length: 0 to ¾"
Pull Force: up to 45 oz.

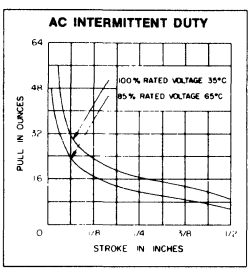
The C Frame Series is our lowest cost line of solenoids. We are tooled for high volume production. Mounting hole locations and dimensions, terminals styles , as well as plunger configurations, are easily modified with our existing tooling to meet **custom** customer requirements.

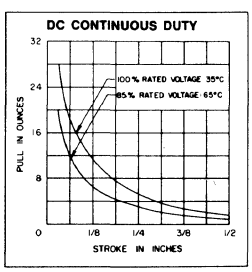
C-33

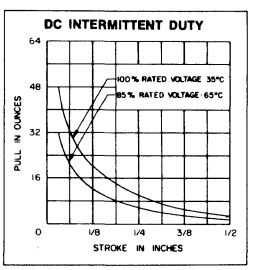












C Frame Range of Sizes:

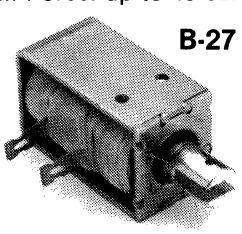
From –
.812 H .750 W 1.125 L
To –
2.125 H 1.312 W 1.657 L

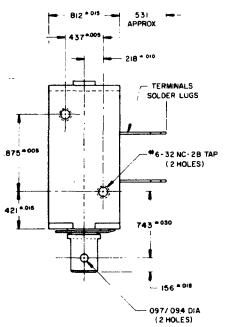
BOX FRAME SERIES

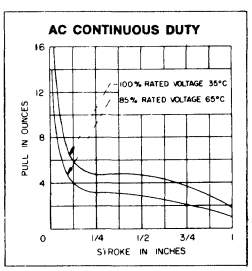
Standard Voltages: 12 to 240 VAC and 6 to 115 VDC
Stroke Length: 0 to 1¾"
Pull Force: up to 45 oz.

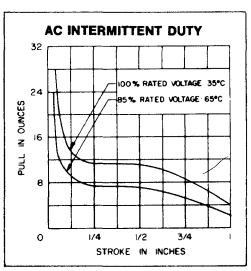
The Box Frame Series provides a longer stroke length than the C Frame Series along with a measureable increase in operational pull force. As with all of our products, tooling for high volume production is in place. Mounting hole locations and dimensions, terminal styles, as well as plunger configurations, are easily modified with our existing tooling to meet **custom** customer requirements.

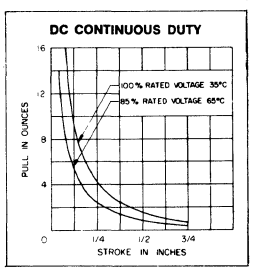
B-27

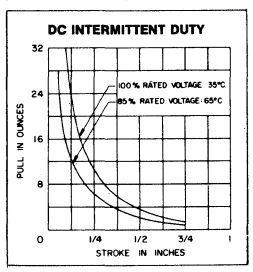










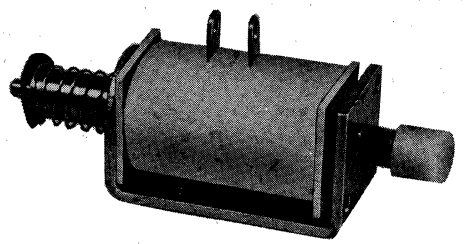


B Frame Range of Sizes:

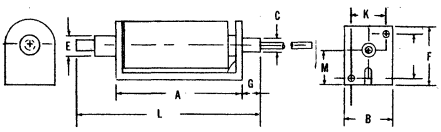
From –
.750 H .750 W .765 L
To –
2.045 H 1.742 W 3.06 L

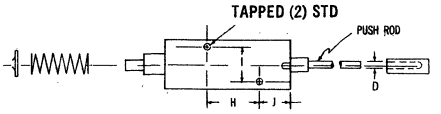
electro-mechanisms INCORPORATED
P.O BOX A
AZUSA, CALIF. 91702
AREA CODE (818) 359-2535
FAX (818) 303-2189

MINI-SOLENOID ACTUATORS



SP SERIES PUSH TYPE





3, 6, 12, 24, 48 VDC

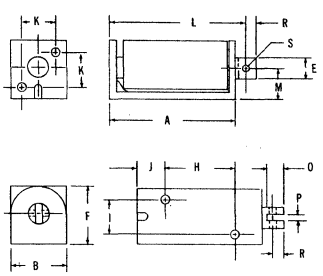
Wire: ..... 130°C Magnet Wire
Termination: ..... Heavy Leads — PVC, Type BU, 5″ Terminals — Solder Lugs
Tape: ..... Mylar
Bobbin: ..... 30% Glass Filled Nylon
Tip: ..... Delrin
Pushrod: ..... Phosphor Bronze
Tol: ..... .xxx ±.005

SPECIFICATIONS
Note: Dimension L is shown with solenoid in energized position. Return Spring and Delrin Tip are Standard on all SP Series.

Part No.	A	B	C	D	E	F	G	H	I	J	K	L	M	S	Max. Stroke*	Weight Oz.	Tapped Holes	Wattage Nom.
SP-25	.548	.236	.093	.036	.100	.298	.093	1/4	.136	1/8	*	.84	.180		1/4	.1	1-72	2
SP-37	.820	.360	.125	.051	.150	.430	.125	5/16	1/4	3/16	1/4	1.22	.250		3/8	.3	1-72	3
SP-50	.980	.488	.125	.051	.187	.510	.150	1/2	3/8	7/32	5/16	1.44	.285		1/2	.7	1-72	4.5
SP-62	1.215	.600	.187	.091	.250	.691	.178	5/8	7/16	1/4	7/16	1.732	.391		5/8	1.2	4-40	6
SP-75	1.621	.730	.240	.091	.306	.838	.172	5/8	7/16	1/4	1/2	2.15	.473		3/4	2.7	4-40	9

Standard Coils 105°C, Hi Temp Available. * Max Stroke, Standard Pushrod length.

PO SERIES PULL TYPE



Wire: ..... 130°C Magnet Wire
Termination: ..... Heavy Leads — PVC, Type BU, 5″ Terminals — Solder Lugs
Tape: ..... Mylar
Bobbin: ..... 30% Glass Filled Nylon
Tip: ..... Delrin
Pushrod: ..... Phosphor Bronze
Tol: ..... .xxx ±.005

SPECIFICATIONS
Note: Dimension L is shown with solenoid in energized position.

Part No.	A	B	E	F	H	I	J	K	L	M	O	P	R	S	Max. Stroke	Weight Oz.	Tapped Holes	Wattage Nom.
PO-25	.548	.236	.100	.298	1/4	.136	1/8	*	.672	.180	.100	.025	.062	.031	1/4	.1	1-72	2
PO-37	.820	.360	.150	.430	5/16	1/4	3/16	1/4	.892	.250	.150	.051	.075	.031	3/8	.3	1-72	3
PO-50	.980	.488	.187	.510	1/2	3/8	7/32	5/16	1.074	.285	.200	.063	.106	.063	1/2	.7	1-72	4.5
PO-62	1.215	.600	.250	.691	5/8	7/16	1/4	7/16	1.340	.391	.200	.063	.094	.063	5/8	1.2	4-40	6
PO-75	1.621	.730	.306	.838	5/8	7/16	1/4	1/2	1.797	.473	.200	.063	.094	.063	3/4	2.7	4-40	9

Standard Coils 105°C, Hi Temp Available.

SPECIALS

ELECTRO-MECHANISMS, INC., is completely equipped, both engineering and production wise, to supply you with variations of our solenoids that you might need for your application. We are also capable of designing special types that you might need within the size range of our products. We would appreciate the opportunity to help you solve design and application problems you may have in the area of miniature solenoid actuators.

The force charts below represent three different duty cycles.

Nominal voltage represents continuous duty.

2X Nominal voltage represents a 25%, intermittent duty cycle 4X Nominal voltage represents a 6% intermittent duty cycle.

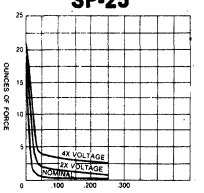
The duty cycle consists of two factors:

1. Percentage of time solenoid is energized in one complete operating cycle.

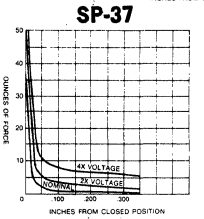
(Ref: DUTY CYCLE = $\frac{\text{Time On}}{\text{Time On} + \text{Time Off}}$ X 100)

2. Length of time of the longest single energization in one complete operating cycle.

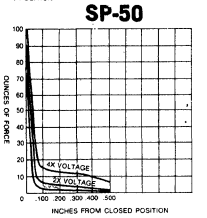
SP-25



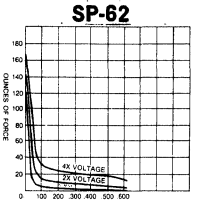
SP-37



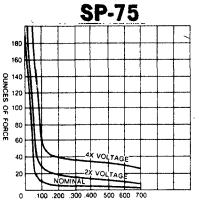
SP-50



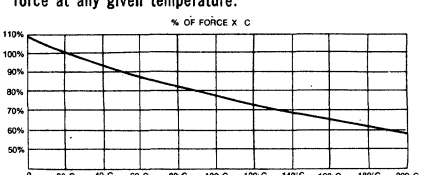
SP-62



SP-75



All forces shown are at 25° ambient. For use at higher ambient temperatures use the chart below to determine force at any given temperature.



FEATURES

ELECTRO-MECHANISMS micro-miniature solenoids offer you static and impact forces equal to standard solenoids 2 to 3 times the size of these units.

Because of their small size, they have extremely fast reaction time. As fast as 2 msec at 4x nominal voltage.

The unique design of PUSH or PULL action, offers many applications beyond the conventional pull type solenoid.

A complete line of 15 solenoids from 3/16″ O.D. to 1.250″ O.D. allows you to choose the correct solenoid with the force you require, from stock items.

The units are highly reliable with life of many millions of operations.

The solenoids are also available with coils in Class F and Class H for high temperature requirements.

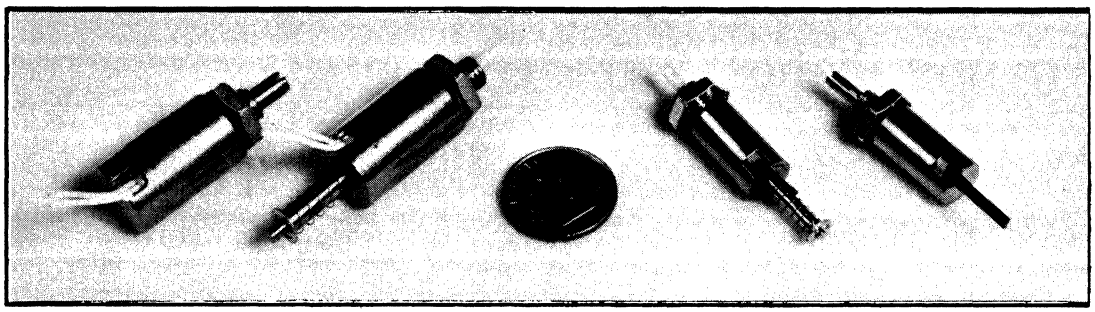
Simplicity of design helps keep the costs down and allows us to pass these savings on to you, our customer.

TYPICAL APPLICATIONS

- Hammers for high speed printers
- Camera shutter actuators
- Locking mechanisms for switches, adding machines and typewriters
- Interpossers for card punching and tape perforation
- Cam actuation
- Pen lifters for plotters
- Event markers for chart recorders
- Key actuators for numerical readouts on typewriters and adding machines
- For life testing different devices
- For indicator flags
- Sensing devices
- Remote switching and actuation

electro-mechanisms INCORPORATED
P.O BOX A
AZUSA, CALIF. 91702
AREA CODE (818) 359-2535
FAX (818) 303-2189

MINIATURE TUBULAR SOLENOIDS

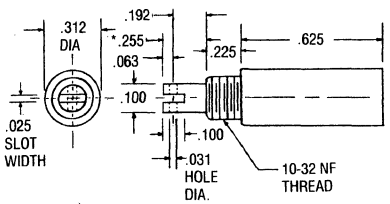


AVAILABLE PUSH or PULL

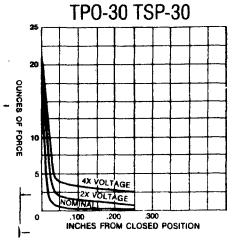
TPO PULL

TSP PUSH

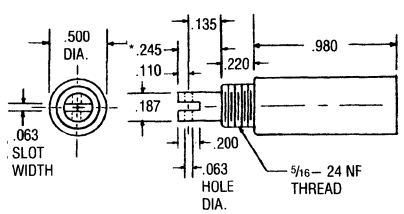
5/16" DIA. X .625
2 WATTS
MODELS TPO-TSP-30



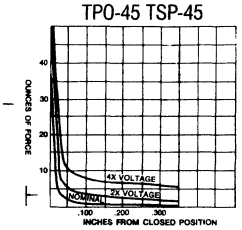
FORCE-DUTY CYCLE DC
TPO-30 TSP-30



17/32" DIA. X 1.00
4.5 WATTS
MODELS TPO-TSP-55

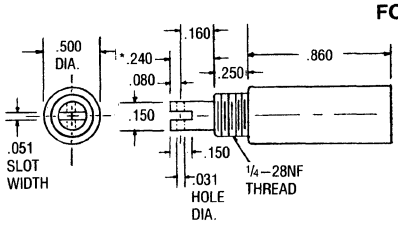


FORCE-DUTY CYCLE DC
TPO-45 TSP-45

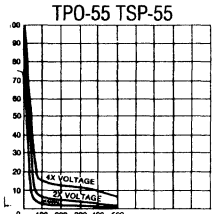


All forces shown are at 25° ambient. For use at higher ambient temperatures use the chart below to determine force at any given temperature.

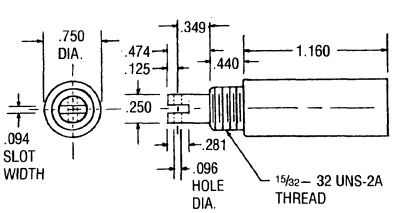
1/2" DIA. X .875
3 WATTS
MODELS TPO-TSP-45



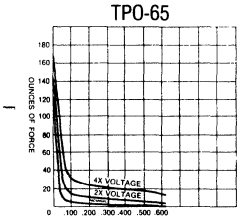
FORCE-DUTY CYCLE DC
TPO-55 TSP-55



3/4" DIA. X 1.160
6 WATTS
MODEL TPO-65

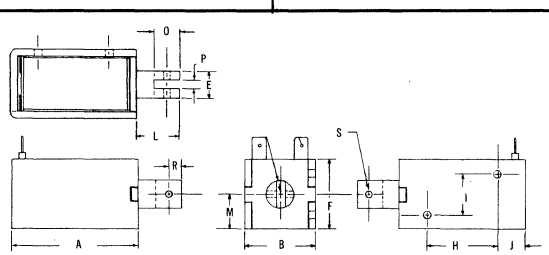


FORCE-DUTY CYCLE DC
TPO-65



PO-100 SERIES
60° CONICAL
11.5 WATTS

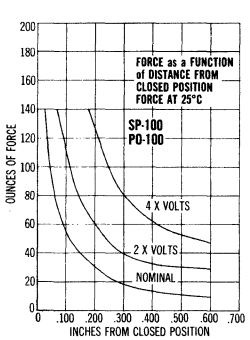
AVAILABLE PUSH TYPE



SPECIFICATIONS

Part No.	A	B	D	E	F	H	I	J	K	L	M	O	P	R	S	T	Height of Terms	Max. Stroke	Tapped Holes	Weight Oz.
SP-100	2.270	1.254	.092	.500	1.254	1.115	.750	.430	.040	.752	.627	*	*	.100	*	.343	.365	1	6-32	10
PO-100	2.270	1.254	*	.500	1.254	1.115	.750	.430	*	.700	.627	.375	.143	.168	.100	*	.365	1	6-32	10

Standard Coils 130°C, Hi Temp Coils Available. * Not Applicable.

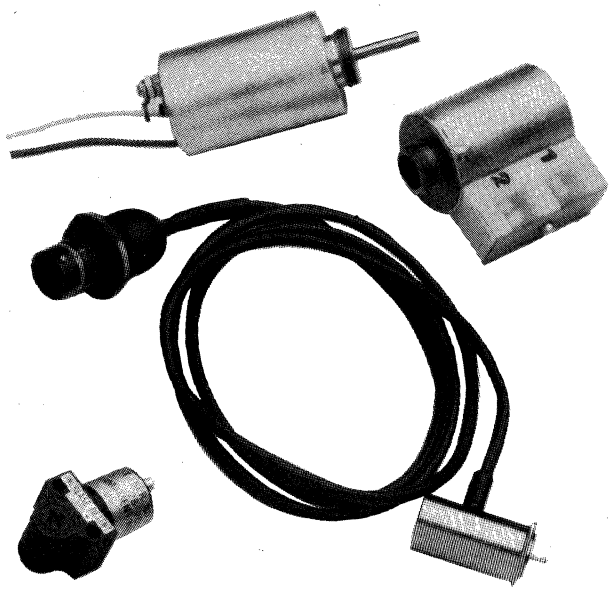


SOLENOIDS...

ENGINEERING•QUALITY•DELIVERY
MILITARY GRADE

Hard to find all these in one company?

NOW YOU CAN!



Our engineers design only solenoids and relays. Their years of experience save you money and shorten your manufacturing lead time.

Complete designs from start to finish or slight modifications to existing products. We know our capabilities and if we can't design and build a cost-effective unit, we'll let you know immediately!

Quality: At Electronic Specialty quality is consistent.
Our in-house environmental and dynamic testing lab gives us control of product quality and keeps our lead times to a minimum.

Delivery: Our sale engineers can help you with your particular application. Slight variations, or a totally new design, they give you answers on price and design quickly. Because we've supplied these kinds of components for years we are equipped to build and deliver your order when you need it.

Design capability, fast delivery of quality products with the assurance they are what you need. That's what Electronic Specialty Corporation offers you. Whether your orders are large or small we never forget the customer is what keeps us in business.

Call us, let us give you a competitive quote quickly and accurately.

PHYSICAL CHARACTERISTICS
Push or pull type

CASE SIZE
1/2″ diameter case O.D. to 3″ diameter case O.D.

STROKE RANGE
.01″ to .5″

WEIGHT
4 oz. to 48 oz.

ELECTRICAL CHARACTERISTICS
AC & DC Operation

Coil Voltages	AC	5 VRMs to 240 VRMs from 50 hz to 800 hz
	DC	5 VDC to 600 VDC

Coil resistance-Commensurate with required power and voltage requirements.
Dielectric to 1500 VDC or VRMs
Insulation resistance 100 meg at 5000 VDC

OPERATING CHARACTERISTICS
Force curves matched to customer requirements or use existing designs.
Plunger strokes from .001 to .5 inches.

ENVIRONMENTAL CHARACTERISTICS

Temperature ranges – 65F to 300F	Vibration
Pressure range	Shock
Fluid compatibility	Salt Spray

CONNECTIONS

Stud screw terminal	Twist lock
Quick connect	Wire leads
Mil Spec multiple connectors	

Electronic Specialty Corporation

P.O. BOX 3501
VANCOUVER, WASHINGTON 98668-3501
206/574/5000 FAX 206-573-4635
TWX 970-44-005

LIBERTY CONTROLS INC.

SOLENOIDS

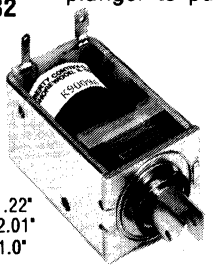
BOX FRAME SOLENOIDS	DUTY CYCLE	DC MIN.*	DC MAX.*	AC MIN.*	AC MAX.*
L-5					
H=.61	Cont.	2.5@1/16"	.3@5/16"	—	—
L=.63	Int.	7.5@1/16"	.6@5/16"	—	—
W=.5	Pulse	21@1/16"	.8@5/16"	—	—
L-22					
H=.75	Cont.	13@1/16	.5@1/2"	5.5@1/16"	.5@1/2"
L=1.16	Int.	22@1/16"	1@1/2"	10@1/16"	1.5@1/2"
W=.75	Pulse	38@1/16"	3@1/2"	19@1/16"	3@1/2"
L-20					
H=.94	Cont.	21@1/16"	1@1/2"	10@1/16"	2@1/2"
L=1.14	Int.	34@1/16"	2@1/2"	20@1/16"	4@1/2"
W=.81	Pulse	62@1/16"	8@1/2"	48@1/16"	11@1/2"
L-28					
H=1.19	Cont.	31@1/16"	1@1/2"	15@1/16"	2@1/2"
L=1.13	Int.	47@1/16"	3@1/2"	29@1/16"	4@1/2"
W=.94	Pulse	83@1/16"	13@1/2"	62@1/16"	11@1/2"
L-81					
H=1.24	Cont.	38@1/16"	4@3/8"	19@1/16"	5@3/8"
L=1.25	Int.	53@1/16"	7@3/8"	34@1/16"	8@3/8"
W=1.00	Pulse	107@1/16"	34@3/8"	90@1/16"	25@3/8"
L-11					
H=1.19	Cont.	48@1/16"	3@3/4"	18@1/16"	6@3/4"
L=1.84	Int.	67@1/16"	7@3/4"	33@1/16"	13@3/4"
W=.94	Pulse	90@1/16"	26@3/4"	54@1/16"	23@3/4"
L-82					
H=1.24	Cont.	55@1/16"	2@3/4"	17@1/16"	11@3/4"
L=2.01	Int.	92@1/16"	7@3/4"	46@1/16"	28@3/4"
W=1.00	Pulse	136@1/16"	16@3/4"	96@1/16"	51@3/4"
L-4					
H=1.63	Cont.	98@1/16"	5@1"	15@1/16"	9@1"
L=2.19	Int.	145@1/16"	18@1"	55@1/16"	34@1"
W=1.44	Pulse	180@1/16"	36@1"	93@1/16"	56@1"
L-88					
H=1.85	Cont.	120@1/16"	4@5/8"	24@1/16"	8@1/2"
L=1.65	Int.	184@1/16"	11@5/8"	49@1/16"	4@3/4"
W=1.58	Pulse	276@1/16"	40@5/8"	138@1/16"	13@3/4"
L-90					
H=1.85	Cont.	148@1/16"	5@1-1/4"	12@1/16"	7@1-1/4"
L=2.63	Int.	208@1/16"	16@1-1/4"	27@1/16"	17@1-1/4"
W=1.58	Pulse	266@1/16"	40@1-1/4"	80@1/16"	43@1-1/4"

U-FRAME SOLENOIDS	DUTY CYCLE	DC MIN.*	DC MAX.*	AC MIN.*	AC MAX.*
L-61					
H=.83	Cont.	18@1/16"	1@1/2"	10@1/16"	2@1/2"
L=1.13	Int.	22@1/16"	1@1/2"	22@1/16"	5@1/2"
W=.75	Pulse	38@1/16"	3@1/2"	44@1/16"	11@1/2"
L-24					
H=1.00	Cont.	28@1/16"	2@5/8"	14@1/16"	2@5/8"
L=1.23	Int.	46@1/16"	3@5/8"	26@1/16"	5@5/8"
W=.84	Pulse	68@1/16"	8@5/8"	52@1/16"	18@1/2"
L-62					
H=1.42	Cont.	48@1/16"	3@1/2"	24@1/16"	10@1/2"
L=1.07	Int.	80@1/16"	5@1/2"	64@1/16"	26@1/2"
W=1.38	Pulse	172@1/16"	27@1/2"	117@1/16"	48@1/2"
L-26					
H=.94	Cont.	33@1/16"	1@3/4"	16@1/16"	3@3/4"
L=1.75	Int.	52@1/16"	3@3/4"	25@1/16"	6@3/4"
W=.84	Pulse	74@1/16"	11@3/4"	72@1/16"	20@3/4"
L-63					
H=1.42	Cont.	56@1/16"	2@3/4"	20@1/16"	6@3/4"
L=1.29	Int.	84@1/16"	4@3/4"	56@1/16"	18@3/4"
W=1.38	Pulse	168@1/16"	16@3/4"	103@1/16"	34@3/4"

Magnetic Latching Solenoid

New! A pulse voltage applied to the coil causes the plunger to pull-in and latch. The plunger remains energized without continous voltage being applied. To release the plunger, apply a pulse voltage of opposite polarity.

M82

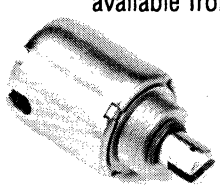


H = 1.22"
L = 2.01"
W = 1.0"

Standard Voltages: 12, 24, 110 VDC
Holding Force @ 0V: 76 -160 oz.
Insulation: UL ClassB
Options: Spring return
Pull & Push types
Wire leads, .187 QC tabs

Tubular Solenoids

New! A complete line of Tubular Soleniods is now available from Liberty Controls. All standard models may be customized to fit your application exactly. For engineering assistance and complete details, please contact us at the factory.



Standard Sizes: $^1/_2$, $^3/_4$, 1-$^1/_2$" dia.

* Forces and Strokes (Ounces and Inches) @ 25°C

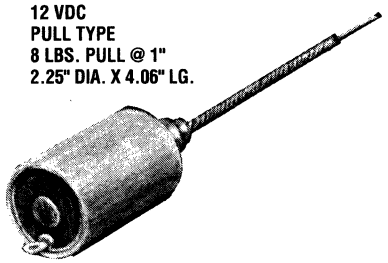
Standard Voltages, Box Frame & U-Frame:
6, 12, 24, 48, 120, 240 AC/DC. Other voltages available.

LIBERTY CONTROLS, INC.
500 BROOKFOREST AVENUE
SHOREWOOD, IL 60435
(815) 725-2241
FAX: (815) 725-6571

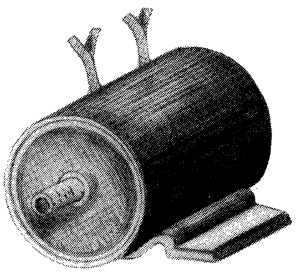
LMC
LINEAR MOTIONS COMPANY
17025 DUBESOR ST./VALINDA, CA 91744/**(818) 918-7806**

CUSTOM SOLENOIDS

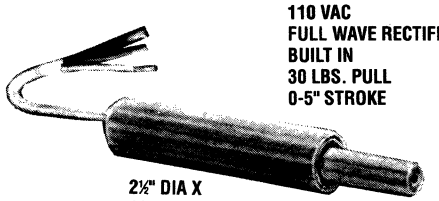
23A51
12 VDC
PULL TYPE
8 LBS. PULL @ 1"
2.25" DIA. X 4.06" LG.



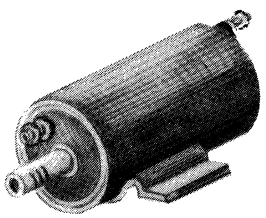
45C72
24VDC
400 LBS. PUSH-PULL
@ ± ½" STROKE
4½" DIA X 7½ LG.



25AJ35
110 VAC
FULL WAVE RECTIFIER
BUILT IN
30 LBS. PULL
0-5" STROKE

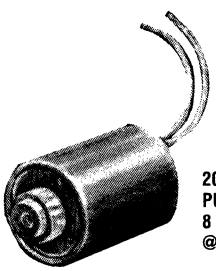


2½" DIA X
10" LG.

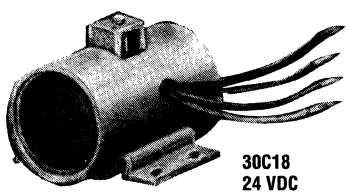


27C80
12 VDC
18 LBS. PUSH-PULL
@ ± 1" STROKE
2⅝" DIA. X 6¾" LG.

2" DIA. X
3⅛" LG.

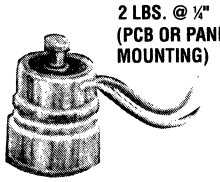


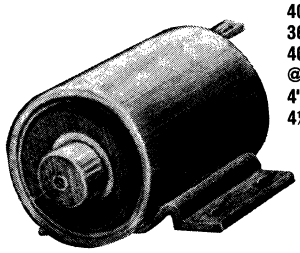
20A17 12 VDC
PULL TYPE
8 LBS. PULL
@ .75"



30C18
24 VDC
35 LBS. PUSH-PULL
@ ± ¼" STROKE

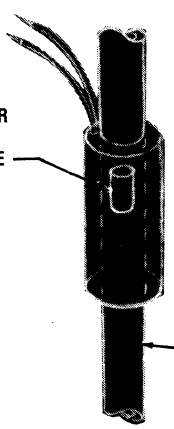
09B32
12VDC
PUSH TYPE
2 LBS. @ ¼"
(PCB OR PANEL MOUNTING)





40A55
36 VDC
400 LBS. PULL
@ .375"
4" DIA. X
4½" LG.

PLUNGER OR MAGNET INSIDE TUBE



TUBE OF NON MAGNETIC MATERIAL

CUSTOM SOLENOIDS

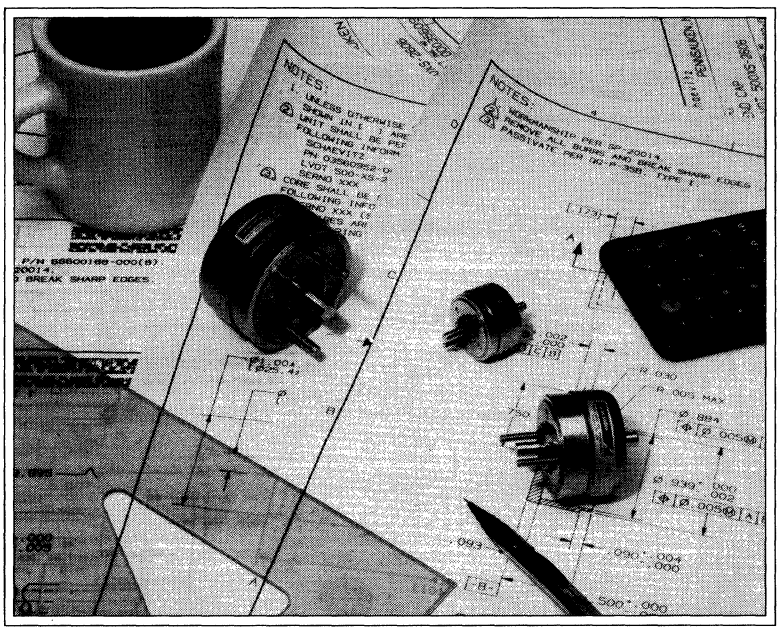
Linear Motions Company specializes in CUSTOM D.C. and Rectified A.C. Solenoids. The solenoids illustrated are a sampling of solenoids that have been designed for specific applications. It is not necessary to sift through numerous catalogs to find a solenoid that might fit your design; send us your specifications and we will design a solenoid to fit your application or send us your obsolete or unknown solenoid and we will reproduce it.

DESIGN FEATURES AVAILABLE

- Plunger return spring
- Pull, Push or Push-Pull actuation
- Long Stroke (5 inches & up)
- Choice of Leadwires, Quick disconnect, Screw type and Solder Terminals
- Built-in or external full wave rectifier
- Any voltage available
- Save assembly cost with unassembled solenoid components (i.e. built-into your enclosure)

Problem:

Need a solenoid for a project, and you're out of time.



Solution:

Lucas Ledex stock prototypes

- *The industry's largest variety of solenoids*
- *Over 400 designs*
- *Same day delivery*

Don't rely on design guide procedures to evaluate a solenoid for your project. Use the quick, cost-effective way– order a stock prototype from Lucas Ledex.

We offer over 400 stock models to cover almost any solenoid application:

- **Rotary solenoids–** up to 117 lb-in. Choose from hundreds of stock models or custom designs for prototype work.
- **Tubular solenoids–** force ratings to 11.5 lbs at 0.30". Push models rated life is +50 million actuations; pull models offer +100 million.
- **Low profile solenoids–** force to 30 lbs at 0.30" stroke. Push/pull, flat face, or conical designs built for high force to size, and fast response.
- **Brushless Torque Actuators–** field proven at over 100 million cycles. Quick, shock-free operation.
- **Soft Shift® solenoids–** proportional control as well as on-off. Rated for up to 50 lbs of force.
- **Open frame solenoids–** pull force to 7.5 lbs at 1.0 in stroke. 42 models offer economical, long-term service.
- **Magnetic latching solenoids–** maintain energized position without current draw.

More than inventory...

Lucas Ledex provides the added services that give you the exact product you want– fast, easy, economically.

Unique customer specifications

- 80% of the solenoids manufactured at Lucas Ledex are designed to customer specifications
- We offer a short order prototyping service which can deliver custom prototypes in 2 weeks or less, for a small service charge

Quick Delivery

- Same day delivery on most stock models

No credit hassels

- Use your Visa or Mastercard and save time

Quality...our measure of leadership

- Lucas Ledex has received numerous awards for exceeding on-time deliveries with zero rejects
- Our manufacturing goal is to achieve zero defects

Turn to the following pages for more details and specifications on many Lucas Ledex solenoid designs.

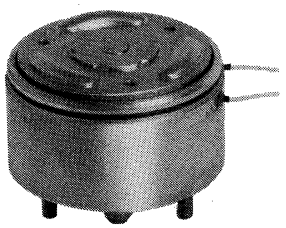
Lucas Ledex

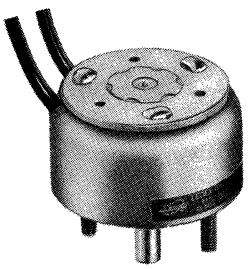
Lucas Ledex Inc.
P.O. Box 427
Vandalia, OH 45377-0427
513/454-2349
FAX: 513/898-8624
TWX: 6874241 Telex: 8674243

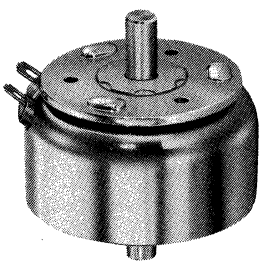
Lucas Ledex Solenoids

Rotary Solenoids

- For millisecond-fast, high torque actuation • Nine sizes • Right or left hand strokes from 10° to 110°
- Torque output to 117 lb-in
- Life of 100 million plus cycles
- Modifications available







Rotary Solenoids			25°		35°		45°		67½°		95°	
Model	O.D. (in)	Height (in)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)
0E	3/4	9/16	—	0.41			—	0.20				
1E	1	5/8	—	1.10			—	0.62				
2E	1-1/8	21/32	0.20	1.70	0.15	1.30	0.10	0.89				
3B	1-5/8	7/8	0.35	3.20	0.25	2.30	0.15	1.70	0.09	0.80		
3E	1-5/16	51/64	0.35	3.20	0.25	2.30	0.15	1.18	0.09	0.89		
4E	1-9/16	61/64	0.90	5.20	0.60	3.50	0.40	3.10	0.20	1.90	0.15	1.20
5B	1-7/8	1-13/64	1.80	10.00	0.90	8.30	0.70	6.00	0.50	4.00	0.19	1.90
5S	1-7/8	1-3/64	1.90	13.20	0.90	9.20	0.70	6.90	0.50	4.90	0.20	2.60
6S	2-1/4	1-27/64	4.60	30.60	3.40	20.50	1.70	12.10	1.60	9.70	0.90	5.70
7S	2-3/4	1-55/64	11.00	46.60	6.00	42.00	5.00	32.80	2.50	19.30	1.50	11.60
8S	3-3/8	2-5/16	16.00	117.00	12.00	77.00	10.00	65.00	4.20	35.00	3.50	20.00

Non-Axial Rotary Solenoids

- Produce high torque with no axial displacement • Severe environmental operating capability including shock and vibration in aerospace applications • 100 million plus cycle life • Low noise
- Features balanced armature mounted on ball bearings • 4 standard sizes up to 2.42" diameter
- Standard angular strokes: 30°, 45° and 60° (90° optional), either CW or CCW • Output torques to 50 in-oz • 5 to 400 VDC input

Magnetic Latching Solenoids

- Utilize permanent magnets coupled with conventional rotary, tubular, low-profile or open frame solenoids to hold the plunger position open or closed without current drain • A momentary pulse releases the latch • Memory is retained during power loss

Soft Shift® Solenoids

- Provide variable speed control, from snap action to quiet variability
- Variable positioning with electronic control • Starting force 3 to 5 times greater than that of other solenoids

Low Profile Solenoids

- Force to 30 lbs at 0.30" stroke
- Push/pull, flat face, or conical designs built for high force to size
- Fast response

Lucas Ledex

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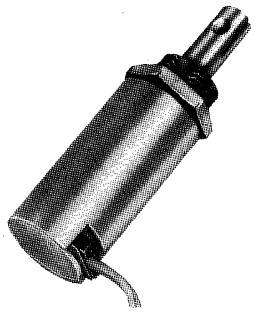
- **Use your Visa or Mastercard to save time**
- **Same day delivery on stock models**
- **Two-week prototyping service for custom designs**

Lucas Ledex Solenoids

Tubular Solenoids

• Provide 50 million actuations, quiet operation, push or pull actuation, and economy • Low friction bobbin assembly for long life • Metal-to-plastic bearing surface construction eliminates powdered metal flaking • Rugged construction for accurate repeatability over extended use • Ideal for applications where field servicing is prohibitive such as business machines, computer peripherals, door inter-locks, interposers and gate releases



Tubular Solenoids

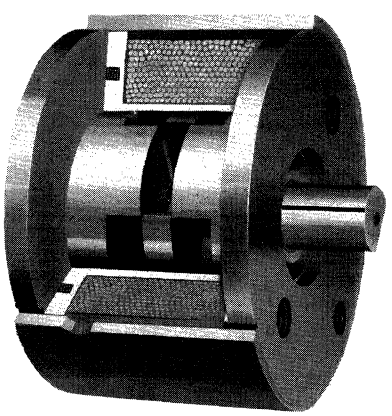
O.D. (in)	Height (in)	Force (0.25" stroke)	Shaft Dia. (Push) (in)	Weight (oz)
1/2	1	1-8.5 oz	0.062	0.84
3/4	1-1/2	0.25-2.5 lb	0.094	2.60
1	2	0.75-5.5 lb	0.125	6.00

Brushless Torque Actuator

• Controlled velocity and position • Quiet, shock-free operation • 100 million plus cycle life • High-speed cycle rate • No axial stroke • Low power consumption • Ball bearing construction

BTA® Brushless Torque Actuator Size 4EX (Model #195500-0)**

** awg	Resistance @ 20°C	Number of Turns	Duty Cycle 100% VDC	50% VDC	25% VDC	10% VDC
23	1.27	190	5.2	7.3	10.3	16.4
24	2.78	321	7.6	10.8	15.3	24.2
25	3.86	357	9.0	12.7	18.0	28.5
26	5.43	402	10.7	15.1	21.4	33.8
27	10.38	600	14.8	20.9	29.5	46.7
28	14.52	672	17.5	24.7	34.9	55.2
29	25.72	935	23.2	32.9	46.5	73.5
30	36	1,045	28	39	55	87
31	61	1,404	36	51	72	113
32	101	1,827	46	65	92	146
33	162	2,328	58	83	117	185



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• Use your Visa or Mastercard to save time
• Same day delivery on stock models
• Two-week prototyping service for custom designs

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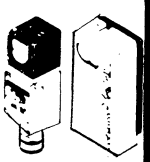
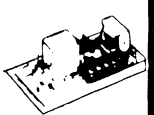
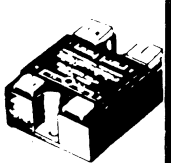
TOGGLE SWITCHES


PHOTOELECTRICS


RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS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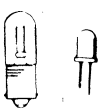
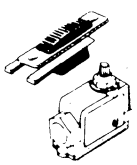
CIRCUIT BREAKERS FUSES & FUSEHOLDERS


KNOBS

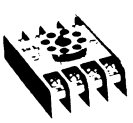

LAMPS & LEDS


SWITCHES


RELAYS


INDICATOR LIGHTS


SOLENOIDS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Solenoids

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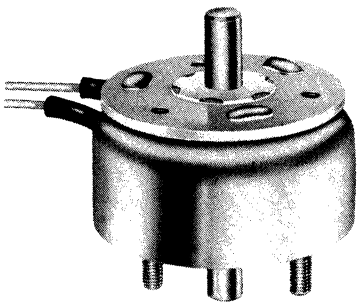
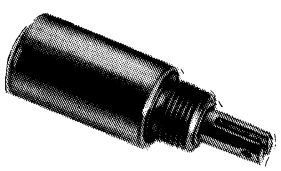


Rotary Solenoids

- Rapid response, high torque actuation
- Eight sizes available
- Right or left stroke from 25° to 95°
- Torque output to 30 lb./in.
- Modifications available

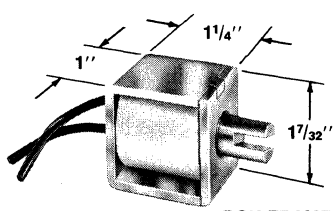
Type	O.D. (in.)	Height (in.)	Torque at 25° Stroke 100% Duty	Torque at 25° Stroke 5% Duty	Torque at 35° Stroke 100% Duty	Torque at 35° Stroke 5% Duty	Torque at 45° Stroke 100% Duty	Torque at 45° Stroke 5% Duty	Torque at 67½° Stroke 100% Duty	Torque at 67½° Stroke 5% Duty	Torque at 95° Stroke 100% Duty	Torque at 95° Stroke 5% Duty
2E	1.125	.656	0.22	1.71	0.17	1.31	0.11	0.89				
3B	1.312	.875	0.37	3.20	0.28	2.40	0.16	1.70	0.09	0.80		
3E	1.312	.796	0.38	3.21	0.27	2.31	0.17	1.82	0.10	0.89		
5B	1.875	1.203	1.89	10.04	1.00	8.35	0.75	6.01	0.55	4.02	—	1.90
5E	1.875	1.203	1.80	11.92	0.90	8.32	0.65	6.22	0.47	4.42	0.20	2.35
5S	1.875	1.046	2.00	13.25	1.00	9.25	0.73	6.91	0.52	4.91	0.23	2.61
6E	2.250	1.546	4.32	27.60	3.15	18.50	1.57	10.90	1.45	8.80	0.82	5.10
6S	2.250	1.343	4.80	30.70	3.50	20.60	1.75	12.10	1.62	9.80	0.92	5.70



Tubular Solenoids

- Provide 10 million cycles
- Push or pull types
- Spring return available
- Nine sizes available
- Pull up to 1 1/4" stroke
- Modifications available

Type	O.D. (in.)	Length (in.)	Duty	Ohms @12VDC	Ohms @24VDC	Force (ounces) @Stroke (inches) Min.	Force (ounces) @Stroke (inches) Max.
C7-18	7/16	1 1/8	Cont. Int.	72.0 14.4	288.0 58.0	1.5@1/8" 6.0@1/8"	0.5@1/4" 2.0@1/4"
C8-14	1/2	7/8	Cont. Int.	60.0 20.6	240.0 82.0	0.8@1/8" 3.0@1/8"	— 0.5@1/4"
C8-24	1/2	1 1/2	Cont. Int.	41.0 9.6	165.0 38.5	3.0@1/8" 6.0@1/8"	0.2@1/2" 2.5@1/2"
C8-32	1/2	2	Cont. Int.	36.0 7.2	145.0 29.0	2.5@1/8" 8.0@1/8"	0.8@3/4" 3.8@3/4"
C12-24	3/4	1 1/2	Cont. Int.	41.0 6.5	165.0 26.0	7.0@1/8" 21.0@1/8"	0.5@3/4" 3.0@3/4"
C16-18	1	1 1/8	Cont. Int.	36.0 7.6	144.0 30.0	10.0@1/8" 35.0@1/8"	0.2@1/2" 4.0@1/2"
C16-32	1	2	Cont. Int.	26.0 3.8	105.0 15.0	20.0@1/8" 65.0@1/8"	1.0@3/4" 13.0@3/4"
C24-26	1 1/2	1 5/8	Cont. Int.	20.6 82.0	82.0 14.0	50.0@1/8" 140.0@1/8"	1.0@3/4" 10.0@3/4"
C24-38	1 1/2	2 3/8	Cont. Int.	14.5 2.4	58.0 9.6	90.0@1/8" 180.0@1/8"	8.0@3/4" 45.0@3/4"



BOX FRAME

Box Frame Solenoids

- A.C. and D.C. available
- Leads or terminals available
- Pull up to 3 3/4# at 1" stroke
- Nine sizes available
- Modifications available

FLAT PACK SOLENOIDS AND SOLENOID SELECTROS ARE ALSO AVAILABLE.

Type	Height (in.)	Length (in.)	Width (in.)	Volts	Duty	Resist. Ohms	Force (ounces) @Stroke (inches) Min.	Force (ounces) @Stroke (inches) Max.
34	3/4	49/64	3/4	24VDC	100% 25%	120.0 33.6	10@1/32" 35@1/32"	1@1/4" 4@1/4"
35	3/4	13/16	3/4	24VDC	100% 25%	91.0 22.7	17@1/16" 35@1/16"	1@3/8" 7@3/8"
36	17/32	1 25/64	1	120VAC	100% 25%	285.00 70.0	23@1/16" 80@1/16"	9@7/8" 32@5/8"
37	15/16	1 5/8	13/16	24VDC	100% 25%	60.0 13.2	32@1/16" 70@1/16"	1@3/4" 6@3/4"
38	1 53/64	1 5/8	19/16	24VDC 120VAC	100% 25% 100% 25%	71.6 18.2 123.0 30.8	56@1/8" 154@1/8" 24@1/8" 75@1/8"	5@1/2" 22@1/2" 8@1/2" 38@1/2"
39	1 53/64	2 1/8	19/16	24VDC 120VAC	100% 25% 100% 25%	67.3 16.1 97.7 24.7	73@1/8" 159@1/8" 18@1/8" 67@1/8"	6@5/8" 28@5/8" 10@5/8" 39@5/8"
40	1 53/64	2 5/8	19/16	24VDC 120VAC	100% 25% 100% 25%	53.0 13.4 86.4 20.7	80@1/8" 150@1/8" 12@1/8" 52@1/8"	5.5@7/8" 29.5@7/8" 5.75@7/8" 26.5@7/8"
41	17/32	1 1/4	1	24VDC 120VAC	100% 25% 100% 25%	74.5 17.5 452.0 114.0	19@1/8" 62@1/8" 12@1/8" 45@1/8"	4@3/8" 23@3/8" 4@3/8" 21@3/8"
42	17/32	2	1	24VDC 120VAC	100% 25% 100% 25%	79.0 19.4 123.0 31.0	26@1/8" 70@1/8" 24@1/8" 21@1/8"	4@1/2" 20@1/2" 12@1/2" 7@1/2"

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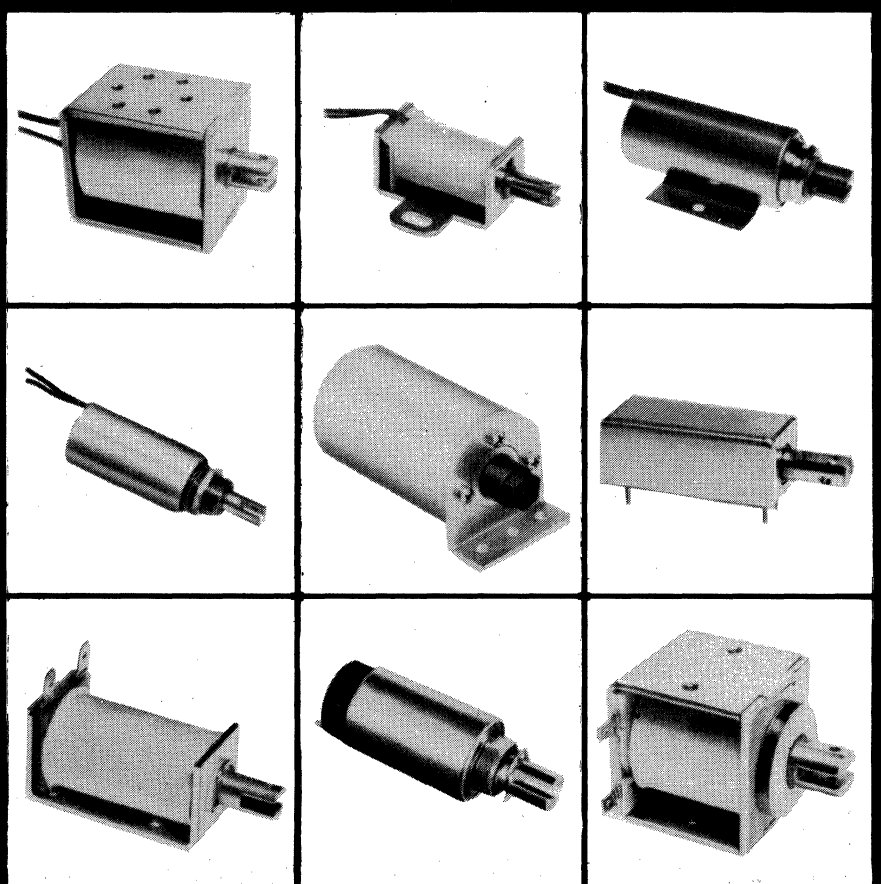

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NO POWER REQUIRED

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A MAGNETIC LATCHING SOLENOID ALLOWS CONTINUOUS HOLDING WITHOUT REQUIRING CONTINUOUS POWER.

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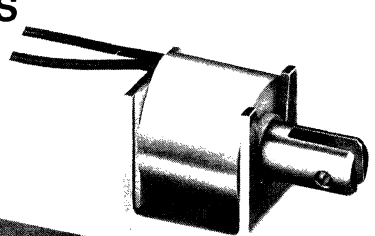
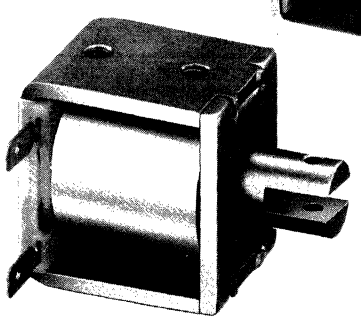
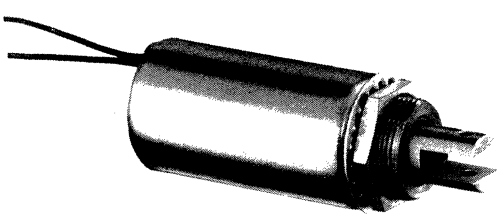
SINGLE COIL DESIGN
Release with Pulse, Pull-In with Reversed Polarity



TWO COIL DESIGN
Release with Pulse to Coil 1, Pull-In with Pulse to Coil 2



MANUAL RESET DESIGN
Release with Pulse Manually Reset



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- **Stroke up to 1.0 in.**
- **No Heat Rise**
- **Push or Pull Operation**
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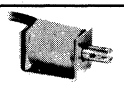
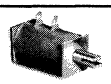
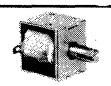
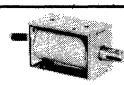
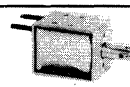
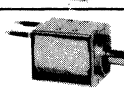
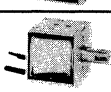
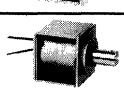
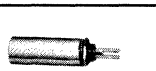
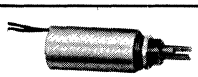
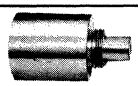
Box-Frame Solenoids (Pull Version)

Push Version Also Available.

	Type	Volts	Duty	Ohms	Forces and Strokes ounces @ inches (min.)	(max.)	Body inches H x L x W
	312-6005	24VDC	Cont.	144	22@1/32"	2@1/4"	3/4 x 1 9/32 x 3/4
	312-6006	24VDC	Int.	60	28@1/32"	4@1/4"	3/4 x 1 5/32 x 3/4
	312-6011	120VAC	Cont.	390	12@1/32"	2.5@1/4"	3/4 x 1 5/32 x 3/4
	312-6012	120VAC	Int.	100	20@1/32"	4@1/4"	3/4 x 1 5/32 x 3/4
	5U5-6053	24VDC	Cont.	114	14@1/16"	2.5@3/8"	15/16 x 1 1/4 x 27/32
	5U5-6054	24VDC	Int.	52	27@1/16"	5@3/8"	15/16 x 1 1/4 x 27/32
	5U5-6059	120VAC	Cont.	500	10@1/16"	4.5@3/8"	15/16 x 1 1/4 x 27/32
	5U5-6060	120VAC	Int.	310	17@1/16"	8.5@3/8"	15/16 x 1 1/4 x 27/32
	5U7-6065	24VDC	Cont.	85	15@1/8"	3@1/2"	15/16 x 1 3/4 x 27/32
	5U7-6066	24VDC	Int.	33	32@1/8"	7@1/2"	15/16 x 1 3/4 x 27/32
	5U7-6071	120VAC	Cont.	250	11@1/8"	7.5@1/2"	15/16 x 1 3/4 x 27/32
	5U7-6072	120VAC	Int.	140	18@1/8"	12@1/2"	15/16 x 1 3/4 x 27/32
	809-6101	24VDC	Cont.	104	12@1/8"	2@1/2"	1 3/16 x 1 1/8 x 15/16
	809-6102	24VDC	Int.	50	22@1/8"	3@1/2"	1 3/16 x 1 1/8 x 15/16
	809-6107	120VAC	Cont.	400	12@1/8"	5@1/2"	1 3/16 x 1 1/8 x 15/16
	809-6108	120VAC	Int.	220	24@1/8"	7@1/2"	1 3/16 x 1 1/8 x 15/16
	827-6113	24VDC	Cont.	72	24@1/8"	4@5/8"	1 3/16 x 1 7/8 x 15/16
	827-6114	24VDC	Int.	32	40@1/8"	8@5/8"	1 3/16 x 1 7/8 x 15/16
	827-6119	120VAC	Cont.	200	12@1/8"	6@5/8"	1 3/16 x 1 7/8 x 15/16
	827-6120	120VAC	Int.	85	20@1/8"	13@5/8"	1 3/16 x 1 7/8 x 15/16
	930-6125	24VDC	Cont.	54	63@1/8"	7@3/4"	1 5/8 x 2 x 1 7/16
	930-6126	24VDC	Int.	15	113@1/8"	25@3/4"	1 5/8 x 2 x 1 7/16
	930-6131	120VAC	Cont.	133	8@1/8"	7@3/4"	1 5/8 x 2 x 1 7/16
	930-6132	120VAC	Int.	37	36@1/8"	26@3/4"	1 5/8 x 2 x 1 7/16
	940-6137	24VDC	Cont.	50	78@1/8"	8@3/4"	1 5/8 x 2 3/16 x 1 7/16
	940-6138	24VDC	Int.	15	140@1/8"	18@3/4"	1 5/8 x 2 3/16 x 1 7/16
	940-6143	120VAC	Cont.	53	24@1/8"	15@3/4"	1 5/8 x 2 3/16 x 1 7/16
	940-6144	120VAC	Int.	15	100@1/8"	65@3/4"	1 5/8 x 2 3/16 x 1 7/16
	960-6149	24VDC	Cont.	58	50@1/8"	8@1/2"	1 5/8 x 1 9/16 x 1 7/16
	960-6150	24VDC	Int.	21	100@1/8"	18@1/2"	1 5/8 x 1 9/16 x 1 7/16
	960-6155	120VAC	Cont.	166	14@1/8"	10@1/2"	1 5/8 x 1 9/16 x 1 7/16
	960-6156	120VAC	Int.	60	45@1/8"	30@1/2"	1 5/8 x 1 9/16 x 1 7/16
	970-6161	24VDC	Cont.	58	65@1/8"	9@1/2"	1 5/8 x 1 25/32 x 1 7/16
	970-6162	24VDC	Int.	20	120@1/8"	24@1/2"	1 5/8 x 1 25/32 x 1 7/16
	970-6167	120VAC	Cont.	100	22@1/8"	16@1/2"	1 5/8 x 1 25/32 x 1 7/16
	970-6168	120VAC	Int.	125	85@1/8"	58@1/2"	1 5/8 x 1 25/32 x 1 7/16

Tubular Solenoids (Pull Version)

Push Version Also Available.

	Type	Volts	Duty	Oms	Forces and Strokes ounces @ inches (min.)	(max.)	Body inches Length x Dia.
	R7X9-6171	12VDC	Cont.	80	5@1/32"	1.2@5/32"	1 1/8 x 7/16
	R7X9-6172	12VDC	Int.	14	9@1/32"	2.5@5/32"	1 1/8 x 7/16
	R7X9-6173	24VDC	Cont.	260	5@1/32"	1.2@5/32"	1 1/8 x 7/16
	R7X9-6174	24VDC	Int.	57	9@1/32"	2.5@5/32"	1 1/8 x 7/16
	R8X7-6362	12VDC	Cont.	55	2.5@1/16"	1@3/16"	7/8 x 1/2
	R8X7-6363	12VDC	Int.	20	6@1/16"	1.5@3/16"	7/8 x 1/2
	R8X7-6364	24VDC	Cont.	240	2.5@1/16"	1@3/16"	7/8 x 1/2
	R8X7-6365	24VDC	Int.	80	6@1/16"	1.5@3/16"	7/8 x 1/2
	R8X12-6372	12VDC	Cont.	40	7@1/32"	1.5@1/4"	1 1/2 x 1/2
	R8X12-6373	12VDC	Int.	10	14@1/32"	4@1/4"	1 1/2 x 1/2
	R8X12-6374	24VDC	Cont.	160	7@1/32"	1.5@1/4"	1 1/2 x 1/2
	R8X12-6375	24VDC	Int.	38	14@1/32"	4@1/4"	1 1/2 x 1/2
	R8X16-6384	24VDC	Cont.	145	2.8@1/8"	1.5@3/4"	2 x 1/2
	R8X16-6385	24VDC	Int.	24	7@1/8"	4@3/4"	2 x 1/2
	R12X12-6211	12VDC	Cont.	41	6.5@1/8"	1.2@5/8"	1 1/2 x 3/4
	R12X12-6212	12VDC	Int.	6	20@1/8"	6@5/8"	1 1/2 x 3/4
	R12X12-6213	24VDC	Cont.	165	6.5@1/8"	1.2@5/8"	1 1/2 x 3/4
	R12X12-6214	24VDC	Int.	25	20@1/8"	6@5/8"	1 1/2 x 3/4
	R16X9-6221	12VDC	Cont.	36	22@1/16"	2.5@1/2"	1 1/8 x 1
	R16X9-6222	12VDC	Int.	8	33@1/16"	4@1/2"	1 1/8 x 1
	R16X9-6223	24VDC	Cont.	145	22@1/16"	2.5@1/2"	1 1/8 x 1
	R16X9-6224	24VDC	Int.	30	33@1/16"	4@1/2"	1 1/8 x 1
	R16X16-6231	12VDC	Cont.	26	21@1/8"	6.5@5/8"	2 x 1
	R16X16-6232	12VDC	Int.	3.8	56@1/8"	20@5/8"	2 x 1
	R16X16-6233	24VDC	Cont.	105	21@1/8"	6.5@5/8"	2 x 1
	R16X16-6234	24VDC	Int.	15	56@1/8"	20@5/8"	2 x 1
	R24X13-6243	24VDC	Cont.	85	50@1/8"	5@5/8"	1 5/8 x 1 1/2
	R24X13-6244	24VDC	Int.	14	150@1/8"	20@5/8"	1 5/8 x 1 1/2
	R24X19-6253	24VDC	Cont.	59	80@1/8"	8@1"	2 3/8 x 1 1/2
	R24X19-6254	24VDC	Int.	10	140@1/8"	32@1"	2 3/8 x 1 1/2

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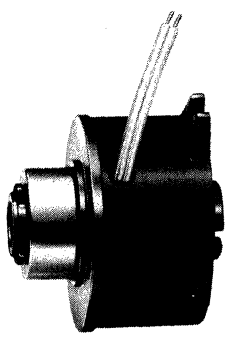

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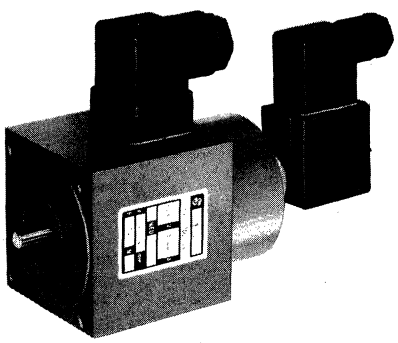

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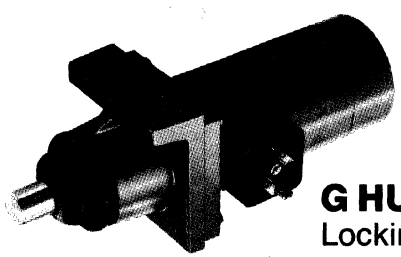

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QUALITY
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BEST OF THE '90s

NKK can show you exactly where the switch industry is headed because we're already there. We have over 1,000,000 different ways to improve your products' reliability and functionality — starting with the just-released breakthrough switch ideas on this page. Send for our free 456-page catalog.

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NKK Switches
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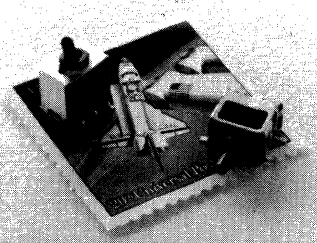
Scottsdale, AZ 85260.
Phone (602) 991-0942.

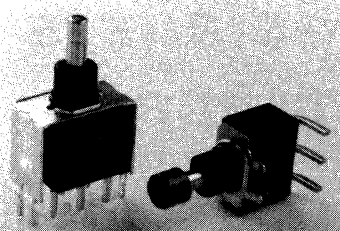
nkk switches

WORLD'S SMALLEST



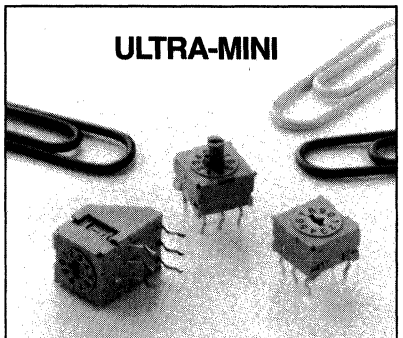
NKK introduces the surface mount G3T with patented STC contacts, gull-wing terminals. VPS or infrared reflow solderable.

EASY DOES IT



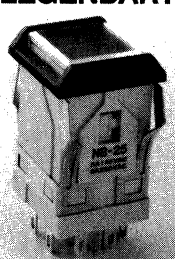
Washable M2B subminiature pushbuttons feature very-light-touch, snap-acting contacts. Straight, right angle, vertical PC terminals.

ULTRA-MINI

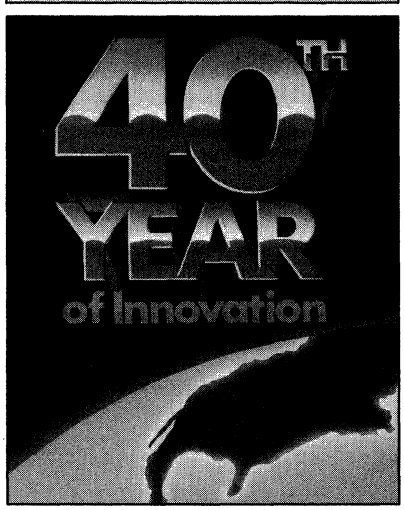


New ND switch is half the size of ordinary binary coded DIP rotaries. Washable and universal footprint pattern.

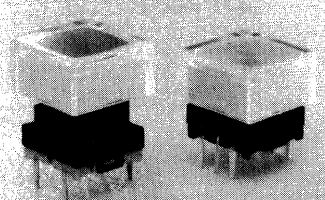
LEGENDARY



New compact, industrial-grade NB snap-in LED pushbutton with split legend up to 4 ways. Built-in resistor. Numerous options.

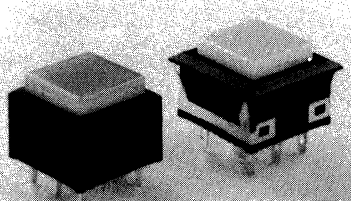


WORTH A MILLION



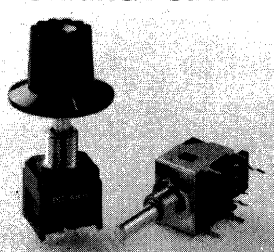
Million operations from unique LED illuminated JB keypad switch. Red, green or yellow LED options.

DOUBLE DUTY



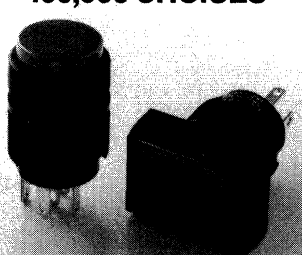
Logic-level for PCB or power rating for snap-in panel mounting, from very low-profile UB pushbuttons with full-face LED illumination.

TURNING POINT



Washable Binary Coded DIP rotary DR-A switch can be PC or panel mounted. Crisp operation. Right angle or straight terminals.

100,000 CHOICES



YB pushbutton yields literally 100,000+ part numbers with variations in mounting, illumination, circuitry and color.

SWITCHES

Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton				Reed	Rocker/ Paddle	Rotary		Slide	Snap Action	Thumb-wheel	Toggle	Mercury	Features
				Position			Push-on/ Push-off			Single Section	Multi-section						
				Momentary Action	Positive Action	Interlock											
Altech Corp.	B•1643		√	√	√	√					√						High voltage, Key lock, Power
AME Corp.	B•1644						√								√		Sealed
American Control Tech. Inc.	B•1645	√		√										√			Illuminated, Sealed, Coded
AMP Inc.	B•1646	√							√	√		√					Coded
Arcolectric Corp.	B•1648			√	√		√		√			√	√		√		Illuminated, High Voltage, Power, Sealed
Aries Electronic	B•1649	√	√		√		√		√								Sealed
Aromat Corp.	B•1650												√				
Burgess SAIA, Inc.	B•1652			√	√	√	√			√	√		√				Explosion proof, Key lock, Sealed
C & K Comps., Inc.	B•1654	√	√	√	√	√	√		√	√		√	√	√	√		Illuminated, Key lock, Power, Sealed, Coded
Capitol Switch Inc.	B•1656	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Carlingswitch Inc.	B•1658		√	√	√		√		√				√		√		Illuminated, Key Lock, Power, Sealed
Cherry Electrical Prods.	B•1661		√	√	√	√							√	√			Decade, Illuminated, Power, Sealed
Cole Instruments	B•1660									√	√						Explosion proof, Key lock, Sealed, Coded
Comus International	B•1668							√								√	Explosion proof, Power, Sealed, Coded, MIL, Flux-Proof, Add-A-Pot
CRL Comps.	B•1669		√	√		√	√		√	√	√		√		√		Illuminated, High voltage, Power, RF, Sealed, Coded

SWITCHES (cont'd)

Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton				Reed	Rocker/ Paddle	Rotary		Slide	Snap Action	Thumbwheel	Toggle	Mercury	Features
				Position			Push-on/ Push-off			Single Section	Multi-section						
				Momentary Action	Positive Action	Interlock											
Crosspoint/ Info-Lite	B•1673																RF, Matrix program, Matrix pinboards, Matrix switches
Crouzet Controls	B•1675								√					√			
CTS Electro-mechanical Div.	B•1676	√															
CW Industries	B•1678								√			√					Illuminated, Power, Miniature, Microminiature
Digitran & Computron	B•1680		√				√			√	√			√			Decade, Explosion proof, Illuminated, Sealed, Coded
Direct Sound Corp.	B•1681			√	√		√		√			√			√		
Dow-Key Microwave	B•1682																Power, RF, Sealed, Coded
Durakool	B•1683															√	
EAO Switch	B•1684			√	√	√	√						√				Illuminated, High voltage, Key lock, Power, Sealed
Electro-Mech Comps., Inc.	B•1686			√	√	√	√						√				Illuminated, Key lock, Coded
Electronic Components Groupe	B•1689			√	√	√	√		√	√		√			√		Illuminated, High voltage, Power, Sealed
Electroswitch/ Dist.	B•1694									√	√		√				
Elma Electronic Corp.	B•1695	√	√	√	√	√	√		√	√	√		√	√	√		Decade, Illuminated, Key lock, Sealed, Coded
Fifth Dimension Inc.	B•1696															√	Tilt Switches, Impulse Switches
Grayhill Inc.	B•1698	√		√	√		√			√	√		√				Explosion proof, Key lock, Power, Sealed, Coded, MIL Spec

SWITCHES (cont'd)

Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton				Reed	Rocker/ Paddle	Rotary		Slide	Snap Action	Thumbwheel	Toggle	Mercury	Features
					Position												
				Momentary Action	Positive Action	Interlock	Push-on/ Push-off			Single Section	Multisection						
Hamlin Inc.	B•1706	√		√				√								√	Sealed, RF
Hasco Components Inc.	B•1707							√									
Hermetic Switch Inc.	B•1708							√									Explosion proof, High voltage, Power, RF, Sealed
IDEC Corp.	B•1709			√										√			Illuminated, Key lock, Photoelectric switches
Illinois Lock Co.	B•1710																Key lock
ITW Switches	B•1712			√			√		√		√	√	√				Illuminated, Sealed
IVO Industries	B•1722													√			Decade, Illuminated, Coded
JAE Electronics Inc.	B•1724	√		√	√							√		√			Decade, Key lock, Coded
Janco Corp.	B•1726			√	√	√				√	√						High voltage, Key lock, Power, RF, Sealed, Coded
Lamb Inds.	B•1728	√	√	√		√	√		√			√	√	√	√		Illuminated, Power, Sealed, Touch, Coded, Miniature DIP Rotary BCD/BCD Compliment
Lucas Ledex Inc.	B•1731									√	√						Packaged, Stepping
McGill Electrical	B•1734								√				√		√		Illuminated, Power, Sealed
Mepcopal	B•1737	√															Digital switches
Micro Switch	B•1738			√	√	√	√		√				√		√	√	Illuminated, High voltage, Key lock, Power, Sealed
MORS/ASC	B•1745		√	√	√		√		√				√		√		Illuminated, High voltage, Power, Sealed

SWITCHES (cont'd)

Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton				Reed	Rocker/ Paddle	Rotary		Slide	Snap Action	Thumb-wheel	Toggle	Mercury	Features
					Position												
				Momentary Action	Positive Action	Interlock	Push-on/ Push-off			Single Section	Multi-section						
NKK Switches	B•1746			√			√		√	√	√	√			√		Illuminated, Key lock, Sealed, Touch, Coded
Oak Switch Systems	B•1754		√	√			√		√	√	√						Explosion proof, Illuminated, High voltage, Key lock, Power, Sealed
Omega Engineering	B•1760				√	√				√	√	√					
Oslo Controls	B•1761			√			√		√								Illuminated, Key lock, Power
Otto Controls	B•1762		√	√	√	√	√		√	√			√		√		Sealed
Power Dynamics	B•1764					√											Key lock
Preh Electronic Ind. Inc.	B•1765			√	√		√										Illuminated, Power , Pneumatic Switches, Safe Switching Devices, Pressure Switches, Vacuum Switches, Differential Pressure Switches, Printed Circuit Board Switches
Pres-Air-Trol Corp.	B•1766			√	√		√										Explosion Proof, Sealed
RDI Electronics	B•1767		√	√	√		√								√		Sealed
Rundel Products	B•1768			√			√										Illuminated, Key lock
Schurter Inc.	B•1771			√	√		√				√		√				Illuminated, High Voltage Power, Sealed
Shallco Inc.	B•1772									√	√						Decade, Coded
Shogyo Int'l . Corp.	B•1778	√	√	√	√	√	√		√	√		√			√		Illuminated, Leaf
Signal Systems	B•1779															√	Vibration & Motion Sensing
Sorenson Lighted Controls	B•1787			√			√										Sealed, Touch
Standex Electronics	B•1782							√									
Switchcraft Inc.	B•1784	√	√	√	√	√			√						√		Illuminated, High voltage
T-Bar Inc.	B•1788			√											√		Sealed, Fiber Optic, Coax Switch Module
Tech Labs	B•1789									√	√		√	√	√		Decade, Power, Sealed, Coded
Veetronix Inc.	B•1790			√	√	√	√	√									Illuminated, Sealed
Wilbrecht Elctrns.	B•1793			√	√							√					Coded

Altech Corp.
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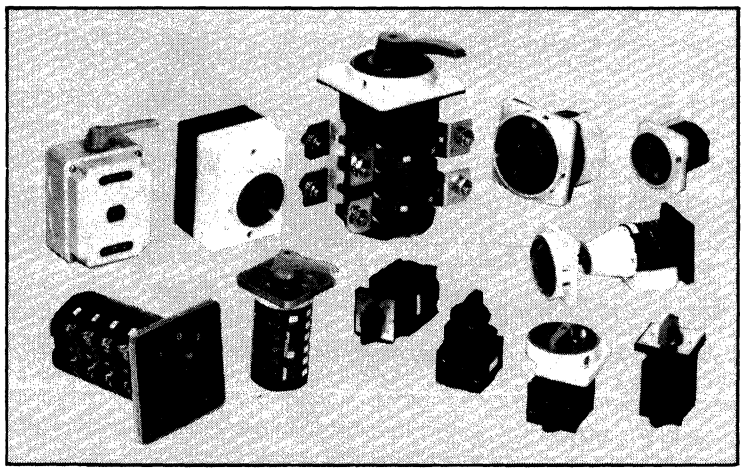
Power Switches

Rugged, safe, reliable switches for industrial control applications...

Automation, Machine Tools, Instrumentation
Material Handling, Railways, Marine

Altech's comprehensive line includes switches for diverse applications and environments, and provides cost effective solutions for any switching problem. Worldwide approvals include UL, CSA, IEC, VDE.



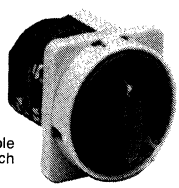
CM Series

- Space Saving Modular Construction
- Up to 25 Amps
- Self-Extinguishing Materials
- Panel, Base or DIN Rail Mount

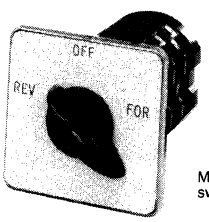
Power Disconnect

Superior performance for use as load and motor disconnects, emergency, and isolator switches.

- Thru-The-Door Interlocks
- Capability Range to 75 KW or 100 HP at 600 VAC.



Pad lockable safety switch



Motor reversing switch

Metering/Selection

Selector switches simplify voltage and current measuring circuits, reducing the need for multiple meters. Compact, they can be mounted side-by-side without installation interference.

- Save Valuable Panel Space
- Ratings at 12A, 16A, 20A, 25A/600VAC

CAM Series

- Assembled From Standard Parts
- Multiple Positioning Mechanism
- Above 25 Amps
- Steel-Thru Shafts & Bolts
- Self-Extinguishing Materials
- Panel, Base or DIN Rain Mount

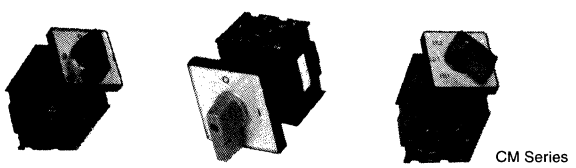


CAM Series

Motor Control

Start-up, reverse, change speeds with rotary CAM switches, single to three-phase motor control. Control and sequence motors with one modular multiple CAM switch.

- Power Supply Selectors
- Transformer Tap Selectors

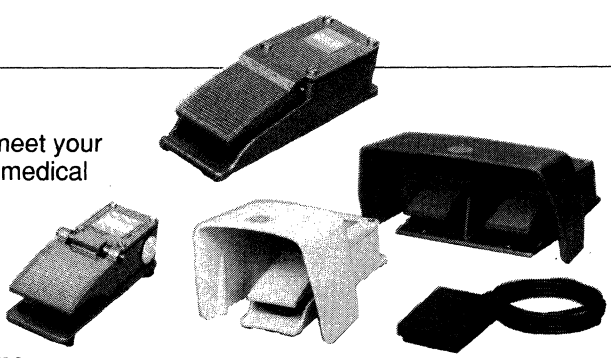


CM Series

Foot Switches

Altech offers attrractive, heavy duty Foot Switches that will meet your design and performance requirements for industrial, electro-medical and commercial applications.

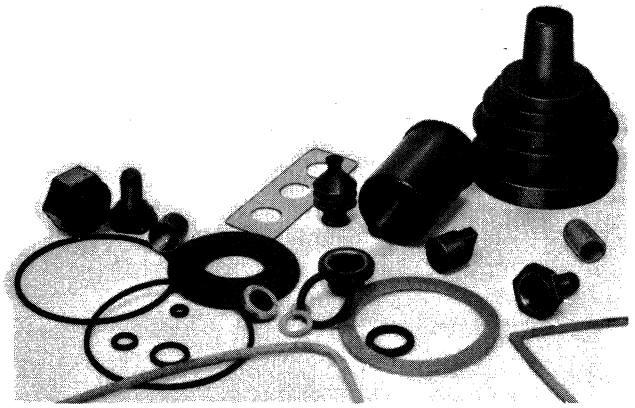
- Single, Double, Triple Pedal
- Sturdy, Rugged Design
- Reliability, Precision
- Potentiometers
- Long Life
- Reset Buttons
- Foot Shields
- Customization
- Water/Oil Tight Versions



Ask about other switches available from Altech: • Safety Trip Cable • Magnetic • Limit

SEE OUR ENCLOSURES IN SECTION 1400 C•1007/SEE OUR CIRCUIT BREAKERS IN SECTION 4300 B•1343/SEE OUR TERMINAL BLOCKS IN SECTION 2100 C•1154

AME SWITCH SEALS



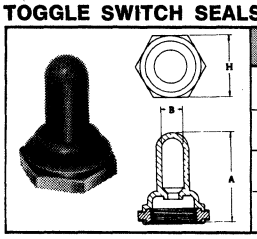
Backed by over 25 years of engineering solutions — for an ever-changing and demanding market.

The wide demand for custom-molded panel and switch seals, threaded inserts bonded to rubber, O-rings, boots and seals, etc., translated is really a demand for talent and know-how to handle the engineering and molding of particularly thorny or unusual custom requirements that frequently plague industry. AME meets the demand. . . with experience, service and unique production techniques.

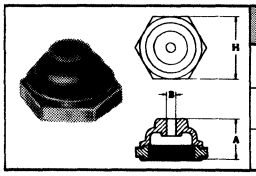
CUSTOM ENGINEERED PRECISION MOLDED ELASTOMERS

- Color filters for incandescent lamps
- Rubber to metal bonding
- Clear silicone products
- Self-sealing hex nuts
- Self-sealing washers
- Extrusions
- O-rings
- Boots
- Gaskets
- Seals
- Conductive rubber
- Die cutting

TOGGLE SWITCH SEALS

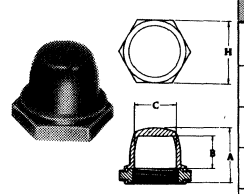


Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	H	Material Specifications
1100	M5423/01-01	15/32-32 UNS-2B	in.	.86	.22	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 50 Gray
			mm	(21.84)	(5.59)	(15.88)	
1102	None	15/32-32 UNS-2B	in.	.86	.22	.625 Hex	
			mm	(21.84)	(5.59)	(15.88)	
1103	None	15/32-32 UNS-2B	in.	.90	.22	.625 Hex	Nut-Brass, Rubber-Neoprene, 50 Durometer Black
			mm	(22.86)	(5.59)	(15.88)	
1105	M5423/05-01	1/4-40 UNS-2B	in.	.50	.064	.375 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 30 Gray
			mm	(12.70)	(1.63)	(9.53)	



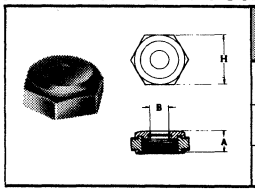
Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	H	Material Specifications
1101	M5423/02-01	15/32-32 UNS-2B	in.	.40	.09	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 50 Gray
			mm	(10.16)	(2.29)	(15.88)	
1104	None	5/8-24 UNEF-2B	in.	.75	.09	.812 Hex	
			mm	(19.05)	(2.29)	(20.62)	
1106	M5423/11-01	1/4-40 UNS-2B	in.	.25	.05	.375 Hex	
			mm	(6.35)	(1.27)	(9.53)	

PUSH BUTTON SWITCH SEALS



Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	C	H	Material Specifications
2100	M5423/07-01	15/32-32 UNS-2B	in.	.55	.32	.42	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 60 Gray
			mm	(13.97)	(8.13)	(10.67)	(15.88)	
2101	None	1/2-32 UNS-2B	in.	.46	.29	.41	.750 Dia.	
			mm	(11.68)	(7.37)	(10.41)	(19.05)	
2102	M5423/07-02	15/32-32 UNS-2B	in.	.72	.48	.42	.625 Hex	
			mm	(18.29)	(12.19)	(10.67)	(15.88)	
2103	M5423/10-01	1/4-32 UNEF-2B	in.	.31	.20	.19	.375 Hex	
			mm	(7.87)	(5.08)	(4.83)	(9.53)	
2104	M5423/10-02	1/4-40 UNS-2B	in.	.31	.20	.19	.375 Hex	
			mm	(7.87)	(5.08)	(4.83)	(9.53)	

ROTARY SWITCH & POTENTIOMETER SEALS



Part Number	Equiv. Military Part Number	Thread Size	Unit	A	Size of Shaft B	H	Material Specifications
3100	M5423/09-02	3/8-32 UNEF-2B	in.	.22	.250	.500 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 60 Gray
			mm	(5.59)	(6.35)	(12.70)	
3101	M5423/09-01	3/8-32 UNEF-2B	in.	.22	.125	.500 Hex	
			mm	(5.59)	(3.18)	(12.70)	
3102	M5423/09-04	15/32-32 UNS-2B	in.	.22	.250	.625 Hex	
			mm	(5.59)	(6.35)	(15.88)	

FOR A COMPLETE LISTING OF ALL STYLES AVAILABLE, INCLUDING ROUND BASE SEALS, PLEASE CONTACT THE FACTORY.

MANY OTHER SIZES AND TYPES AVAILABLE

Pressure capabilities: Internal Pressure
1 Atmosphere, 15 psi (103.4 kPa)

External Pressure
2 Atmospheres, 30 psi (206.8 kPa)

For Part #1106 — Internal pressure
.7 Atmosphere, 10 psi (69 kPa)

External pressure
1.4 Atmospheres, 20 psi (138 kPa)

Endurance: Exceeds 100,000 actuations (depending on environment).

Useful life: 20 years to unlimited (depending on environment).

Switch Seals are designed and manufactured to meet or exceed applicable military specifications.

Switch Seals

An elastomeric boot which seals, thus protecting a switch and internal components against hazardous foreign elements. AME's one piece switch seal is constructed of a flexible rubber boot element bonded during molding to a threaded metal insert that fully encapsulates the switch and bushing to the panel.

This assembly replaces the panel mounting nut and seals the mounting hole making it watertight. It protects against moisture, oil, dirt, dust, most solvents, many acids (see elastomer selection guide).

Switch seals provide vibration resistant mounting and act as double insulation with no interference to switch movement.

CAST URETHANE & SILICONE

AME supplies cast urethane and silicone products precision engineered to meet your most demanding requirements.

If you need high tensile/tear strength, excellent resistance to abrasion and high impact capability, our cast urethane is ideally suited for the job. Superb temperature resistance to the damaging sub-zero cold or searing heat extremes is found in the cast silicone custom engineered by AME Corporation.

FAX (201) 263-8199

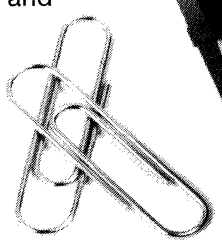
AME CORPORATION
33 Jacksonville Rd.
P.O. Box 195 Dept. EM
Towaco, NJ 07082-0195
(201) 263-1700

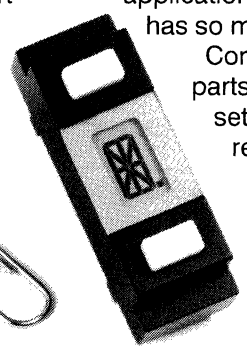
SWITCH SEALS

The world's first intelligent man/machine interface in a DIP . . .

Provides all of the display and switch functions you'll ever need in a single compact device. Stackable and cost-effective.

The secret? A single LSI chip with state-of-the-art CMOS logic. Developed jointly with GE/RCA. Logic that combines a single-character alpha-numeric display, thumbwheel switch and pushbutton switch functions in one easy-to-use component. A true peripheral device with a RAM-like CPU interface.





An intelligent thumbwheel switch that will put you miles ahead of the competition. With capabilities they can only dream about. Unless, of course, you tell them.

In a simple application you might directly replace those out-dated mechanical thumbwheel switches. A typical cookbook design. And without a host CPU.

In a more sophisticated application you might use a host processor to provide programmable control over man/machine interactions. Such as formula selection and entry, display of messages, user friendly menus, or a mix of some or all of these capabilities. The possibilities are limited only by your imagination.

No matter how simple or how complex your application is, no other interactive component has so much to offer and is so easy to use.

Concerned about availability? Standard parts are typically off-the-shelf. We've even set up a second source so that you'll receive an uninterrupted supply.

Got a deadline to meet? Our technical support team will help get you on the air in record time. Or maybe one of our off-the-shelf intelligent thumbwheel assemblies will fit the bill.

Whether you need to make a decision fast, or you're just thinking about down the road. Our microcontroller-based evaluation kit will provide you with instant evaluation, complete documentation and everything else you need to get started. Order one right now and experience intelligent interaction.

To place an order or for more information call: (708) 426-6780.

EVALUATION/DESIGNER'S KIT

This handy low-cost kit will save you weeks of time. The kit includes everything you need for evaluating, prototyping and designing with this new technology. A MUST for your engineering lab.

Includes a microcontroller programmed to demonstrate the many functions and capabilities of these devices.

The kit includes:

- 15 assorted intelligent thumbwheels
- A microcontroller-based evaluation board with all components (includes a preprogrammed Signetics S87C751 microcontroller)
- Technical data sheets and specifications
- Application notes

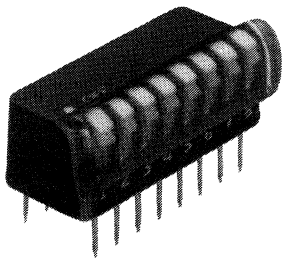
Order # EVAL-SST-KIT $245

™AMERICAN CONTROL TECHNOLOGY

AMERICAN CONTROL TECHNOLOGY, INC., 825 VILLAGE QUARTER RD., W. DUNDEE, IL 60118
PHONE: (708) 426-6780 FAX: (708) 426-1057

Printed Circuit Board Switches and Shunts

Single Pole Single Throw Side Actuated



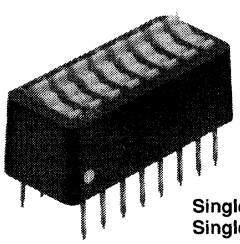
Contact Lead Spacing—
.100 x .300 [2.54 x 7.62]
Lead Length—.140 [3.57] below mounting surface

No. of Switch Positions	SPST Side Actuated Part No.	
	Unsealed[1]	Sealed
2	1-435802-0	1-435802-3
3	435802-2	1-435802-4
4	435802-3	1-435802-5
5	435802-4	1-435802-6
6	435802-5	1-435802-7
7	435802-6	1-435802-8
8	435802-1	435802-9
9	435802-7	1-435802-9
10	435802-8	2-435802-0
12	—	2-435802-2

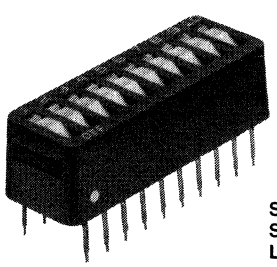
[1]All switches are bottom sealed.

DIP Switches Standard 7100 Series

Contact Lead Spacing—
.100 x .300 [2.54 x 7.62]
Lead Length—.140 [3.57] below mounting surface



Single Pole Single Throw



Single Pole Single Throw Low Profile

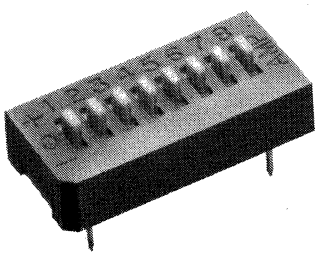
No. of Switch Positions	SPST Standard Profile Part No.		SPST Low Profile Part No.	
	Unsealed[1]	Sealed	Unsealed[1]	Tape-Sealed
2	2-435640-9	3-435640-3	435668-1	2-435668-6
3	3-435640-0	3-435640-4	435668-2	3-435668-3
4	435640-2	3-435640-5	435668-3	3-435668-4
5	435640-3	3-435640-6	435668-4	3-435668-5
6	435640-4	3-435640-7	435668-5	2-435668-5
7	435640-1	3-435640-8	435668-6	2-435668-7
8	435640-5	3-435640-9	435668-7	2-435668-8
9	435640-6	4-435640-0	435668-8	2-435668-9
10	435640-7	4-435640-1	435668-9	3-435668-0
12	3-435640-2	4-435640-3	1-435668-1	3-435668-2

[1]All switches are bottom sealed.

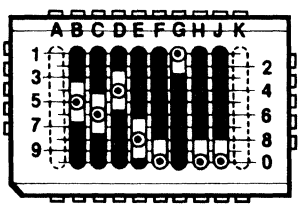
Trinary Slide Switch 7800 Series

Materials:
Case and Base—Glass-filled polyester, 94V-0 rated
Slide—Polyester, 94V-0 rated
Spring Contacts and Leads—Copper alloy, plating in accordance with AMP Product Specification 108-7047

8 Pos. Part No. 436172-3



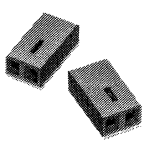
AMP Mini-Matrix Slide Switches



Materials:
Structural Plastic—Glass-filled thermoplastic, 94V-0 rated
Column and Row Buses—Copper alloy, contact areas gold plated
Slide Springs and Contacts—Beryllium copper, gold plated

Switch Configuration	Switch Part Number
10 x 10	436270-1

Tandem Spring Shunts



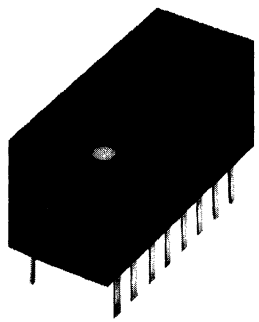
.100 [2.54] Centerline

Part No. 530153-2
.000030 [0.00076] Gold Inlay in contact area

For **drawings, technical data or samples,** contact your local AMP distributor, your AMP sales engineer or call the AMP Product Information Center **1-800-522-6752.**

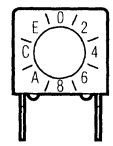
For more information request Catalog 82162

Preprogrammed Printed Circuit Board Switches

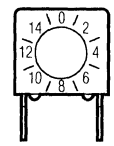


Contact Lead Spacing—
.100 x .300 [2.54 x 7.62]
Lead Length—.120 [3.05] below mounting hole

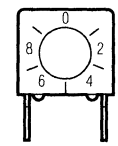
Stamping Legend



Style I



Style II



Style III

Switch Type	Actuator	Stamping Legend Style[1]	Removable Tape Seal on Actuator	Switch Part No.
Hexadecimal w/Complement (16 Position)	Screwdriver Slot	I	No	53137-5
Hexadecimal w/Complement (16 Position)	Screwdriver Slot	II	No	53137-6
Hexadecimal w/Complement (16 Position)	Screwdriver Slot	I	Yes	54792-1
Hexadecimal w/Complement (16 Position)	Screwdriver Slot	II	Yes	54792-2
BCD w/Complement (10 Position)	Screwdriver Slot	III	No	53919-2
BCD w/Complement (10 Position)	Screwdriver Slot	III	Yes	54778-1
BCD w/Complement (10 Position)	Extended Shaft	None	No	54308-1

[1]All switches marked with epoxy ink unless otherwise specified

Post Shunts 2-Position, Low Profile Shunts

.100 [2.54] Centerline

Part No. 531220-2
.000015 [0.00038] Gold Plate[1]

Part No. 531220-3
.000030 [0.00076] Gold Plate[1]

Part No. 531220-1
.000100 [0.00254] Tin Plate

[1]In contact area



.200 [5.08] Centerline

Part No. 531230-2
.000015 [0.00038] Gold Plate[1]

Part No. 531230-3
.000030 [0.00076] Gold Plate[1]

Part No. 531230-1
.000100 [0.00254] Tin Plate

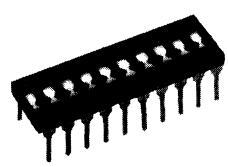
[1]In contact area



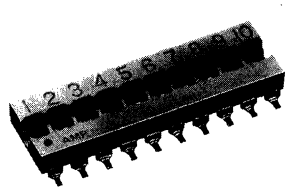
DIP Shunts 7600 Series

Contact Lead Spacing—
.100 x .300 [2.54 x 7.62]
Lead Length—.140 [3.57] below mounting hole

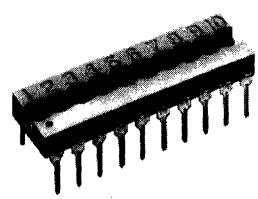
Standard Shunt Standard Pressure



Machine Insertable Shunt



Surface Mount Shunt

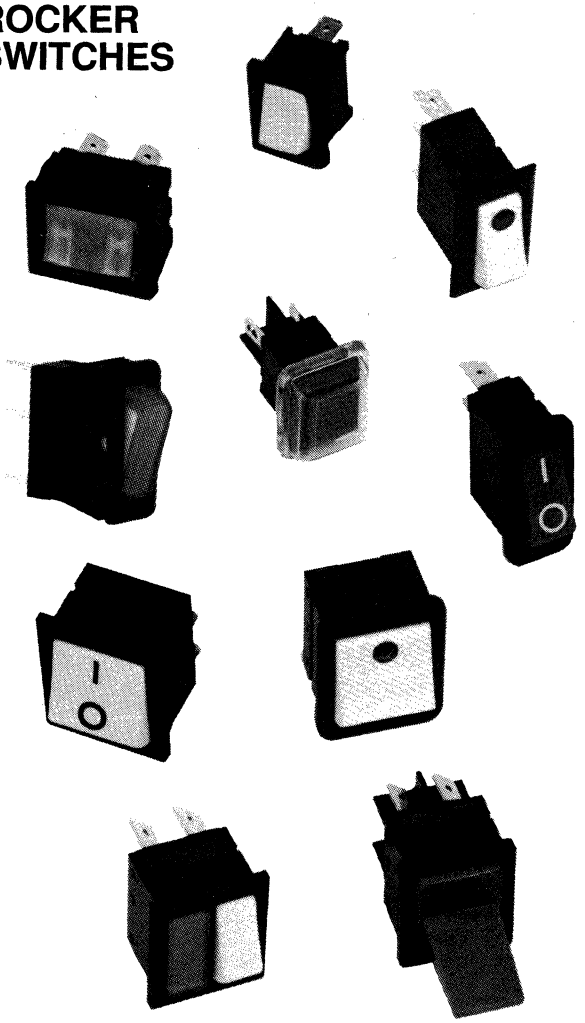


No. of Positions	Standard Shunt	Machine Insertable Shunt	Surface Mount Shunt
2	435704-2	—	382341-2
3	435704-3	—	382341-3
4	435704-4	436860-3	382341-4
5	435704-5	—	382341-5
6	435704-6	436860-5	382341-6
7	435704-7	436860-6	382341-7
8	435704-8	436860-7	382341-8
9	435704-9	—	382341-9
10	1-435704-0	436860-9	1-382341-0
12	1-435704-2	1-436860-1	1-382341-2

Arcolectric

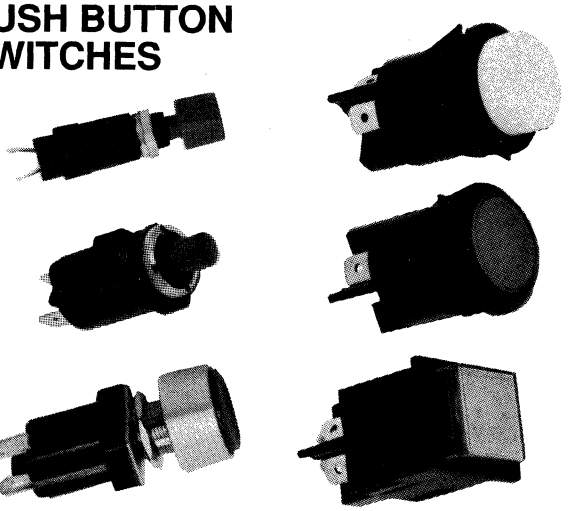
ROCKER--PUSH BUTTON--SLIDE--TOGGLE SWITCHES

ROCKER SWITCHES



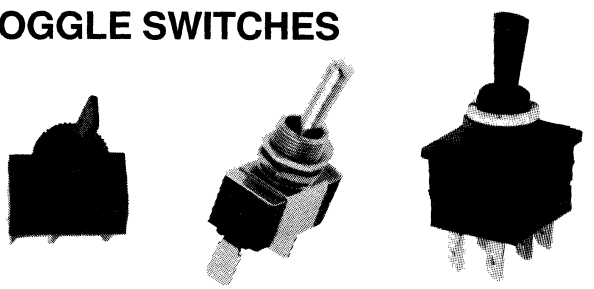
Single and double pole • Maintained, momentary circuits • Lighted and nonlighted • Twin switches in one body • Special colors and legends • Numerous cut out sizes • Isolated lamp circuits • Water resistant versions • Protective front cover boots • Electrical ratings up to16a 250vac 1HP 200a In-rush • Most of these ranges are fully automated offerings, low cost, consistant quality and 100% testing

PUSH BUTTON SWITCHES



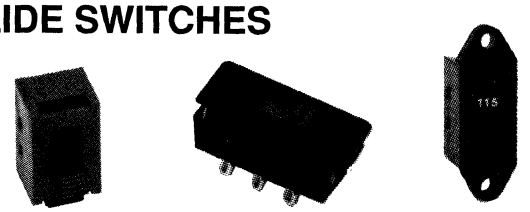
Single, double pole, momentary, alternate action, lighted and non-lighted circuits. Ratings up to 16a 250vac 1HP.

TOGGLE SWITCHES



Single and double pole circuits. Ratings up to 20a 250vac 1 3/4HP

SLIDE SWITCHES



Single and double. Ratings to 12a 250vac

Most products are UL, CSA and VDE etc approved.
Complete details supplied on request.

SEE PAGE B • 1141, SECTION 2460 FOR INDICATOR LIGHTS.

A FULL LINE CATALOG OF DRAWINGS AND SPECIFICATIONS AVAILABLE FREE OF CHARGE.

Arcolectric Corporation 9001 Canoga Ave., Canoga Park, CA 91304
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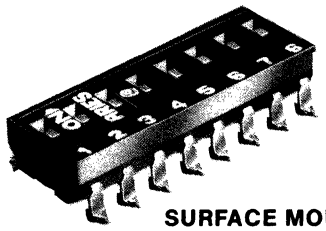
QUALITY FEATURES... ARIES® DIP SWITCHES
Competitively Priced!

FEATURES:

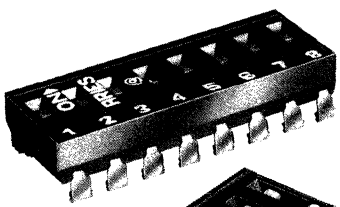
- Number of positions available: 4 thru 10 and 12.
- Top Quality Materials:
  - Base, Cover and Slider: UL94VO rated glass filled high temperature thermoplastic. PPS Base and Cover rated at 500°F (260°C).
  - Slider Contact: Beryllium Copper Alloy w/selective gold plating over nickel plating.
  - Terminal: Copper Alloy w/selective gold plating over nickel plating and tin plating on leads.
- Fully sealed assembly:
  - Molded cover ultrasonically welded to base with insert molded and dual sealed terminals.
  - Slider contact with insert molded slider.
  - KAPTON* (polyimide) sealing tape.
- Redundant bifurcated slider contacts—self cleaning wiping action.
- 20μ gold in contact area.
- Compatible with auto-insertion equipment.
- End stackable.
- Recessed slider travel = .045″ (1,14)
- Low profile height of .170″ (4,31) for all three styles.
- Preprogramming available.
- Tape and Reel packaging as per EIA-481-A available.
- Fully automated assembly and 100% tested.
- Competitively priced.

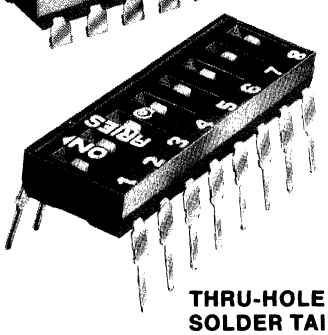
CURRENT SIZES
4, 5, 6, 7, 8, 9, 10 and 12

POS.	LENGTH
4	.395 (10,03)
5	.495 (12,57)
6	.595 (15,11)
7	.695 (17,65)
8	.795 (20,19)
9	.895 (22,73)
10	.995 (25,27)
12	1.195 (30,35)



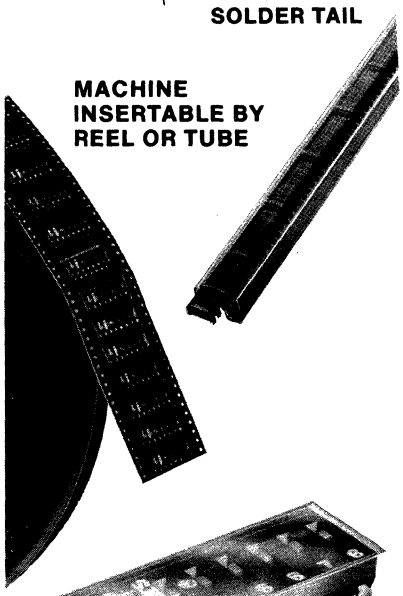
SURFACE MOUNT, "J" or GULL WING

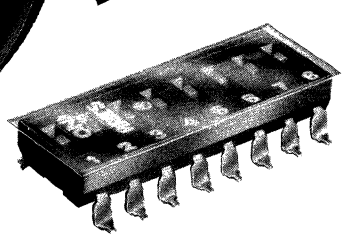




THRU-HOLE SOLDER TAIL

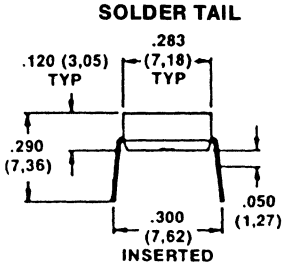
MACHINE INSERTABLE BY REEL OR TUBE





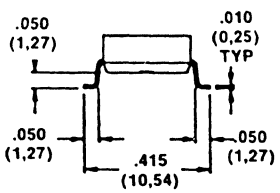
TAPE STANDARD
With Surface Mount Switches

THRU-HOLE SOLDER TAIL



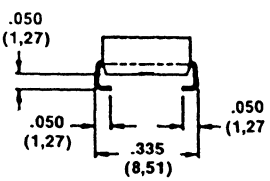
WITH OR WITHOUT TAPE SEAL

GULL WING



TAPE SEAL STANDARD

J-LEAD



TAPE SEAL STANDARD

HOW TO ORDER

XX - 7X7 - XX

- Number of Positions 4-10, 12
- 707 = w/Tape; 717 = No Tape
- 1 = Machine insertable THRU-HOLE; 2 = Gull Wing Surface Mount; 3 = "J"-Lead Surface Mount
- 1 = Standard Tube Packaging; 2 = Tape and Reel Packaging for Surface Mount Versions

* Trademark of DuPont

Samples are FREE — please provide title, company name and telephone number.

P.O. Box 130
Frenchtown, NJ 08825
Phone (908) 996-6841
FAX 908-996-3891

ARIES ELECTRONICS, INC.

Aromat Snap-Action Switches

Size	Type		Features	O.F. by pin plunger g, max. (oz, max.)	Contact capacity (250 V AC, cos φ = 1) 0.5 1 3 5 10 15 21(A)	Contact rating (resistive)	Low-level rating
Smallest	AV4	Standard	• Super-miniature size (7.5×2.5×5 mm) (.295×.098×.197 inch) • Solder terminal type with mounting holes available	100 (3.527)		0.5A 30VDC	—
		Low-level circuit		100 (3.527)	0.1 A	0.1A 30VDC	1mA 5VDC 0.4mA 12VDC 0.2mA 24VDC
Ultra-miniature	AH1	Standard	• Ultra-miniature size (6×12.7×6 mm) (.236×.500×.236 inch) • Flux-resistant construction	150 (5.291)	(125 VAC)	3A 125VAC 2A 30VDC	—
				75 (2.645)		1A 125VAC	
		Low-level circuit	• High contact reliability in low-level circuit • 1.2 mm hole type available	150 (5.291)	0.1 A	0.1A 125VAC 0.1A 30VDC	5mA 6VDC 2mA 12VDC 1mA 24VDC
				75 (2.645)			
Subminiature	AH3	High capacity	• High contact capacity	180 (6.349)		10.1A 250VAC	—
		Standard	• High contact reliability and welding resistance	50 (1.764)		3A 250VAC	—
				180 (6.349)		5A 250VAC	
		Low-level circuit	• High contact reliability in low-level circuit	50, 180 (1.764, 6.349)		3A 250VAC	5mA 6VDC 2mA 12VDC 1mA 24VDC
				25 (.882)		2A 250VAC	
	AH6	Sealed	• Sealed construction for use in adverse environments • Terminal sealed and wire sealed types	250 (8.818)		1A 250VAC	5mA 6VDC 2mA 12VDC 1mA 24VDC
	AV3	Standard	• Consistent quality through fully automatic fabrication • High contact reliability in low level circuit • Long life version of AV3 standard and low level circuit types available	50, 100 (1.764, 3.527)		3A 250VAC	—
		Low-level circuit		25, 50, 100 (.882, 1.764, 3.527)	0.1 A	0.1A 250VAC	5mA 6VDC 2mA 12VDC 1mA 24VDC
	AVM3	Long life version		150 (5.291)	Standard / 0.1 A Low-level	Standard 5A 250VAC Low-level 0.1A 250VAC	Low-level 5mA 6VDC 2mA 12VDC 1mA 24VDC
Miniature	AH7	Standard	• Extra long-lived spring mechanism	200, 400 (7.055, 14.110)		15A 250VAC	—
				100 (3.527)		10A 250VAC	
				50 (1.764)		5A 250VAC	
	AH8	Terminal sealed	• Sealed construction for use in adverse environments	300 (10.582)		3A 250VAC	5mA 6VDC 2mA 12VDC 1mA 24VDC
		Wire sealed	• Sealed construction for use in adverse environments	300 (10.582)		3A 250VAC	5mA 6VDC 2mA 12VDC 1mA 24VDC
	AV5	High capacity	• 21 A high contact rating • Continuous use at 100°C (212°F) possible	300, 400 (10.582, 14.110)		21A 250VAC	—
	AHR5	Standard	• High contact pressure with light operating action	10.2 g-cm (.402)		5A 250VAC	—
		Low-level circuit	• High contact reliability in low-level circuit	10.2 g-cm (.402)		1A 250VAC	5mA 6VDC 2mA 12VDC 1mA 24VDC
	AH4	Standard	• Wide insulation distance • High dielectric strength	10, 35 (.353, 1.235)	(125 VAC) / (250 VAC)	5A 125VAC 3A 250VAC	—
Special	AV1		• Double-return spring • Contact gap-more than 3 mm .118 inch	1X: 650 (22.928) 1Y, 1Z: 750 (26.455) 2X: 1000 (35.274) 3X: 1500 (52.911)	16 A	16A 380VAC	—

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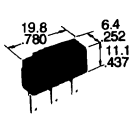
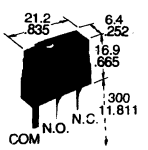
Dust protected type



Immersion protected type



mm inch

ORDERING INFORMATION

ABS1 [ ] 1 [ ] [ ] [ ]

Type of switch	Terminal	Contact arrangement	Actuator	Operating force by pin plunger (max.)	Contact
ABS1: BS1 switch	1: .110 Quick-connect terminal (IP50) 4: Solder terminal (IP50) 5: PC terminal (IP50) 6: Wire leads (IP67)	1: SPDT	0: Pin plunger 1: Short hinge lever 2: Hinge lever 3: Long hinge lever 4: Simulated roller lever 6: Roller lever	4: 100 g 2.527 oz 5: 150 g 5.291 oz	0: Silver alloy 1: Gold-clad triple layer 4: Gold-clad double layer

SPECIFICATIONS

1. Contact ratings

Voltage	Silver alloy contact type		Gold-clad contact type	
			Triple layer	Double layer
	Resistive load	Inductive load	Resistive load	Resistive load
125 V AC	2 A	2 A	0.1 A	—
250 V AC	2 A	2 A	0.1 A	—
30 V DC	2 A	2 A	0.1 A	0.1 A
125 V DC	0.4 A	0.05 A	—	—

Rated voltage	Resistive load
6 V DC	5 mA
12 V DC	2 mA
24 V DC	1 mA

2. Characteristics

Mechanical life (O.T.: Specified value)		Min. 5×10^5 (at 60 cpm)*
Electrical life at rated load (O.T.: max.)	Silver alloy contact type	Min. 5×10^4 (at 20 cpm)
	Gold-clad contact type	Min. 2×10^5 (at 20 cpm)
Insulation resistance		Min. 100 MΩ (at 500 V DC)
Dielectric strength Between non-continuous terminals Between each terminal and other exposed metal parts Between each terminal and ground		 1,000 Vrms 1,500 Vrms 1,500 Vrms
Vibration resistance (Pin plunger type)		10 to 55 Hz at single amplitude of 0.75 mm (Contact opening: max. 1 msec.)
Shock resistance (Pin plunger type)		Min. 30 G (Contact opening: max. 1 msec.)
Contact resistance (Initial)	Silver alloy contact type	Dust protected type: Max. 50 mΩ Immersion protected type: Max. 100 mΩ (By voltage drop 1 A 6 to 8 V DC)
	Gold-clad contact type	Dust protected type: Max. 100 mΩ Immersion protected type: Max. 150 mΩ (By voltage drop 0.1 A 6 to 8 V DC)
Allowable operating speed (at no load)		0.1 to 500 mm/sec.
Max. operating cycle rate (at no load)		120 cpm
Ambient temperature		−40°C to +85°C −40°F to +185°F
Ambient humidity		Max. 95% R.H.
Unit weight		Approx. 2 g .071 oz (IP50 type)

*Long mechanical life types (min. 5×10^6 operations) are available.

3. Operating characteristics

Type of actuator	Operating force, max. g oz	Release force, min. g oz	Pretravel, max. mm inch	Movement differential, max. mm inch	Overtravel, min. mm inch	Operating position, mm inch
Pin plunger	150 (100) 5.291 (3.527)	20 (15) .705 (.529)	0.6 .024	0.1 .004	0.4 .016	8.4±0.3 .331±.012
Short hinge lever	60 (40) 2.116 (1.411)	4 (3.5) .141 (.123)	2.5 .098	0.5 .020	0.8 .031	8.8±0.8 .346±.031
Hinge lever	55 (35) 1.940 (1.235)	3.5 (3) .123 (.106)	2.8 .110	0.8 .031	1.2 .047	8.8±0.8 .346±.031
Long hinge lever	45 (25) 1.587 (.882)	3 (2.5) .106 (.088)	3.5 .138	1.0 .039	1.6 .063	8.8±1.2 .346±.047
Simulated roller lever	55 (35) 1.940 (1.235)	3.5 (3) .123 (.106)	2.8 .110	0.8 .031	1.2 .047	11.65±0.8 .459±.031
Roller lever	60 (40) 2.116 (1.411)	4.0 (3.5) .141 (.123)	2.5 .098	0.5 .020	0.8 .031	14.5±0.8 .571±.031

( ): Low force type

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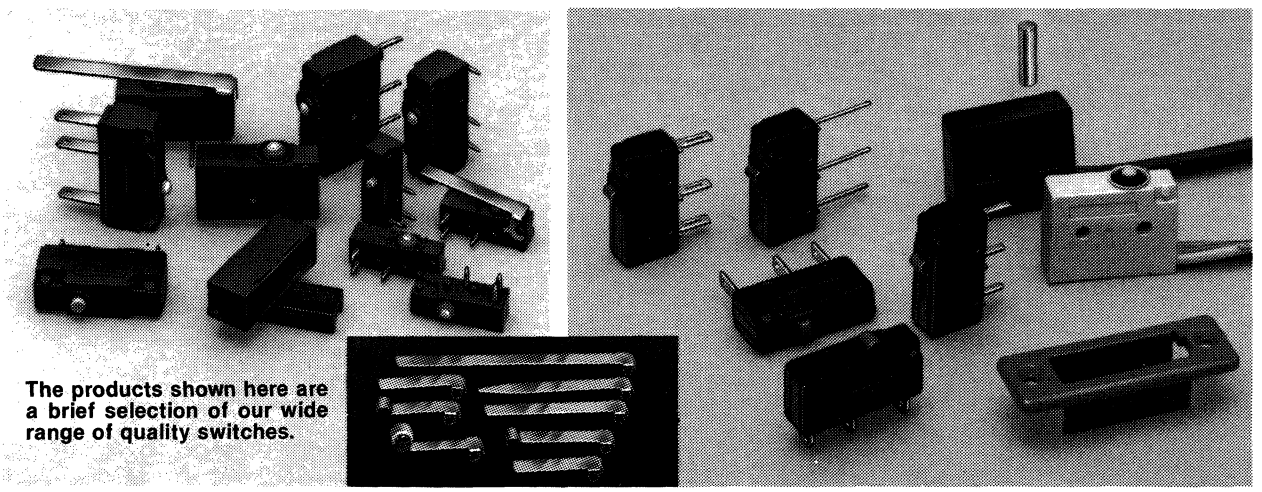
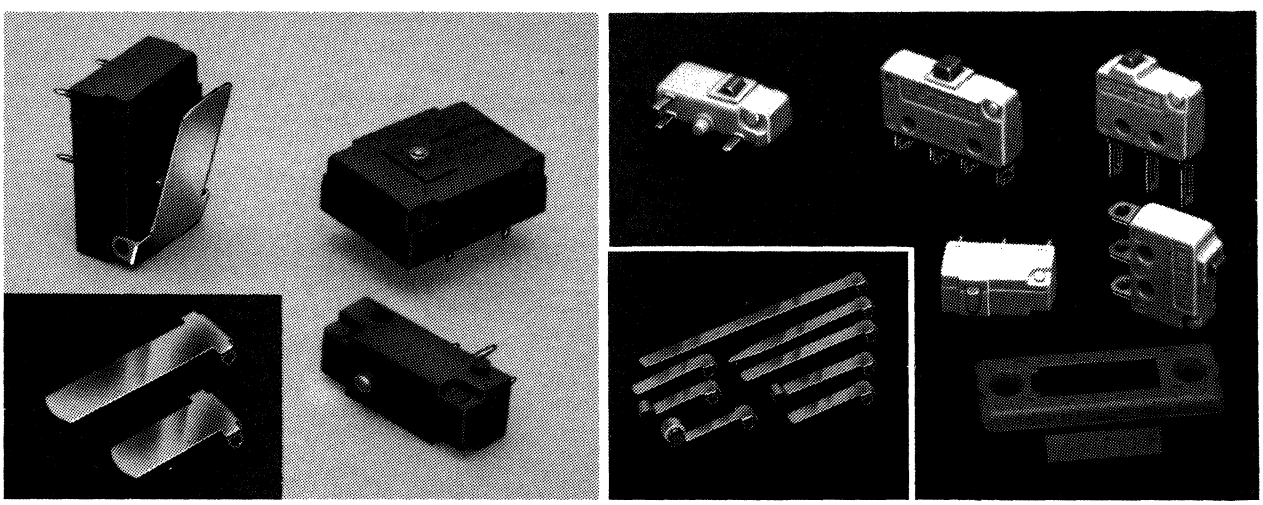


The products shown here are a brief selection of our wide range of quality switches.

Sub-Miniature and Sub-Ultra Miniature
Features: 10 million cycle life, 7 terminal options, gold cross-point or silver contacts, full overtravel, fully sealed & process compatible models w/without leads, mounting holes or pegs, standard/low force models, wide variety of clip-on levers, snap-on terminal covers, high temp. versions.

Reference	Actuator	Dimensions L	W	H	Actuating Force N	OZ	Max. Rating 125/250 VAC	Terminals
F1N	Plunger	15	5	6	2.0	7.0	5	Side PCB
F1NS	Sealed Plunger	15	5	6	2.0	7.0	5	Side PCB
V4N	Plunger	20	6	18	1.4/0.5	5.0/1.8	5/2	Sldr. PCB, QC,SM
V4NS	Sealed Plunger	20	6	18	2.5	9.0	5	Sldr., PCB QC,SM,Lds.
XC	Plunger	20	6	18	3.0/0.4	11/1.4	10/1	Sldr.,PCB,QC
V4NHE (Hall-Effect)	Magnet	20	7	18	–	–	20MA/24VDC	Leads



Ultra-Miniature/Low Profile – Mechanical life 10 million cycles, gold or silver contacts, full over travel, double pole versions, 3 terminal options, broad range of clip-on levers, selection of operating forces.

Burgess-SAIA products are approved by all major national testing authorities worldwide including UL, VDE, and CEE 24

Reference	Actuator	Dimensions L	W	H	Actuating Force N	OZ	Max. Rating 125/250 VAC	Terminals
F1T8	Plunger	16	10	7	1.4	5.0	5	Side PCB
F5T8	Plunger	13	5	12	1.2	4.3	5	PCB
F4T7	Plunger	13	5	18	1.2	4.3	5	Sldr./QC
LPHSP	Plunger	20	7	9	1.8	6.5	3	PCB
LPSP	Plunger	20	7	9	1.4	5.0	2	PCB
LP1SP	Plunger	20	7	9	0.75	2.7	1.5	PCB
LPDP	Plunger	20	14	9	2.8	10.0	2	PCB
LP1DP	Plunger	20	14	9	1.5	5.4	1.5	PCB
FK4T7	Plunger	18	5	15	1.5	5.4	5	Sldr./QC

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Switch Division

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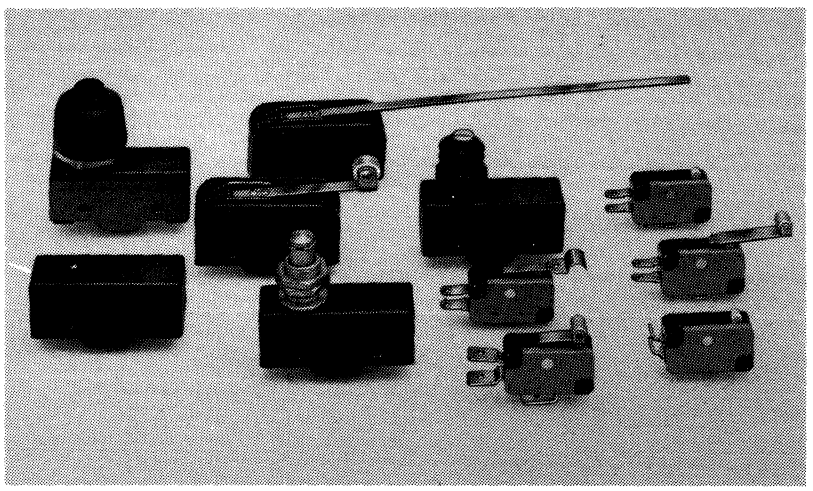
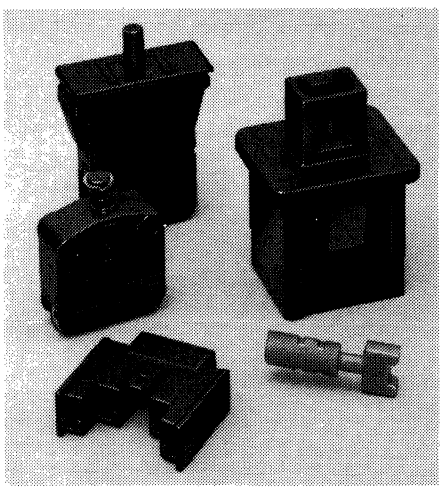
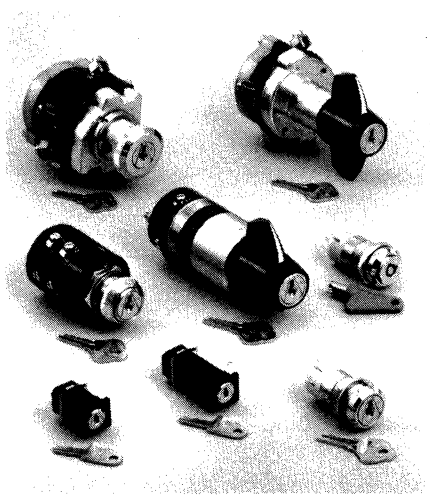


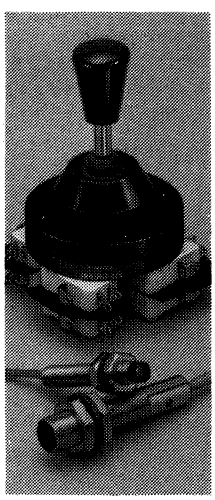


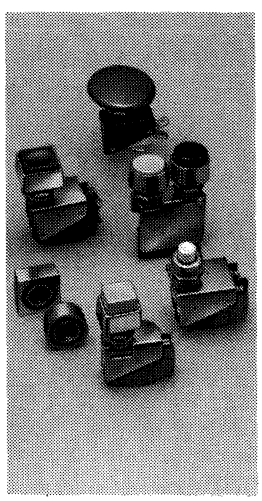
CR – CT Basics – Single-pole, changeover, snap-action with moulded cases and lids, sensitive beryllium copper trident spring mechanisms, flat base with 3 solder tag terminals version, stepper base fitted with 6-32 UNC screw and cup washer terminal version, explosion proof models, 15A 125/250 VAC rating, broad selection of actuators, sealed models.

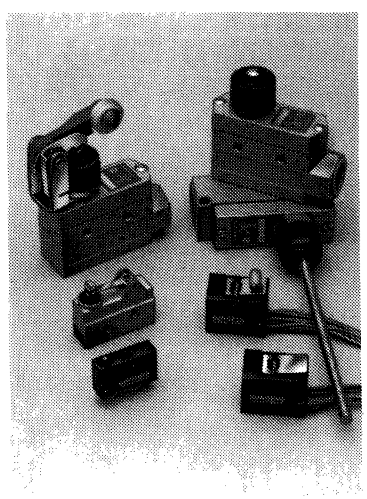
XG Miniatures – Single-pole, double or single throw, seven force/current variations 320 cN/45cN - 20A ½ hp/10A 1/6 hp, up to 100 million cycles mechanical life. Silver, gold, or silver-cadmium-oxide contacts, high temperature versions up to 150° C. Wide selection of terminals including PCB mount, large variety of integral lever actuators.
International approvals - UL/CSA, BEAB, VDE, SEMKO, SEV, DEMCO, NEMCO, KEMA, UTE.

XP, XT, XS Multi-pole Security Switches – Intended for use in locations within equipment where doors and covers are opened and personnel are to be protected. XP Single Pole, XT Double Pole and XS Triple Pole versions are available.
Electrical breaking capacity ranges from 0.3A 30 VAC for low-voltage to 16A 125/250 VAC for electrical mains or power contact. Contact gaps in excess of 3mm for use in main isolation, contact gaps creepage and air gaps up to 8mm for UL / CSA, VDE, BEAB, SEV SEMKO, NEMKO, DEMKO, SETI, KEMA, IMQ, BEAB, and CEBEC approvals. Normally open, normally closed and changeover version, – 20° C. to + 85° C. and + 140° C. on some models.
Contact material or range varies from silver nickel, silver palladium, pure silver, gold-plated and other materials on request.
Accessories include a multiplug terminal housing connection and a service key for the XT Series.









Tok Switches – Key and rotary operated switches from a wide range of styles, sizes, and options for many security applications.
From the miniature "M" and "E" series key switches with low level switching applications and electrical rating of 100 mA at 30 VDC maximum... ideal for high volume OEM applications.
P 5 knob operated switches are small size where space is a premium. The normal electrical rating of a P 5 is 7 A at 250 VAC.
P 13 and P 25 switches are heavy-duty switches with nominal rating of 15 A AC and 25 A AC respectively.

Joysticks – 40 standard options with latching, momentary, lift-to or normal operation, V3 or V4 switching, 2 or 4 gate or 360° stirring action, panel sealing to IB65, accurate down to – 50° C., designed for scientific installations and industrial applications.

EUROPA – Proximity Sensors – Over 300 models, sensing ranges from under 1mm up to 20mm, AC, DC and NAMUR, N/O, N/C and universal outputs, housed in rugged nickel plated brass in compact or standard lengths, models to meet CENELEC EN, plug and socket types for easy installation.
Push-Buttons – 3 to 25A 125/250 VAC, reliability over a long life with positive, nonfatiguing operation, single and double pole versions with momentary or alternate actions, a two button version, an emergency stop button unit, and a wide variety of bezels including a sealed bezel.
Protected Switches – A versatile selection of switches for difficult environments, from 15A 250 VAC metal housed with conduit entry and industrial actuators down to 10A 250 VAC compact, and 5A 250 VAC miniature single and double pole pre-wired sealed and preserve tested to 6 p.s.i. Mechanical life up to 10 million cycles, NEMA Type 6 IP 67 enclosures.

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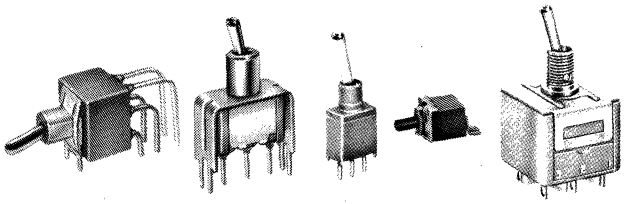

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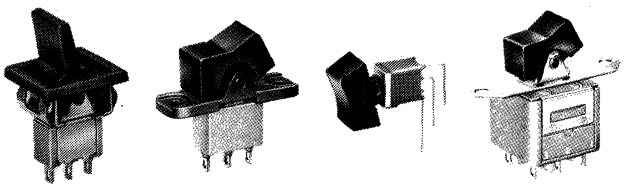
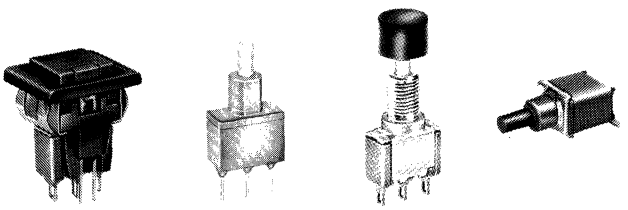


Rocker and Lever Handle Switches
A full range of miniature and tiny models for panel and P.C. mounting, including anti-static and sealed/process compatible designs. SP thru 4P models and many options available.



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Slide Switches
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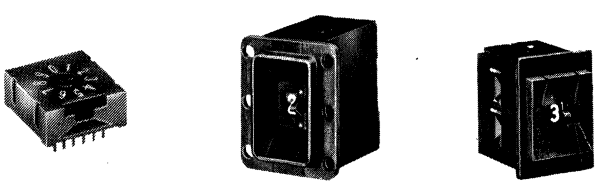

Thumbwheel Switches
A full range of miniature, sub-miniature and mini-thumbwheel switches with snap-in front or rear panel mounting and P.C. mounting.



DIP Switches
LD Series available in 4, 6 and 8 positions. Low profile, machine insertable, surface mount or thru-hole P.C. terminations. Fully sealed/process compatible. BD Series available in 1 through 12 positions (except 11 pos.). The washable design can be wave soldered.

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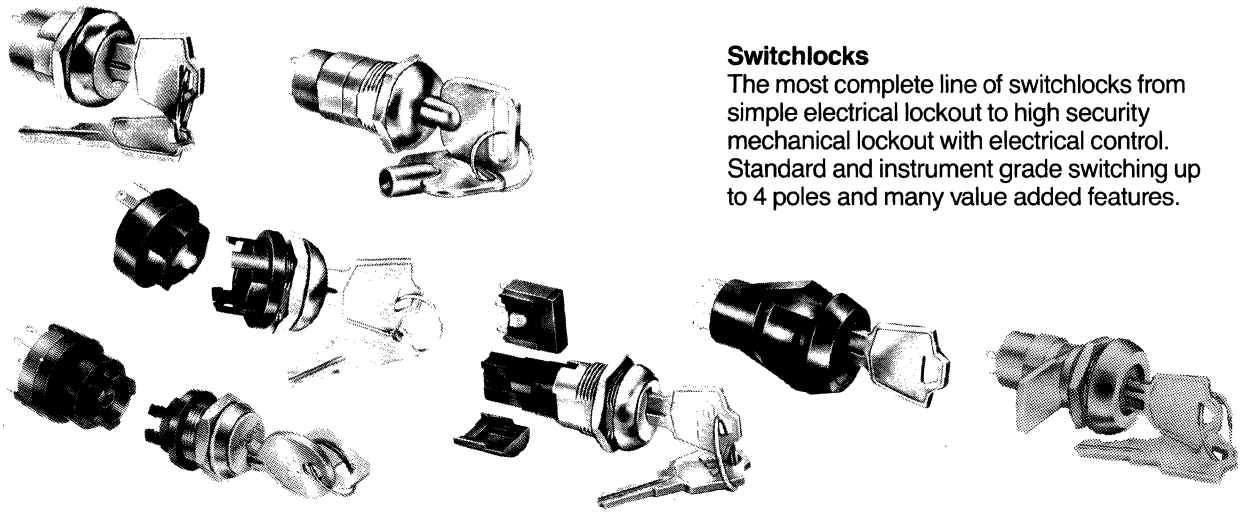

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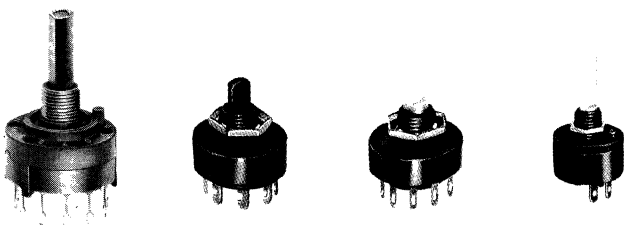

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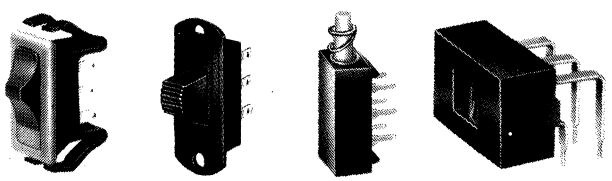
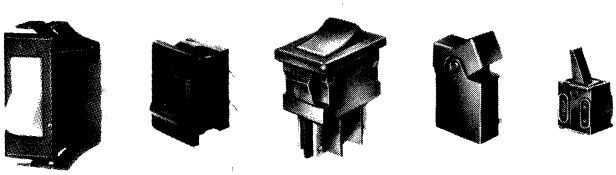
All plastic rotary switches adjustable from 2 to 12 positions. ROTA-SLIDE,® Power ROTA-SLIDE and Miniature ROTA-SLIDE rotary switches.



Slide Switches
Power and Line Voltage Select Slide Switches. Miniature and Snap-In Slide Switches.



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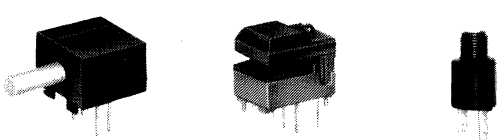
A full range of miniature power rocker and lever handle switches.



Pushbutton Switches
Pushbutton and mechanical pushbutton models and options for panel and P.C. mounting.



Illuminated Pushbutton Switches
Seven different styles of illuminated and non-illuminated pushbutton snap-acting switches with modular snap-together construction.

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MINIGLOSSARY
RELAY CONTACT FORMS

A
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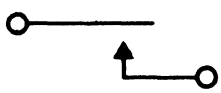
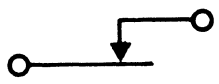
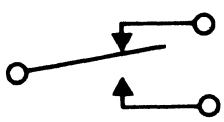


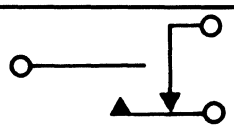
B
Break
SPST-NC



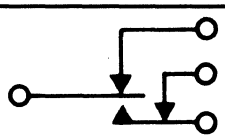
C
Break, Make
(Transfer)
SPDT



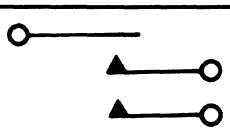
D
Make, Break
(Continuity
Transfer)



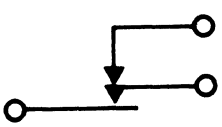
E
Break,
Make,
Break



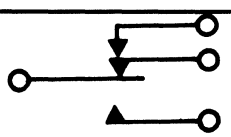
F
Make,
Make



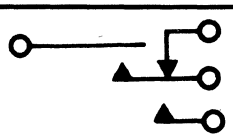
G
Break,
Make



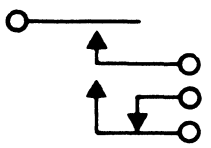
H
Break,
Break,
Make



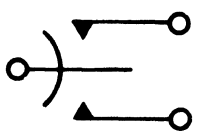
I
Make,
Break,
Make



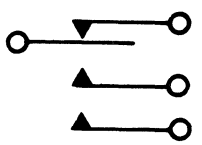
J
Make,
Make,
Break



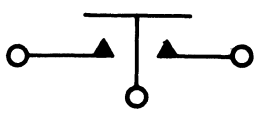
K
Center off
SPDT



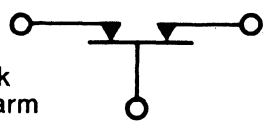
L
Break,
Make,
Make



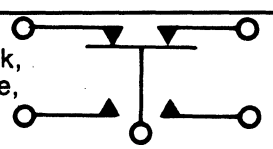
U
Double
make
Contact
on arm



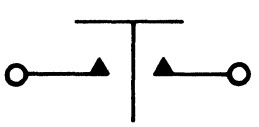
V
Double break
Contact on arm



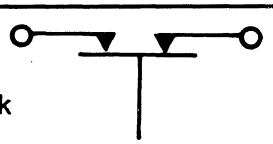
W
Double break,
Double make,
Contact
on arm



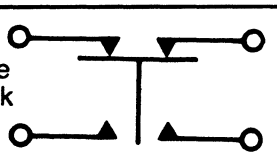
X
Double
make



Y
Double break



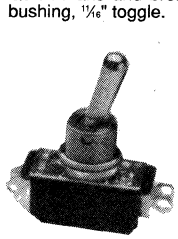
Z
Double make
Double break
SPDT-DB

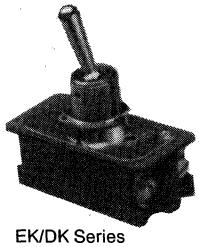


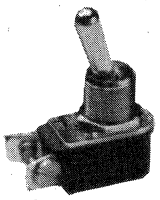
CARLINGSWITCH SWITCHES

GENERAL PURPOSE AC-DC TOGGLE SWITCHES

Quick make and break AC-DC rated. UL recognized and CSA certified 15/32" bushing, 1/16" toggle.


2B Series


EK/DK Series

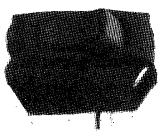

110 Series

CURVETTE® SNAP-IN SWITCHES

Slow make and break action, .250 quick connect terminals. 16 amps 125 VAC – 10 amps 250 VAC, 10(4) amps—250VAC. UL recognized, CSA and VDE certified. Rated life 50 M cycles @ rated load. Also features our unique Visi-Rocker®, two-color molded curved rocker for low cost "ON" indication.

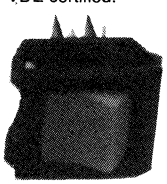

R Series


LR Series

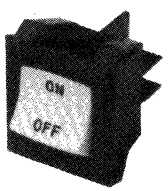

Visi-Rocker R Series

SC HIGH INRUSH CURVETTE SNAP-IN SWITCHES

Designed to handle current surges over 100 amps. UL recognized and CSA certified for 20 amps 125 VAC—15 amps 250 VAC, 16(6) amps 250 VAC, VDE certified.


LRGSC Series

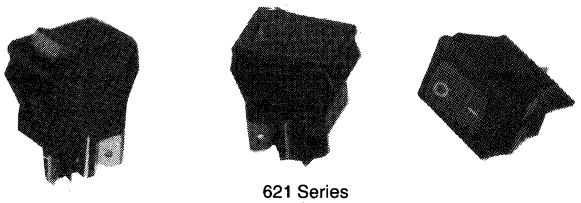

RSC Series



RGSC Series

MINIATURE CURVETTE SNAP-IN SWITCHES

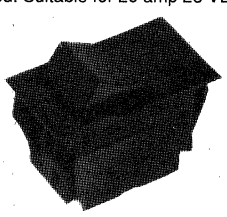
These miniature switches are rated @ 4 amps 250 VAC—8 amps 125 VAC, 6(4) amps 250 VAC. UL recognized, CSA and VDE certified. Also features our unique Visi-Rocker two-color molded rocker for low cost "ON" indication.


621 Series

HEAVY DUTY ROCKER SWITCHES

These full-size rocker switches are designed for AC and low voltage DC applications. They include a slow-make, slow-break contact mechanism, nylon snap-in brackets. They are rated at 15 amps 125 VAC, 10 amps 250 VAC, ¾ H.P. UL recognized and CSA certified. Suitable for 20 amp 28 VDC.


LTIL Series


TIG Series

6 AMPS 125 V, 3 AMPS 250 V		
Type	**Switch Action**	**Terminals**
110-73	S.P.S.T. ON-NONE-OFF	Solder
110-S-73	S.P.S.T. ON-NONE-OFF	Screw
111-16-73	S.P.S.T. ON-NONE-OFF	Wire
2BB62-73	S.P.D.T. ON-NONE-ON	Solder
2BK62-73	D.P.S.T. ON-NONE-OFF	Solder
2BK65-73	D.P.S.T. ON-NONE-OFF	Wire
2BL62-73	D.P.D.T. ON-NONE-ON	Solder
HEAVY DUTY AC-DC TOGGLE SWITCHES 16 AMPS, 125 V; 8 AMPS 250 V; 1 HP125-250 V		
DK284-73	D.P.S.T.	Screw
20 AMPS 125 V—10 AMPS 250 V—1½ H.P. 125-250 V		
EK204-73	D.P.S.T.	Screw

Type	Switch Action	Rocker Color
RA911-RB-B-0-N	S.P.S.T. ON-NONE-OFF	Black
RA911-VB-B-0-V	S.P.S.T. ON-NONE-OFF	Visi-Rocker*
RA911-VB-B-1-V	S.P.S.T. ON-NONE-OFF	Visi-Rocker* w/ON-OFF Legend
RB211-RB-B-0-N	S.P.D.T. ON-NONE-ON	Black
RC211-RB-B-0-N	S.P.D.T. ON-OFF-ON	Black
LRA211-RS-B/120N	S.P.S.T. ON-NONE-OFF Lighted	Strawberry

*Curvette Visi-Rocker has a second color molded in for attractive low cost "ON" indication.
ON/OFF imprinting is available, consult factory.

Type	Switch Action	Rocker Color
RSCA711-RB-B-0-N	S.P.S.T. ON-NONE-OFF	Black
RGSCC711-RB-B-0-N	D.P.S.T. ON-NONE-OFF	Black
LRGSCK221-RS-B/120N	D.P.S.T. ON-NONE-OFF Lighted	Strawberry

ON/OFF imprinting is available, consult factory.

Type	Switch Action	Terminals	Rocker Color
62111926-0-0-N	S.P.D.T. ON-NONE-ON	Solder	Black
62112926-0-0-N	D.P.D.T. ON-NONE-ON	Solder	Black
62116319-0-0-N* 11 amps 125 VAC	S.P.S.T. ON-NONE-OFF	.187 Tabs	Black
62115929-0-0-V**	D.P.D.T. ON-NONE-ON	.187 Tabs	Visi-Rocker
62116919-0-9-V**	S.P.S.T.	.187 Tabs	Visi-Rocker w/I-O legend

* UL recognized and CSA certified for 11 amp 125 VAC ratings.
** Curvette Visi-Rocker has a second color molded in for attractive low cost "ON" indication.
ON/OFF imprinting is available, consult factory.

Type	Switch Action	Terminals	Rocker Color
TIGA51-6S-BL-NBL	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black
TIGK54-6S-BL-NBL	D.P.S.T. ON-NONE-OFF	Screw	Black
LTILA51-6S-BL-RC-NBL (125 VAC lamp)	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black w/red light

DRIP DRY ROCKER SWITCHES

We have modified the Tippette® Switches above to provide front panel dust and moisture protection with built in seal feature.

Type	Switch Action	Terminals	Rocker Color
TIGA51-6S-BL-WBL	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black
TIGK54-6S-BL-WBL	D.P.S.T. ON-NONE-OFF	Screw	Black
LTILA51-6S-BL-RC-WBL (12V lamp)	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black

ON/OFF imprinting is available, consult factory.

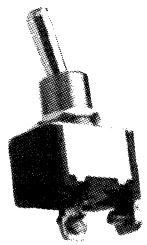
The information listed above is for standard Carlingswitch products. Consult Carlingswitch for additional product information.

CARLINGSWITCH, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156
(203) 793-9281 • FAX: (203) 793-9231 • 1-800-243-8556

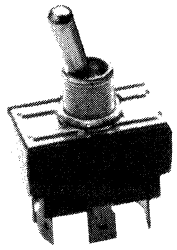
CARLINGSWITCH SWITCHES

HEAVY DUTY AC RATED TOGGLE SWITCHES

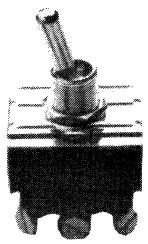
General purpose switches rated @ 15 amps 125 VAC and 10 amps @ 250 VAC. UL recognized and CSA certified in single, double, three and four pole configurations. All are rated ¾ H.P. 125-250 VAC—15/32" bushing—1 1/16" toggle. Suitable for 20 amp 28 VDC.



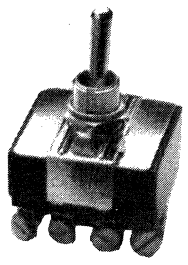
F Series



G Series



H Series



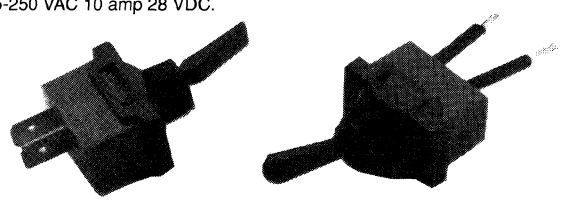
I Series

Type	Switch Action	Terminals
2FA53-73	S.P.S.T. ON-NONE-OFF	Solder
2FA53-73-TABS	S.P.S.T. ON-NONE-OFF	Spade
2FA54-73	S.P.S.T. ON-NONE-OFF	Screw
2FB53-73	S.P.D.T. ON-NONE-ON	Solder
2FB53-73-TABS	S.P.D.T. ON-NONE-ON	Spade
2FB54-73	S.P.D.T. ON-NONE-ON	Screw
2FC53-73	S.P.D.T. ON-OFF-ON	Solder
2FC53-73-TABS	S.P.D.T. ON-OFF-ON	Spade
2FC54-73	S.P.D.T. ON-OFF-ON	Screw
6FC54-73*	S.P.D.T. ON-OFF-ON	Screw
2GK50-73	D.P.S.T. ON-NONE-OFF	Solder
2GK51-73	D.P.S.T. ON-NONE-OFF	Spade
2GK54-73	D.P.S.T. ON-NONE-OFF	Screw
2GL50-73	D.P.D.T. ON-NONE-ON	Solder
2GL51-73	D.P.D.T. ON-NONE-ON	Spade
2GL54-73	D.P.D.T. ON-NONE-ON	Screw
2GM50-73	D.P.D.T. ON-OFF-ON	Solder
2GM51-73	D.P.D.T. ON-OFF-ON	Spade
2GM54-73	D.P.D.T. ON-OFF-ON	Screw
HK250-73	3.P.S.T. ON-NONE-OFF	Solder
HK251-73	3.P.S.T. ON-NONE-OFF	Spade
HK254-73	3.P.S.T. ON-NONE-OFF	Screw
HL250-73	3.P.D.T. ON-NONE-ON	Solder
HL251-73	3.P.D.T. ON-NONE-ON	Spade
HL254-73	3.P.D.T. ON-NONE-ON	Screw
HM250-73	3.P.D.T. ON-OFF-ON	Solder
HM251-73	3.P.D.T. ON-OFF-ON	Spade
HM254-73	3.P.D.T. ON-OFF-ON	Screw
IK250-73	4.P.S.T. ON-NONE-OFF	Solder
IK251-73	4.P.S.T. ON-NONE-OFF	Spade
IK254-73	4.P.S.T. ON-NONE-OFF	Screw
IL250-73	4.P.D.T. ON-NONE-ON	Solder
IL251-73	4.P.D.T. ON-NONE-ON	Spade
IL254-73	4.P.D.T. ON-NONE-ON	Screw
IM250-73	4.P.D.T. ON-OFF-ON	Solder
IM251-73	4.P.D.T. ON-OFF-ON	Spade
IM254-73	4.P.D.T. ON-OFF-ON	Screw

*Momentary On Action

NYLON INSULATED TOGGLE SWITCHES

Series D switches have self-cleaning wiping action contacts suitable for both power and low-level switching, nylon flat or bat lever actuators and bushing/frame super structure for double insulated requirements—UL recognized, CSA certified. Series rated @ 10 amp 125 VAC 5 amp 250 VAC ½H.P. 125-250 VAC 10 amp 28 VDC.



D Series

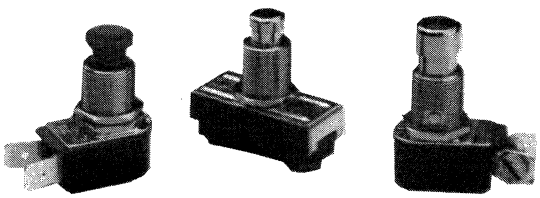
PADDLE TOGGLE ACTUATOR

DA100-PB-B	S.P.S.T. ON-NONE-OFF	Solder/Spade
DA105-PB-B	S.P.S.T. ON-NONE-OFF	Wire
DB100-PB-B	S.P.D.T. ON-NONE-ON	Solder/Spade
DC100-PB-B	S.P.D.T. ON-OFF-ON	Solder/Spade

BAT TOGGLE ACTUATOR

DA100-BB-B	S.P.S.T. ON-NONE-OFF	Solder/Spade
DA105-BB-B	S.P.S.T. ON-NONE-OFF	Wire
DB100-BB-B	S.P.D.T. ON-NONE-ON	Solder/Spade
DC100-BB-B	S.P.D.T. ON-OFF-ON	Solder/Spade

GENERAL PURPOSE PUSHBUTTON SWITCHES



P27 Series 170 Series 110-SP Series

6 AMP 125 VAC—3 AMP 250 VAC UL RECOGNIZED AND CSA CERTIFIED

Type	Switch Action	Terminals	Caps
P26A-1D-RMB	S.P.N.O.	Solder	Metal
P26L-1D-RMB	S.P.N.C.	Solder	Metal
P27A-BL	S.P.N.O.	Solder	Black
P27A-RD	S.P.N.O.	Solder	Red
P27L-BL	S.P.N.C.	Solder	Black
P27L-RD	S.P.N.C.	Solder	Red

5 AMP 125 VAC—10 AMP 250 VAC

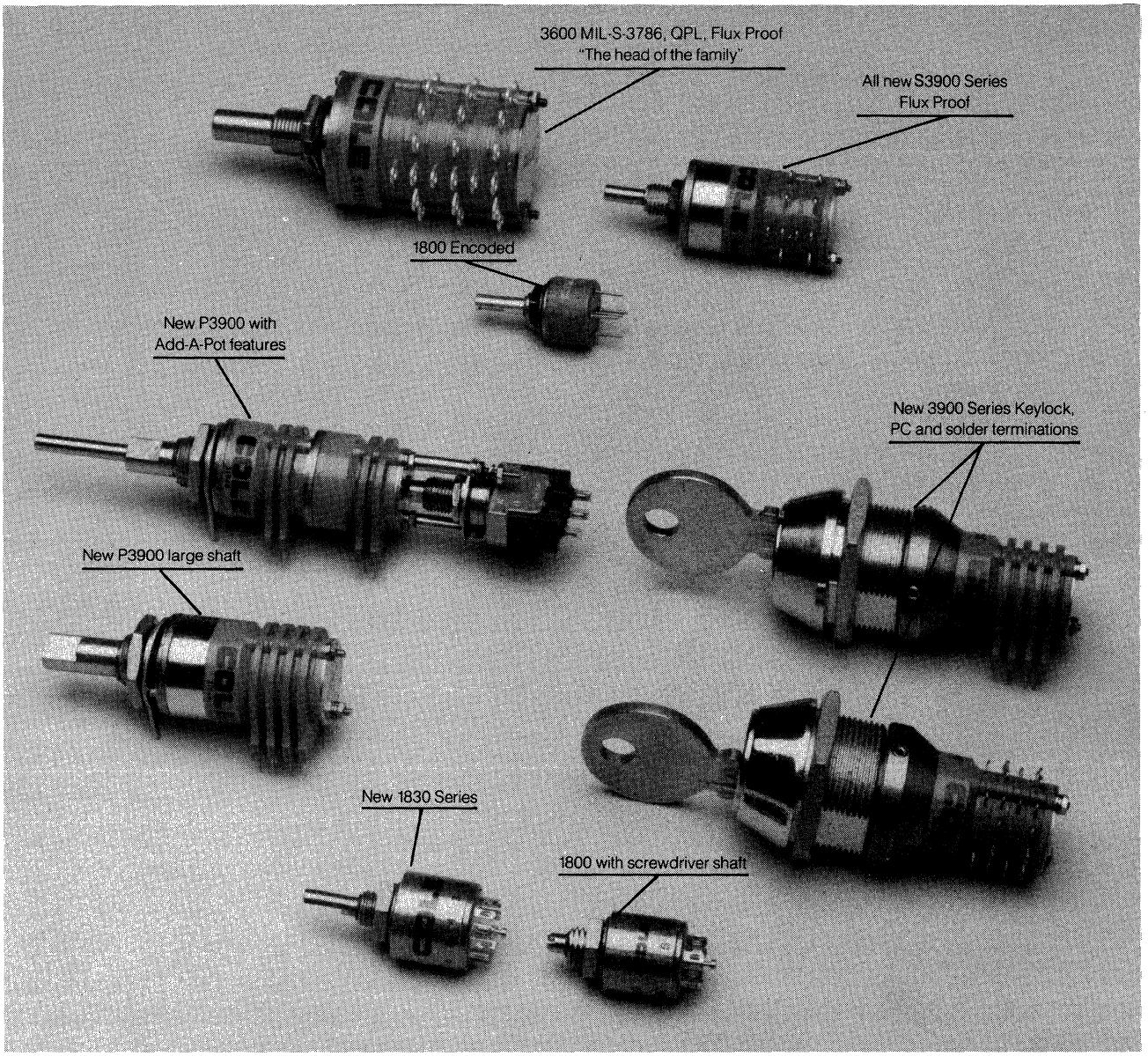
170	S.P.N.C.	Screw	Metal
172	S.P.N.O.	Screw	Metal

QUICK MAKE/QUICK BREAK MAINTAINED AC/DC
6 AMP 125 V—3 AMP 250 V UL RECOGNIZED AND CSA CERTIFIED

110-SP	S.P.S.T.	Screw	Metal
111-16P	S.P.S.T.	Wire	Metal

The information listed above is for standard Carlingswitch products. Consult Carlingswitch for additional product information.

CARLINGSWITCH, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156
(203) 793-9281 • FAX: (203) 793-9231 • 1-800-243-8556



In fact, it's a whole family of commercial grade switches, evolved from COLE's 3600 Series MIL-S-3786, QPL flux and contaminant proof switches—the head of the family.

The all new 3900 Series half-inch rotary switches are made from the same ultra clean materials, and fabricated in the same clean room facilities as our MIL switches; only the level of documentation is different. *And,* the 3900 Series offer new improvements and features of their own. For example, as shown in the photo, they're available with solder lugs or PC terminations that allow the switch to be plugged directly into PCB's, motherboards, or flex circuits for instant substitution or replacement. The *Add-a-Pot* version permits ganging of pots or linear switches on the same shaft. High security *Keylock* versions are part of the new line. All of this quality is now available to designers at competitive commercial pricing. But if you are spec'd in to MIL-S-3786, the 3900 Series is offered in full MIL, QPL form.

THIS IS A COMMERCIAL

Also new from COLE, an addition to the 1800 Series half-inch MIL switches—the *Model 1830,* a 30 degree rotation single deck precision switch.

A final word about *flux and contaminant proof* switches. Other manufacturers say they offer them—at considerable cost. Most do not offer this feature—they can't. COLE Instrument Corp. invented flux proof switches, literally. *U.S. Patent #4,910,364* has just been awarded to R.L. Garcia, COLE Instrument Corp. The word on flux proof switches is COLE . . . period.

New things are happening at COLE. Call or FAX for updated specs or application engineering assistance.

COLE
INSTRUMENT CORP

2650 South Croddy Way • Santa Ana, California 92704
Telephone (714) 556-3100 • FAX (714) 241-9061

CHERRY ELECTRICAL PRODUCTS
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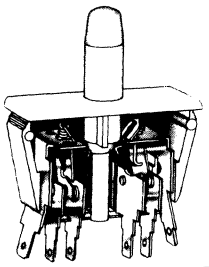
Panel Mount Pushbutton
E series - Double Pole



Series E75	16 amps
Series E77	10 amps/ 0.1 amps
Series E78	0.1 amps
Series E79	10 amps

Switch body 1.57″ x 1.05″ x .680″


-00A

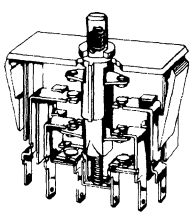

-20A


-30A


-40A


-50A

Line Interrupt
F80 series

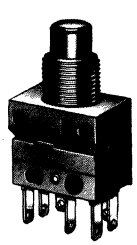


Series F81	10 amps
Series F82	16 amps
Series F83	0.1 amps
Series F84	Combination of current ratings



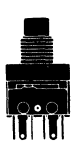
Switch body 1.57″ x 1.16″ x .685″

Lighted Pushbutton Switches
P1 series



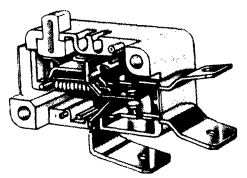
Series P162	10.1 amps
Series P163	0.1 amps

Switch body .844″ x .688″ x .578″

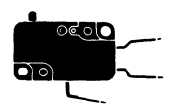


-C3RA Red button-LED, SPDT
-C3BU Black button-No light, SPDT
-D3RA Red button-LED, DPDT
-D3BU Black button-No light, DPDT

International Miniature
D3 series - Heavy Duty

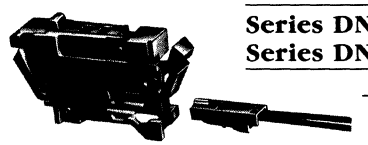


Series D36	4 amps
Series D37	10 amps
Series D38	16 amps

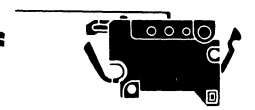


Switch body 1.094″ x .625″ x .406″

Terminator
DN series

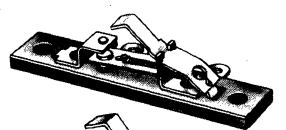


Series DN3	0.1 amps
Series DN6	3 amps



Switch body
1.337″ x .854″ x .406″

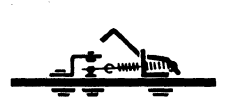
Open Switches
S series

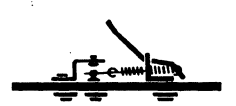




Series S23	5 amps
Series S25	10 amps
Series S30	10 amps
Series S31	0.1 amps

Switch body
S23, S25 2.125″ x .438″ x .094″
S30 1.062″ x .750″ x .093″
S31 1.031″ x .250″ x .062″


-00T

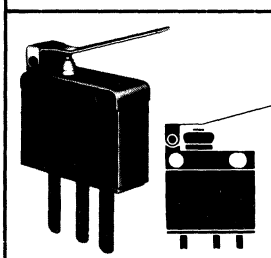

-60T


-00W


-20W


-20P

Weatherproof
E72 series



Series E72	10.1 amps
Series E73	0.1 amps

Switch body .915″ x .880″ x .385″

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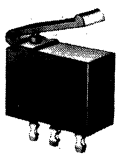
Ultra - Subminiature
DH series*



Series DH1C	**50-500 mA**
Series DH2C	**5-50 mA**

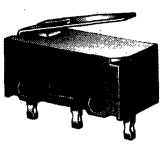


DH1C-B1AA
DH2C-B1AA
Switch body
.322″ x .244″
x .106″



DH1C-B1PA
DH2C-B1PA
Switch body
.322″ x .244″
x .106″

Sub - Subminiature
DG series*

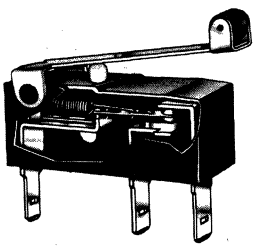


Series DG1	**3 amps**
	2 amps
Series DG2	**50 mA**



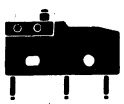
DG series
Switch body
.504″ x .255″ x .228″

Subminiature
DA3 series - Automated

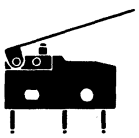


Series DA3	**0.1 amps**

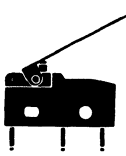
Switch body
.781″ x .375″ x .250″



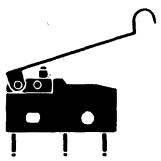
-F1AA



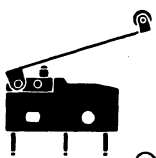
-F1LB



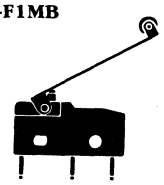
-F1MB



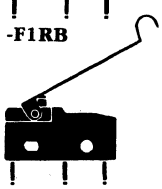
-F1SB



-F1RB

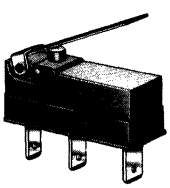


-F1TB

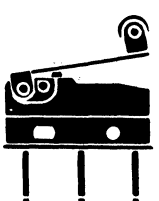


-F1UB

Subminiature International
DB series* - Automated



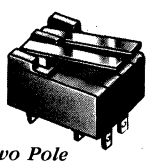
Series DB1	**5 amps**
Series DB2	**10 amps**
Series DB3	**0.1 amps**



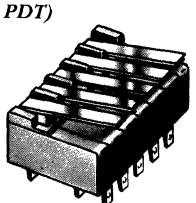
DB series
Switch body
.783″ x .380″
x .256″

* Silhouettes shown actual size

Subminiature Modules
HM series



Two Pole
(2 PDT)



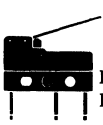
Five Pole
(5 PDT)

Series E61	**5 amps**
Series E62	**10.1 amps**
Series E63	**0.1 amps**

Switch body
2 PDT = .781″ x .483″ x .470″
3 PDT = .781″ x .483″ x .672″
4 PDT = .781″ x .483″ x .875″
5 PDT = .781″ x .483″ x 1.086″



Standard Ratio

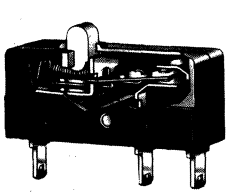


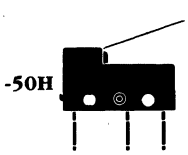
High Ratio

Subminiature
E series

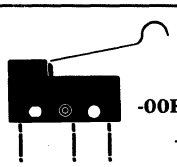
Series E61	**5 amps**
Series E62	**10.1 amps**
Series E63	**0.1 amps**

Switch body
.781″ x .375″ x .250″

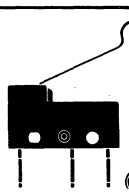




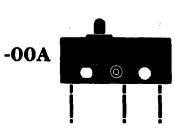
-50H



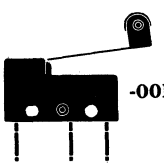
-00R



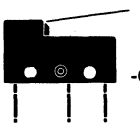
-50R



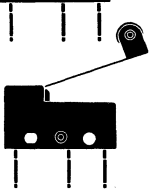
-00A



-00K



-00H



-50K

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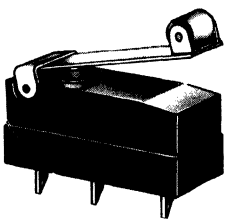
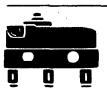
International Subminiature Waterproof

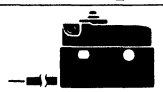


DC series

Series DC1	**5 amps**
Series DC2	**10.1 amps**
Series DC3	**0.1 amps**
Series DC4	**3 amps**



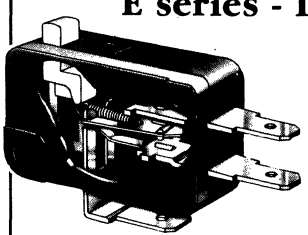
Solder Terminals
Switch body
.783" x .397"
x .256"



Wire Terminals
Switch body
.783" x .602"
x .256"

Miniature

E series - Light Force (X Suffix)



Standard Force

Series E21	**0.1 amps**
Series E22	**3 amps**
Series E23	**5 amps**
Series E31	**1 amp**
Series E33	**10 amps**
Series E34	**15 amps**
Series E35	**20.1 amps***

*Light Force only

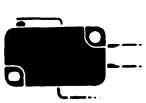
Switch body
1.093" x .625" x .406"



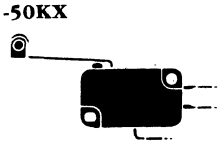
-00A
-00AX



-50K
-50KX



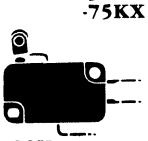
-00H
-00HX



-50KL
-75KX



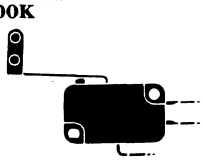
-50H
-50HX



-00K



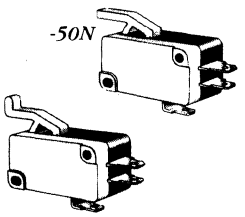
-75HX



-50P

Plastic Lever Actuator

for miniature E series Light Force and Standard Force



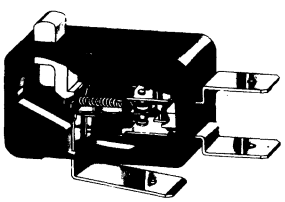
-50N

-90N

Series/prefix numbers, electrical ratings and switch body dimensions are the same as the E series models shown above.

Miniature International

D4 series Light Force (L-Suffix) Standard Force (C-Suffix)

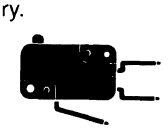


Series D41	**0.1 amps**
Series D42	**3 amps**
Series D43	**5 amps**
Series D44	**10 amps**
Series D45	**15 amps ***

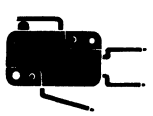
US part number suffix (straight terminals)
(International suffix) (dogleg terminals)

Switch body
1.095" x .625" x .406"
27.81 mm x 15.88 mm
x 10.31 mm

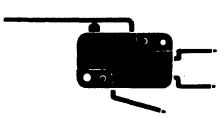
* International versions of D45 require larger terminals. Consult factory.



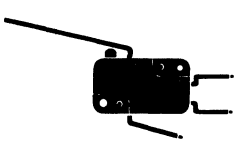
L-R1AA C-R1AA
(9-Q3AA) (3-Q3AA)



L-R1LA C-R1LA
(9-Q3LA) (3-Q3LA)



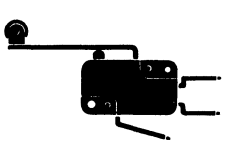
L-R1YD C-R1LD
(9-Q3YD) (3-Q3LD)



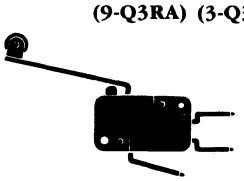
L-RIXD C-RIXD
(9-Q3XD) (3-Q3XD)



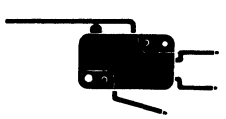
L-R1RA C-R1RA
(9-Q3RA) (3-Q3RA)



L-R1RC C-RIRC
(9-Q3RC) (3-Q3RC)



L-R1TC C-R1TC
(9-Q3TC) (3-Q3TC)



L-R1YL C-RIYL
(9-Q3YL) (3-Q3YL)

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3600 Sunset Ave., Waukegan, IL 60087
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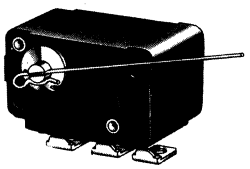
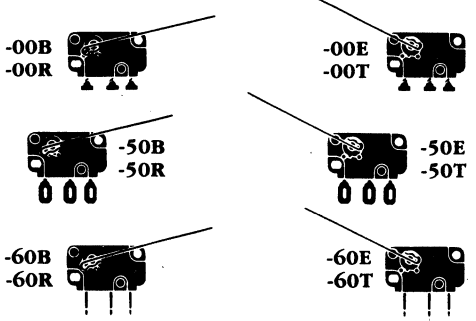
Low Torque
E/F Series

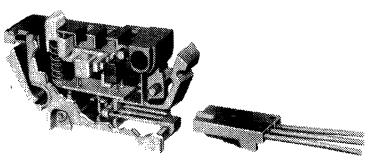


Series E51/F51 6 amps
Series E53/F53 0.1 amps

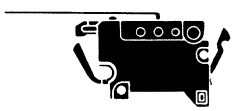
Switch body
1.218″ x .687″ x .580″



Logic Switch
DN Opto Series

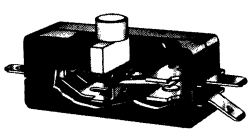


Linear button/actuator type optoelectronic switch.



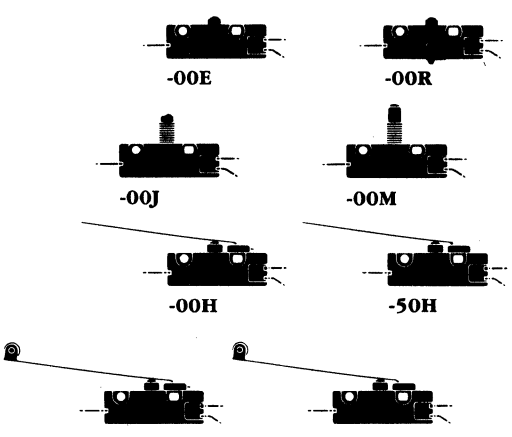
Switch body
1.337″ x .914″ x .406″

General Purpose
E series - Single Pole

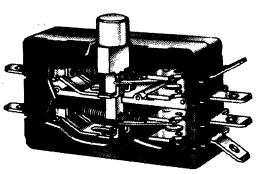


Series G13	**0.1 amps**
Series E13	**15 amps**
Series E14	**25 amps**
Series E30	**30.1 amps**

Switch body
1.823″ x .640″ x .644″

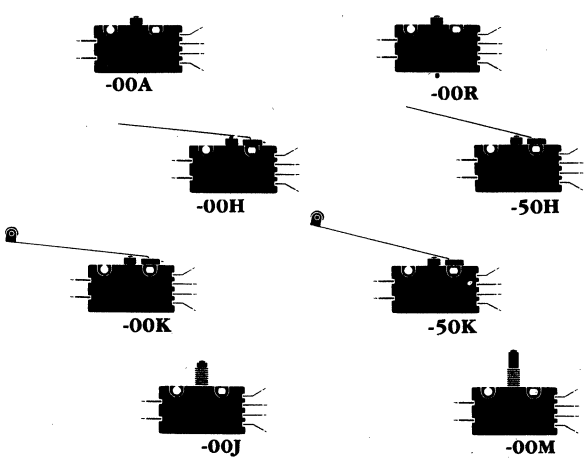


General Purpose
E series - Double Pole

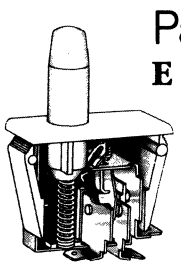


Series E19	**15 amps**
Series E19A	**15 amps/ 0.1 amps**
Series E20	**20 amps**
Series G20	**0.1 amps**

Switch body
1.813″ x 1.125″ x .640″

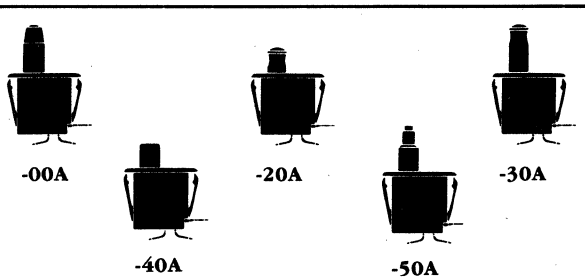


Panel Mount Pushbutton
E series - Single Pole



Series E65	**16 amps**
Series E68	**0.1 amps**
Series E69	**10 amps**

Switch body 1.25″ x 1.05″ x .680″



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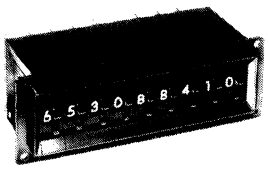
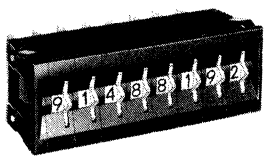


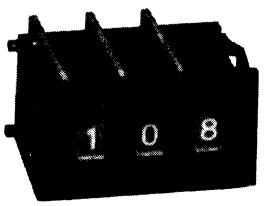
SERIES T10
THUMBWHEEL
Industrial Size Back Mount

- 8, 10, 12 and 16 dial positions
- Variety of output codes
- Wide window version
- Stops to limit rotation
- Dimensions: 1.36″ (34.55mm)H x .500″ (12.7mm)W



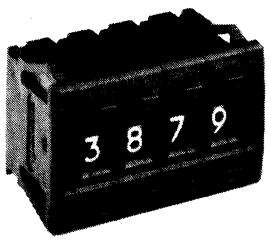
SERIES T75
THUMBWHEEL
Standard Size Front Mount Snap-In

- 8, 10, 12 and 16 dial positions
- Variety of output codes
- Lighted version
- Stops to limit rotation
- Dimensions: 1.30″ (33mm)H x .394″ (10mm)W



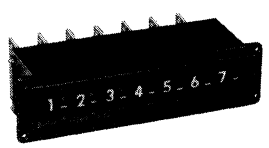
SERIES T55
PUSHWHEEL
Sub-Subminiature Size Front Mount Snap-In

- 8, 10, or 16 dial positions
- Variety of output codes
- Lighted version
- Stackable units without mounting hardware
- Dimensions: .591″ (15mm)H x .300″ (7.62mm)W



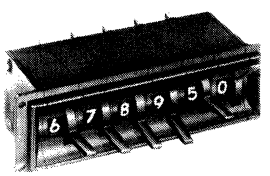
SERIES T59
PUSHWHEEL
Sub-Subminiature Size "Dustproof" Front Mount Snap-In

- 8 or 10 dial positions
- BCD or octal codes
- PC pin outputs
- Stackable units without mounting hardware
- Dimensions: .709″ (18mm)H x .236″ (6mm)W



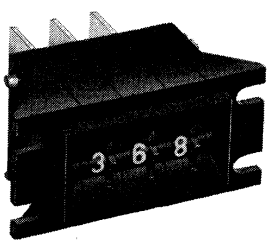
SERIES T20
THUMBWHEEL
Miniature Size Back Mount

- 8, 10, 12 or 16 dial positions
- Variety of output codes
- Lighted version
- Stops to limit rotation
- Dimensions: .960″ (24.4mm)H x .500″ (12.7mm)W



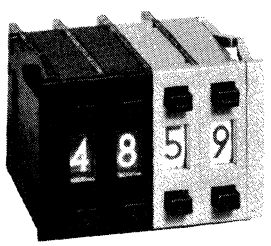
SERIES L20
LEVERWHEEL
Miniature Size Back Mount

- 8, 10, 12 or 16 dial positions
- Variety of output codes
- Quick re-set lever action
- Stops to limit rotation
- Dimensions: .960″ (24.4mm)H x .500″ (12.7mm)W



SERIES T50
THUMBWHEEL
Subminiature Size Back Mount

- 8, 10 or 16 dial positions
- Variety of output codes
- Most popular series
- Stops to limit rotation
- Dimensions: .709″ (18mm)H x .315″ (8mm)W



SERIES T56
PUSHWHEEL
Sub-Subminiature Size Front Mount Snap-In

- 8, 10 or 16 dial positions
- Variety of output codes
- Lighted version
- Stackable units without mounting hardware
- Dimensions: .945″ (24mm)H x .300″ (7.62mm)W

Other Series available upon request.

eem SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
«	much smaller than
$>$	larger than
$\geq$	larger than or equal to
»	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1,\varphi_1,\alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

MERCURY SWITCHES

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- Small Size
- Stable Resistance
- Special Designs

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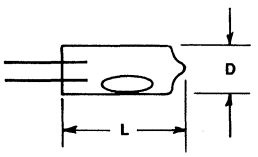
Glass Switches

Part. No.	Dimensions L	D	Max. Operate Angle	AC Ratings (Amps) 30V	115V	230V	DC Ratings 30V	120V	250V	Mount Clip#
CA20-0	0.5	.16	10°	.25	.1	.05	0.1	.07	.03	1A
CA22-0	0.9	.18	1°	.3	.1	.05	0.1	.07	.03	1A
CB17-0	1.4	.32	10°	6	3	2	3	2	1	3BH
CB51-0	1.0	.32	2°	3	1	0.5	1.5	0.7	.3	3BH
CC55-0	1.7	.44	5°	15	10	4	10	8	3	7KF
CD10-0	2.0	.52	10°	25	15	7	15	10	4	5D
CH03-0	1.4	.35	1.4°	1	0.2	0.1	.2	.15	.05	3BH
* CH04-0	1.6	.35	2°	1	0.2	0.1	0.2	.15	.05	3BH
CK30-0	2.2	.45	28°-32°	20	10	5	12	8	3	7KF
CL52-0	2.6	.60	3°	20	10	5	12	8	3	9L

*SPDT



Metal Switches

Part No.	A x B x C	Fig.	Max. Operate Angle	AC Ratings 30V	115V	230V	DC Ratings 30V	120V	250V	Mount Clip#
CM1-0	.38 .32 .82	1	10°	2	1	0.75	0.7	0.5	0.2	3BH
CM2-0	.66 .32 1.1	1	8°	4	2	1.5	1.7	1.0	0.4	3BH
CM225-0	.66 .32 1.1	1	20°-30°	4	2	1.5	1.7	1	0.4	3BH
CM10-0	1.25 .44 1.5	2	10°	20	10	5	8	5	3	T59
* CM10C-0	1.25 .44 1.8	3	10°	20	10	5	8	5	3	T59
CM13-0	.40 .19 .88	1	5°	1	0.5	0.3	0.5	0.2	0.1	1A
CM13R-0	.40 .19 .88	1	3°	0.5	0.25	0.2	0.5	0.2	0.1	1A
CM18-1	.28 .18 .40		**	0.2	0.1	0.08	0.1	.07	.03	1A

*SPDT
**No angle specified - vibration sensor

Fig. 1

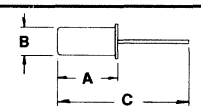


Fig. 2

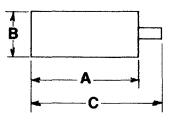
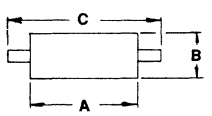


Fig. 3

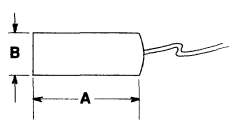


Encapsulated Switches

Part No.	Max. Operate Angle	A x B	AC Ratings 30V	115V	230V	DC Rating 30V	120V	250V
CM1-70	10°	1.3 x 0.5	2	1	.75	0.7	0.5	0.2
CM2-70	8°	1.3 x 0.5	4	2	1.5	1.7	1.0	0.4
CM10-70	10°	1.8 x 0.55	20	10	5	8	5	3
CM13R-70	3°	0.9 x 0.3	0.5	0.25	0.2	0.5	0.2	0.1
CM14-70 ††	25°-35°	1.3 x 0.5	2	1	0.75	0.7	0.5	0.2
CM14B-70 ††	20°-40°	1.3 x 0.5	2	1	0.75	0.7	0.5	0.2

††Tip-Over Switch

Epoxy Sealed Housing



Consult Factory With Custom Package Requirements.

Nylon And Steel Mounting Clips Available.

Tip-Over Switches - Omnidirectional

Part No.	Operate Angle	Dimensions A x B x C	Fig.	AC Ratings 30V	115V	230V	DC Rating 30V	120V	250V
CM13-2 NO	50°-70°	.40 .23 1.0	1	.5	.25	.200	0.5	0.2	0.1
CM14-0 NO	25°-35°	.38 .37 .81	1	2	1	0.75	0.7	0.5	0.2
CM14B-0 NC	20°-40°	.38 .37 .81	1	2	1	0.75	0.7	0.5	0.2
CM15-0 NC	25°-45°	.49 .91 .74	2	30	12.5	7	15	8	5
CM15-T11 * NC	25°-45°			30	12.5	7	15	8	5
CM15-T75 * *NC	25°-45°			30	12.5	7	15	8	5
CM17-0 NC	20°-40°	.42 .60 .66	2	2	1.5	0.8	1.0	0.6	0.2
CM415(1) NO	4° (Typ)	.42 .93 .65	2	1	1	0.5	1.0	0.6	0.2

* (2) 1/4" QC terms. UL approved.

(1) Four N.O. contacts that close depending on direction of tilt.
** (2) 1/4" QC terms and insulated mounting stand-off. UL approved.

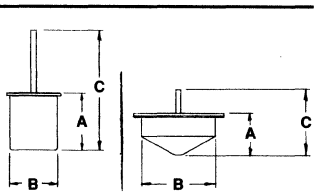


Fig. 1 Fig. 2

Also Available As Encapsualted Switch. Contact Factory.

CRL™ Components, Inc.

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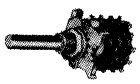
FAX: (515) 573-1342

ROTARY SWITCHES

SUBMINIATURE ROTARY SWITCH OEM SERIES 160, 180, AND 800

DISTRIBUTOR SERIES PSA AND PS



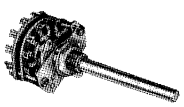
CRL Components' 1" diameter subminiature rotary switches offer a two-ball starwheel lateral thrust index with good torque control and feel. These switches are designed to meet the requirements of Military Switch Specification MIL-S-3786 Style SR05, and are available with ceramic, diallyl phthalate, or phenolic insulation material.

SPECIFICATIONS
GENERAL
Clips and Rotor Contacts Material: Brass, silver plated.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP, Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.
ELECTRICAL
Current and Voltage Rating: Make and break resistive load 0.55 amp. @ 28 VDC, 0.25 amp @ 115 VAC.
Current Carrying Capacity: 7 amp.
Dielectric Strength: 750 VAC between current carrying parts and ground.
Contact Resistance: Average initial 5.0 milliohms.
Surface Resistivity: Average in excess of 900,000 megohms.

MECHANICAL
Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual-ball, side thrust.
Index Life: 50,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30°
Index Stops: Adjustable.
Stop Strength: 10 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MINIATURE ROTARY SWITCH OEM SERIES 050

DISTRIBUTION SERIES SPRING RETURN



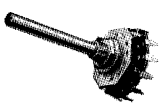
CRL Components' Series 050 has a star-wheel index utilizing a precision roller and coil spring to provide the optimum combination of both positive detent and reliable spring return. Four insulations are standard: phenolic, ceramic, diallyl phthalate or glass epoxy.

SPECIFICATIONS
GENERAL
Clips and Rotor Contacts Material: Brass, silver plated.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.
ELECTRICAL
Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp @ 115 VAC.
Current Carrying Capacity: 9 amp.
Dielectric Strength: 1500 VAC between current carrying parts and ground.
Contact Resistance: Average initial 3.5 milliohms.
Surface Resistivity: Average in excess of 500,000 megohms.

MECHANICAL
Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Coil spring.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Spring return, 30°.
Index Stops: Fixed.
Stop Strength: 25 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MINIATURE ROTARY SWITCH OEM SERIES 070

DISTRIBUTOR SERIES PA-7000



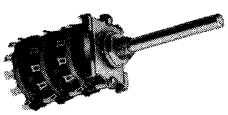
CRL Components' Series 070 switches are economical single section switches using phenolic insulation. The formed spring index uses a small face plate area. These switches are available with up to twelve positions, and a low cost nylon shaft when ordered in large quantities.

SPECIFICATIONS
GENERAL
Clips and Rotor Contacts Material: Brass, silver plated.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.
ELECTRICAL
Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp @ 115 VAC.
Current Carrying Capacity: 9 amp.
Dielectric Strength: 1500 VAC between current carrying parts and ground.
Contact Resistance: Average initial 3.5 milliohms.
Surface Resistivity: Average in excess of 500,000 megohms.

MECHANICAL
Construction: Open staked.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Formed spring, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30°.
Index Stops: Fixed.
Stop Strength: 25 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MINIATURE ROTARY SWITCH OEM SERIES 550 AND 557

DISTRIBUTOR SERIES PA-5000



CRL Components' Series 550 and 557 offer more features than any comparable size switch in the industrial line. A dual-ball side thrust index provides a good torque control. Phenolic, ceramic, diallyl phthalate, and glass epoxy are standard insulations.

SPECIFICATIONS
GENERAL
Clips and Rotor Contacts Material: Brass, silver plated.
Insulation Material: Diallyl Phthalate, IAW, MIL-M-14F. Type SDG.
ELECTRICAL
Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp @ 115 VAC.
Current Carrying Capacity: 9 amp.
Dielectric Strength: 1500 VAC between current carrying parts and ground.
Contact Resistance: Average initial 3.5 milliohms.
Surface Resistivity: Average in excess of 900,000 megohms.

MECHANICAL
Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual ball, side thrust.
Index Life: 50,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30° and 60°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

CRL™ Components, Inc.

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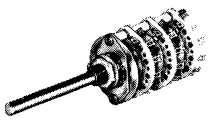
ROTARY SWITCHES

MINIATURE ROTARY SWITCH OEM SERIES 020 AND 024

DISTRIBUTOR SERIES PA-1000 AND PA-2000



CRL Components' Series 020 and 024 offers a small front plate with the quality feel of a ball and spring index mechanism. Phenolic, ceramic, glass epoxy, and diallyl phthalate insulations are available. Stops may be fixed or adjustable.

SPECIFICATIONS

GENERAL

QPL: MIL-S-3786, style SR02.
Clips and Rotor Contacts Material: Brass, silver plated.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.

ELECTRICAL

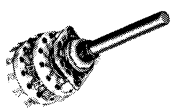
Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp 115 VAC.
Current Carrying Capacity: 9 amp.
Dielectric Strength: 1500 VAC between current carrying parts and ground.
Contact Resistance: Average initial 3.5 milliohms.
Surface Resistivity: Average in excess of 1 million megohms.

MECHANICAL

Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Single-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30° and 60°.
Index Stops: Adjustable.
Stop Strength: 10 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrision.

MINIATURE ROTARY SWITCH OEM SERIES 600 AND 602

DISTRIBUTOR SERIES PA-6000



CRL Components' Series 600 and 602 feature military qualifications under MIL-S-3786. Style SR03. Indexing is hill and valley ball type, available with phenolic, diallyl phthalate, ceramic, or glass epoxy insulation.

SPECIFICATIONS

GENERAL

QPL: MIL-S-3786, style SR03.
Clips and Rotor Contacts Material: Silver alloy treated for solderability.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE: Diallyl Phthalate, MIL-M-14F, Type SDG.

ELECTRICAL

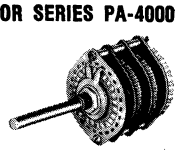
Current and Voltage Rating: Make and break resistive load 2.6 amp @ 28 VDC, 1.0 amp @ 115 VAC.
Current Carrying Capacity: 12 amp.
Dielectrical Strength: 1000 VAC between current carrying parts and ground.
Contact Resistance: Average initial 2.0 milliohms.
Surface Resistivity: Average in excess of 1 million megohms.

MECHANICAL

Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Single-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb. minimum.
Materials and Finishes: Special. All metal parts non-corrosive material or suitably plated to meet 100 hour salt spray test.

MINIATURE ROTARY SWITCH OEM SERIES 670

DISTRIBUTOR SERIES PA-4000



CRL Components' Series 670 indexing is provided by a dual-ball hill and valley index. Angle of throw is 15° with 24 maximum positions. All multiple section switches have "wing type" rotor drive which minimizes rotational lag.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Brass, silver plated.
Insulation Material: Phenolic MIL-P-3115P, Type BPEP; Glass Epoxy, MIL-P-18177, Type GEE.

ELECTRICAL

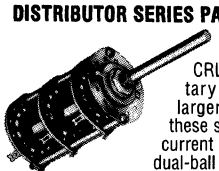
Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.23 amp @ 115 VAC.
Current Carrying Capacity: 9 amp..
Dielectric Strength: 1000 VAC between current carrying parts and ground.
Contact Resistance. Average initial 5.0 milliohms.
Surface Resistivity: Average in excess of 500,000 megohms.

MECHANICAL

Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 15°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb. minimum.
Material and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

HEAVY DUTY ROTARY SWITCH OEM SERIES 300 AND 650

DISTRIBUTOR SERIES PA-3000, 1400 AND 2500



CRL Components' heavy duty rotary switches uses physically larger conductors which enable these switches to handle 50% more current than our miniature line. A dual-ball hill and valley index is standard. The Series 300 has a minimum of 12 positions with phenolic or ceramic insulation, and the Series 650 has a maximum of 18 positions with phenolic insulation.

SPECIFICATIONS

Clips and Rotar Contacts Material: Brass, silver plated.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422.

ELECTRICAL

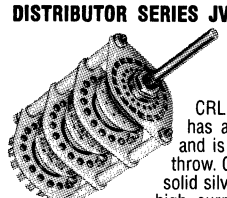
Current and Voltage Rating: Make and brake resistive load 2.25 amp @ 28 VDC, 1.0 amp @ 115 VAC.
Current Carrying Capacity: 9 amp.
Dielectric Strength: 1500 VAC between current carrying parts and ground.
Contact Resistance: Average initial 3.0 milliohms.
Surface Resistivity: Average in excess of 500,000 megohms.

MECHANICAL

Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

POWER ROTARY SWITCH OEM SERIES 230

DISTRIBUTOR SERIES JV-9000



CRL Components' power switch has a maximum of 18 positions and is offered with a 20° angle of throw. Construction features include solid silver alloy contact surfaces for high current switching capability. A dual-ball hill and valley index provides high torque (100 in. oz. nominal) to ensure necessary acceleration to minimize contact arcing.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Silver alloy surface.
Insulation Material: Ceramic, MIL-1-10A. Grade L-422.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 11.0 amp @ 28 VDC, 9.0 amp @ 115 VAC.
Current Carrying Capacity: 17 amp.
Dielectric Strength: 3000 VAC between current carrying parts and ground.
Contact Resistance: Average initial 7.0 milliohms.
Surface Resistivity: Average in excess of 1 million megohms.

MECHANICAL

Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 20°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

CRL™ Components, Inc.

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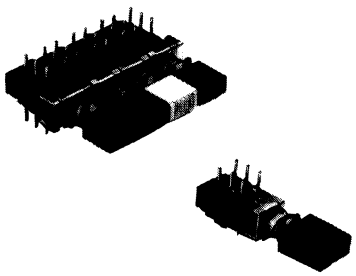
PUSHBUTTON SWITCHES

PBS SERIES



CRL Components' PBS Series pushbutton switches mount horizontally and are available in single or multiple switch assemblies. The modular construction of the basic switch module allows design flexibility when combined with a variety of options.

SPECIFICATIONS

GENERAL

Materials: Switch Enclosure: Phenolic UL94HB. Switch Actuator: Acetal UL94HB. Terminals: Silver plated copper. Contacts: Nickel silver alloy with coin silver overlay. Mounting Hardware: Plated steel.

ELECTRICAL

Switch Function: Non-shorting, double-throw.
Contact Rating (Switching): 1.0A @ 28 VDC resistive load.
Contact Rating (Non-Switching): 11.0A.
Contact Resistance (Load of 100mA @ 2 VDC): 4 to 6 milliohms typical initial.
Dielectric Strength: Terminal to terminal; 1500 VAC. Terminal to bracket; 1500 VAC. Pole to pole; 1250 VAC.
Switch Capacitance: Terminal to terminal; 0.5pF maximum. One terminal to all others grounded. 3.5pF maximum.
Insulation Resistance (Average):

Condition	Measured Between	Resistance (Megohms)
70% RH @ 23°C. 500VDC	Terminal to Bracket Terminal to Terminal Pole to Pole	100K
After 96 hrs. @ 95% RH @ 40°C. 500VDC	Terminal to Bracket Terminal to Terminal Pole to Pole	600 700 800

MECHANICAL

Switch Actuation: Momentary. Push-push.
Actuator Travel:

Actuation	Travel (Nominal)	Overtravel
Push-Push Momentary	.152 (3.86) .156 (3.96)	.050/.050 - (1.27/1.52)

Actuator Force:

Poles	Silver Contact System
2	12-22 oz. (.34- .62) Kg
4	17-27 oz. (.48- .76) Kg
6	24-36 oz. (.68-1.02) Kg
8	30-46 oz. (.85-1.30) Kg

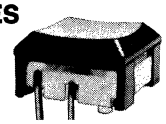
Button: Black button supplied attached.

CLEANING AND SOLDERABILITY

Solderability: Meets EIA standard RS-178-A.
Wave Flow Soldering: 10 seconds @ 260°C.
PC Board Cleaning: When cleaning boards in aqueous solutions, it is recommended that the switches be completely dry prior to the application of power.
Dry Time: 1 hour forced air dry at 52°C to 66°C.

NOTE: The performance of switches and the materials in the bracket are not adversely affected by the materials and processes encountered in typical wave soldering systems. Each customer must determine by direct experience which soldering and cleaning system is best suited to his particular needs.

CDS-PV SERIES



CRL Components' CDS-PV Series keyswitch is a versatile, economical, low profile switch. The module configurations is suited for automatic PCB insertion and is applicable to wave or drag soldering processes.

SPECIFICATIONS

MATERIALS

Module: Polycarbonate 20% glass fiber.
Contacts: Steel silver plated.
Dome Spring: Phosphor bronze silver plated.

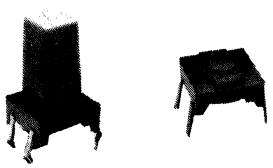
MECHANICAL

Actuating Force: 275 gram (9.7 oz.).
Travel of Disc: 0.28-0.41mm (.011-.016 in.).
Maximum Mech. Overload: 5.45Kg (12 lb.), 60 sec. duration.
Life Expectancy: 3 million actuations.

ELECTRICAL

Contacts: SPST, N.O.
Maximum Voltage: 30 VAC.
Maximum Current: 10mA.
Contact Resistance: 100 milliohms initial, 1 ohm typical at 1 million actuations.
Operating Temperature: −20°C to +70°C (−40°F to +158°F).

CDS-710/720 SERIES



CRL Components' CDS-PR Series 9mm keyswitch is an SPST, momentary, snap action dome switch developed for space limiting electronic applications. This keyswitch is adaptable for automatic insertion into PWB's and compatible with automatic soldering and cleaning processes.

SPECIFICATIONS

ELECTRICAL

Contacts: SPST, N.O. Momentary.
Max. Switched Power: 10 VA.
Contact Rating: 50mA @ 20 VDC.
Max. Voltage: 50 VDC.
Contact Resistance: <20 milliohms initial (100mA @ 2 VDC). 500 milliohms after electrical endurance.
Electrical Endurance: 5 x 10^5 actuations @ maximum switching power.
Contact Bounce: <5 milliseconds.
Insulation: 100 megohms.
Dielectric Strength: 100 VAC.

MECHANICAL

Life: 1 million actuations.
Travel: .305mm (.012")
Actuation Force: 160 gr. minimum, 270 gr. maximum initial.
Return Force: <90% actuation force.

MATERIALS

Snap Dome: Silver plated phosphor bronze—nickel underplating.
Terminals: Silver plated brass—nickel underplating.
Module and Actuator: Polycarbonate 10%—glass fiber.

ENVIRONMENTAL

Operating Temperature: −10°C to 70°C.
Storage Temperature: −30°C to 85°C.
Solderability: EIA RS-178-1.
Flammability: UL94VO Class SE.1

CLEANING AND SOLDERABILITY

Cleaning of the fluxes from the circuit board after soldering can be done with Freon* TMS or TMC fluorocarbon or equivalent solvents. Aqueous cleaning can be employed to remove aqueous flux.

*Trademark of E. I. DuPont DeNemours & Co.

MPS SERIES



CRL Components' MPS Series pushbutton switches are designed to mount vertically into pc boards and can be specified in single or multiple bracketed switch assemblies. The MPS Series offers a lighted version featuring a spot indicator. Illumination is provided by an LED.

NOTE: All products are available through distribution.

SPECIFICATIONS

GENERAL

Switch Enclosure: Molded UL94V-0 polyester.
Switch Actuator: UL94HB acetal.
Terminals: Tinned copper alloy with gold inlay.
Contacts: Gold alloy inlay on beryllium copper.
Brackets: Plated steel.

ELECTRICAL

Contacts: SPST, SPDT, and DPDT non-shorting.
Contact Rating (25 Watts Maximum): 0.5 amps resistive load @ 50 VDC or VAC. .125 amps resistive load @ 110-120 VAC.
Contact Resistance (With Load of 100 Milliamps @ 2 VDC): 50 milliohms maximum.
Contact Bounce: .5 milliseconds typical closing, 1.0 milliseconds typical opening.
Dielectric Strength: Terminal to terminal: 1250 VAC @ 60 Hz RMS for 1 minute. Bracket to terminal: 1250 VAC @ 60 Hz RMS for 1 minute.
Insulation Resistance (Average Reading):

Condition	Measured Between	Resistance (Megohms)
70% RH @ 23°C, 100 VDC	Terminal to ground Pole to Pole	1000 1000
After 96 hrs. @ 95% RH @ 40°C, 100 VDC	Terminal to ground Pole to Pole	10 10

MECHANICAL

Switch Actuation: Momentary, Push-Push.
Actuator Travel: 144 ±.004 (3.66 ±0.10).
Actuation Force At .135 (3,43) Travel):

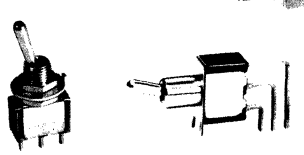
Switch Actuation	Typical Ounces (Grams)
Momentary SPST (N.O.)	2.82-3.88 (80-110)
Momentary Single Pole, DPST (N.O.), DPDT Push-Push—Single Pole	6.7-9.15 (190-260)
Push-Push—Double Pole	9.87-12.3 (280-350)

CLEANING AND SOLDERABILITY

Solderability: Meets EIA Standard RS-178-A.
Wave Flow Soldering: 10 seconds @ 260°C.
PC Board Cleaning: When cleaning boards in aqueous solutions, it is recommended that the switches be completely dry prior to the application of power.
Maximum Dry Time: @ +18°C to +24°C, 40-50% RH is 24 hours; @ +66°C to +93°C, 0-10% RH is 2 hours; @ +121°C to +177°C, 0-10% RH is 15 minutes (not to exceed 1 hour).

MINIATURE TOGGLE SWITCHES





Available in industry standard configurations, our miniature toggle switches (Series 570) offer maximum design flexibility. Choose from low-level and 5-ampere ratings; up to five switching functions; and numerous mounting and terminal styles to meet your unique parameters. Miniature size saves valuable space, particularly where PC boards are utilized. Ideal for telecommunications, industrial control, computer peripherals and many other applications where high reliability, easy visual identification of switch functions, and low cost are prime objectives. U.L. listed and CSA certified.

SPECIFICATIONS

ELECTRICAL RATINGS

Low-level and 5 amps resistive at 120VAC or 28 VDC; 2 amps resistive at 250 VAC.

ELECTRICAL LIFE

Up to 100,000 operations.

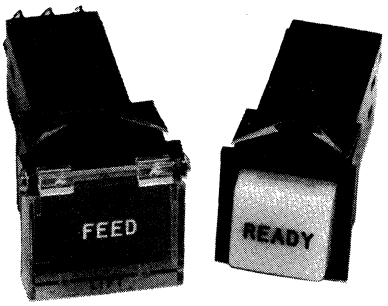
MATERIALS

Gold and/or silver contacts and terminals, stainless steel housing and chrome plated brass toggles.

CRL™ Components, Inc.

Highway 20 West
Fort Dodge, Iowa 50501
Telephone: (515) 573-1300
FAX: (515) 573-1342

COMPUTER GRADE ILLUMINATED PUSHBUTTON SWITCHES



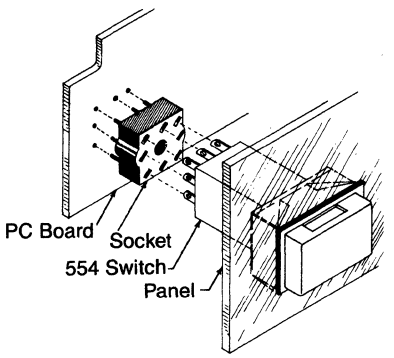
Ideal for all types of equipment, in addition to computers, our computer grade illuminated pushbutton switches (Series 554) offer long life, independent incandescent or LED illumination and outstanding design flexibility. Bright cap illumination provides quick identification of switch status, while independent lamp circuitry can be used to denote required operator action. Fingertip grips on caps also simplify lamp replacement in the field. Available in a wide variety of combinations. Choose from four contact ratings (including Solid State Hall Effect), nine cap styles (including LED illumination and split screen), momentary or alternate action mechanisms, matching indicators and two mounting styles. Optional wave-solderable and washable sockets are available for PC board applications. Optional side barriers and Kap-Guard™ device minimize the chance of accidental actuation. U.L. listed. CSA certified.

Specifications

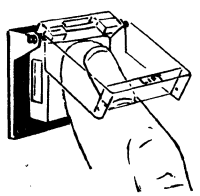
Electrical Ratings
Snap-action silver, snap-action gold, wiping-action gold and solid state up to 7 amps at 125 VAC or 30 VDC; 2 amps at 250 VAC.

Operating Life
750,000 operations (momentary), 250,000 (alternate action) and 1,000,000 operations minimum (solid state).

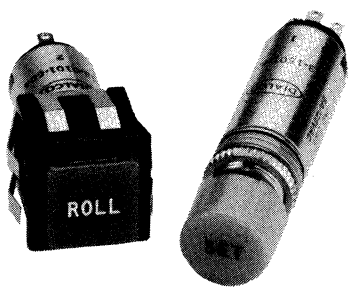
Materials
Gold plate and/or silver contacts, high temperature U.L. approved plastic housing and high impact plastic caps.



Protective Kap-Guard™



COMMERCIAL GRADE ILLUMINATED PUSHBUTTON SWITCHES



Highly dependable contact mechanisms and rugged metal bodies make our commercial grade lighted pushbutton switches (Series 513) ideal for applications requiring more rigid switch construction. Bright cap illumination provides quick identification of switch status, while independent incandescent illumination can be used to denote required operator action. Fingertip grips on caps also simplify lamp replacement in the field. Choose from thousands of combinations, including momentary, snap or non-snap, alternate action; two contact ratings; fifteen cap styles; five cap colors; engraving, hot stamping or replaceable film legends; and snap-in or rear-panel mounting. U.L. listed.

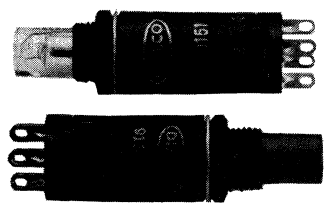
Specifications

Electrical Ratings
Standard and Low-level up to 5 amps resistive at 125 VAC or 30 VDC.

Operating Life
Up to 100,000 operations.

Materials
Gold plated coined silver contacts, anodized aluminum housing and high-impact plastic caps with a nickel plated brass shank.

LED ILLUMINATED PUSHBUTTON SWITCHES



Our led illuminated pushbutton switches (Series 913) feature a high brightness LED with current-limiting resistor for 5 VDC operation. Their integral cap prevents unintentional removal. While their highly reliable momentary switching mechanism has a typical life of one million actuations. Specifically designed for attractive rear-panel mounting, these switches require no subpanels and a minimum of hardware, reducing both material and labor costs.

Specifications

Electrical Ratings
0.1 amp resistive at 125 VAC or 30 VDC.

Operating Life
1,000,000 operations.

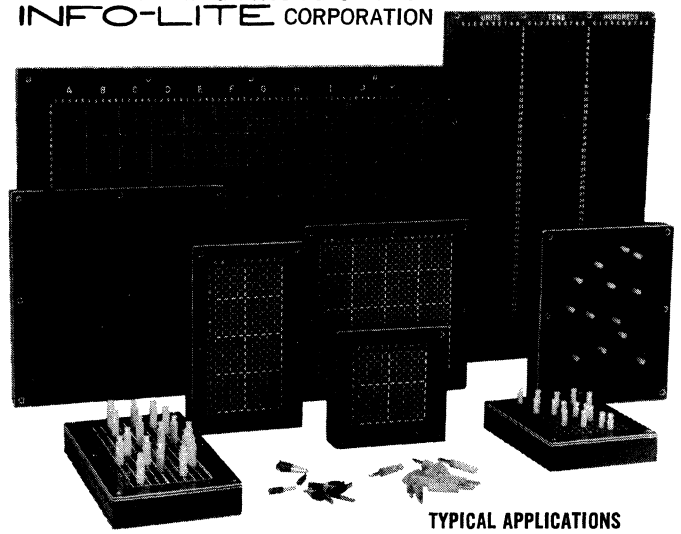
Materials
Gold plated contacts and black anodized aluminum housing.

CROSSPOINT

THE PROGRAMMING PRODUCTS DIVISION OF
INFO-LITE CORPORATION

PROGRAMMING PRODUCTS

MATRIX PINBOARDS



INFO-LITE has developed a most convenient, compact and economical system for reliable programming and switching • The Matrix Program Board allows a wide variety of switching/programming functions to be performed by simply inserting programming pins (shorting or diode type) into a 2 to 10 deck contact matrix • No accessories such as "read" "write" equipment are required • Matrix Board features have led them to be favored over such devices as patchboards, card readers, toggle and thumbwheel switches, mag/punched tape and electronic memories • The two basic uses for Matrix Program Boards are: (1) Cordless patching (input-output switching), using shorting pins; (2) Programmable diode matrices (logic memories), using diode pins • Units with up to 100 x 100 crosspoints can be supplied to meet your requirements, whether for prototype or production quantities.

See Data Sheet MB3 for detailed specifications.

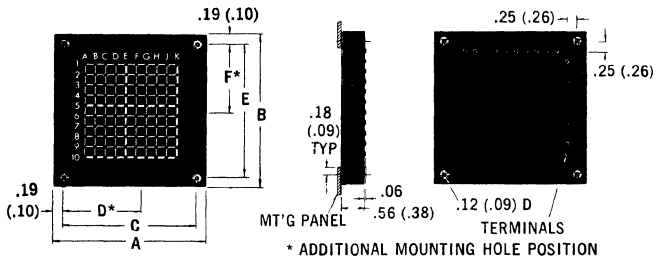
FEATURES

- Reliable closed entry contac.
- Rugged programming pins that will not bind
- Rapid and convenient method of programming/switching
- Permits insertion of components into network without soldering
- Replaces costly complex switching hardware
- Attractive and compact package
- Low capacitance for high frequency applications
- Ease of visual program checking

TYPICAL APPLICATIONS

Numeric Controlled Equipment
Logic Memories
Power Distributors
Circuit/Component Test Programmers
Lighting Systems
Code Generators
Programmable Diode Matrices
Communications Distributors
Status Indicators
Data Logging
Vending Machine Control
Thermo-Couple Selectors
Batching Programmers
Function Generators
Sequence Programmers
Pulse Code Programmers

STANDARD SPECIFICATIONS & STOCK MATRICES FOR 1000 & 2000 SERIES



* ADDITIONAL MOUNTING HOLE POSITION

Matrix Size	Dash #	2000 Series — .250" Grid						1000 Series — .130" Grid					
		A	B	C	D	E	F	A	B	C	D	E	F
10 x 10	—1	3.69	3.69	3.25	—	3.25	—	2.02	2.02	1.82	—	1.82	—
10 x 15	—2	3.69	4.94	3.25	—	4.50	—	2.02	2.67	1.82	—	2.47	—
10 x 20	—3	3.69	6.19	3.25	—	5.75	2.75	2.02	3.32	1.82	—	3.12	—
10 x 25	—4	3.69	7.44	3.25	—	7.00	3.50	2.02	3.97	1.82	—	3.77	1.82
10 x 50	—5	3.69	13.69	3.25	—	13.25	4.50	2.02	7.22	1.82	—	7.02	3.51
20 x 20	—8	6.19	6.19	5.75	2.75	5.75	2.75	3.32	3.32	3.12	—	3.12	—
25 x 25	—9	7.44	7.44	7.00	3.50	7.00	3.50	3.97	3.97	3.77	1.82	3.77	1.82
50 x 50	—10	14.44	14.19	14.0	7.00	13.75	7.00	**7.48**	**7.35**	**7.28**	**7.15**	**3.64**	**3.51**

STANDARD SPECIFICATIONS

1 — Contact Type: Closed Entry
2 — Contact Material: Be-Cu, Alloy 25
3 — Contact Finish: a - .0002" Ag over Cu Flash
b - .00002" Min. Au over Ni Flash
4 — Contact Support Material: Silicone Rubber
5 — Contact Resistance: .040 Ohm, typ.
6 — Contact Capacitance: 1 uuf [2 uuf]/in. at 1 MHz, typ.
7 — Bussing: 1st (top) Deck Vertical; 2nd Deck Horizontal
8 — Breakdown Voltage: 1000 VRMS
9 — Current Rating: 5 [2] Amps standard; 10 [4] Amps available
10 — Terminals: Combination Taper Pin Socket/Solder Cup [Solder Cup]
11 — Panel Material: Black XX Grade Phenolic
12 — Panel Marking: Alpha-Numeric/Grid, White Epoxy Ink Screened

NOTE: Values in brackets [ ] are for 1000 Series if two values are given.

SPECIFYING PART NUMBERS

X000-X - X X

.130" GRID 1 / .250" GRID 2 — MATRIX SIZE (SEE TABLE)
S SILVER CONTACT FINISH
G GOLD CONTACT FINISH
A SCREENED FRONT PANEL
B BLANK FRONT PANEL

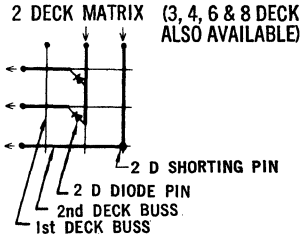
EXAMPLE: A 20 x 20, .250" grid matrix with silver contacts and blank front panel would have Part Number 2000-8-BS. U.S. Patent No. 3,631-374

Programming Pins Diode Pins 1000 Series (.13" Grid)	Specifications Diode	Anode Tot
1020S-CS0001/-CS0002	1N4151	Tip/Sleeve
1020G-CS0003/-CS0004	1N4151	Tip/Sleeve
2000 Series (.25" Grid)	†On Std. Matrices Tip makes W/2nd Deck.	
2020S-CS0006/CS0007	1N270	Tip/Sleeve
2020S-CS0010/CS0011	1N4151	Tip/Sleeve
2020G-CS0012/CS0025	1N4151	Sleeve/Tip
2020S-CS0014/CS0024	1N4004	Sleeve/Tip
Shorting Pins 1010G & 2010GA		

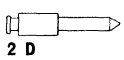
† Sold in multiples of 25 pieces.

SCHEMATIC

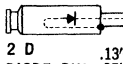
2 DECK MATRIX (3, 4, 6 & 8 DECK ALSO AVAILABLE)



PROGRAMMING PINS



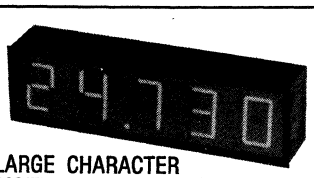
2 D SHORTING PIN
.13 GRID: #1010G
.25 GRID: #2010GA*
*2010GA has straight shank with undercut on grip end (without plastic cap).



X020X-CSXXXX
2 D DIODE PIN
.13" GRID 1 / .25" GRID 2
DEFINES DIODE & ORIENTATION. SEE TABLE ON LEFT
SILVER S
GOLD G

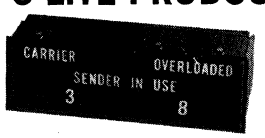
Diode orientation shown: Anode to Sleeve (1st Deck)

OTHER INFO-LITE PRODUCTS



LARGE CHARACTER DIGITAL DISPLAYS

MULTI-MESSAGE LIGHTED INDICATORS





DIGITAL INSTRUMENTS & SYSTEMS

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- Decibel Products

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- Calif. Chassis

CAPACITORS
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- E.F. Johnson
- Mallory
- Sprague

CIRCUIT BREAKERS
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- Potter Brumfield
- Waber Electric

CONNECTORS
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- Amphenol
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- E.F. Johnson
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- Paladin
- Panduit
- Pomona
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- Amphenol
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- Madison

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- Mallory
- Stancor

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- Littelfuse
- U.S.D.

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- Alta Boots
- AMP
- Ico Rally
- E.F. Johnson
- G.C. Electronics
- Harvey Hubbell
- Kulka Smith
- OK Tools
- Panduit
- Vector

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- Ledu
- Luxo
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- Stanley

OUTLET STRIPS
- Waber

POT'S & CONTROLS
- Bourns
- Clarostat
- Ohmite

POWER SUPPLIES & TRANSFORMERS
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- Microtran
- Sola
- Stancor
- Superior
- Triad
- Tripp-lite
- UTC
- Waber

RELAYS
- Aleph International
- Allied Controls
- American Zettler
- Aromat
- C.P. Clare
- Crydom
- Coto
- Gordos
- Guardian
- ITT
- Line Electric
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- Sigma
- Struthers-Dunn
- Theta-J

RESISTORS & NETWORKS
- R.G. Allen
- Bourns
- Clarostat
- Mallory
- Ohmite

SEMICONDUCTORS
- Semi Inc.
- Semitronics

SWITCHES
- Arrow Hart
- AMP
- C & K
- Cherry Electric
- G.C.
- McGill
- Omron
- Oslo
- Otto
- Switchcraft
- Unimax

TERMINAL BLOCKS
- AMP
- Buchanan
- Curtis
- Electrovert
- Magnum
- RDI
- Siemen
- USD
- Vernitron-Beau
- Weidmuller

TEST EQUIPMENT
- Fluke
- Simpson Electric
- Triplett

TIMERS
- Agastat
- Amperite
- Industrial Timer
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- SSAC

TOOLS & SOLDER
- AMP
- Blazer
- Ersin
- Kester
- OK Machine & Tool
- Paladin
- Portasol
- Ungar
- Weller
- Xcelite
- Helper Winch

TRANSFORMERS
- Dormeyer
- Jeffersons
- Microtran
- Sola
- Stancor
- Thordarson
- Triad
- U.T.C.

TUBES
- Eimac
- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

TUBING
- Alpha
- Electrovert
- Heli-Tube
- Panduit

WIRE & CABLE
- Alpha
- Belden
- Cablewave
- Carol
- Iboco
- Madison
- Manhattan
- Quabbin

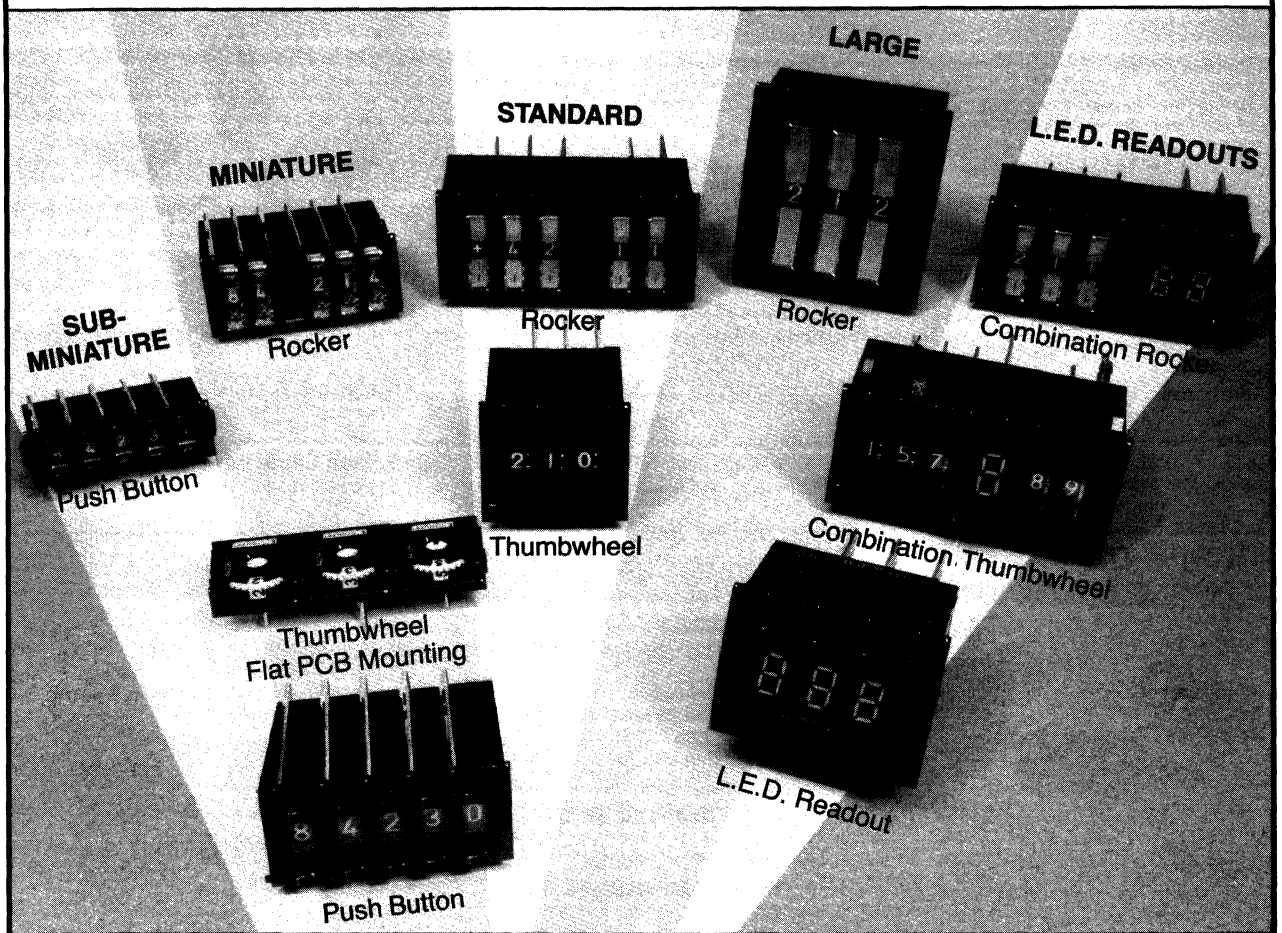
CHERRY



C&K
The Primary Source Worldwide®.

Crouzet® Digital Switches

Thumbwheel, Rocker, Push Button, L.E.D. Readouts



THUMBWHEEL	• Standard Size: .31″(8)W x 1.30″(33)H – 84 210 Series • Flat PCB Mounting – 84 235 Series
ROCKER	• Miniature Size: .30″(7.62)W x .95″(24)H – 84 214 & 84 218 Series • Standard Size: .39″(10)W x 1.30″(33)H – 84 211 & 84 213 Series • Large Size: .49″(12.5)W x 2.28″(58)H – 84 212 Series
PUSH BUTTON	• Sub-Miniature Size: .30″(7.62)W x .59″(15)H – 84 231 Series • Miniature Size: .30″(7.62)W x .94 ″(24)H – 84 230 Series
L.E.D. READOUT MODULES	• Compatible with Standard Size Digital Switches 84 215 – 84 216 – 84 217 Series

CODES:
Decimal
BCD
BCD + Complement
BCD complement
BCD Excess 6 + Complement
Repeating (+/−) or (0/5)
Hexadecimal BCD
Hexadecimal BCD + Complement
Hexadecimal BCD complement

OPTIONS:
Short or long circuit board
Various case and wheel colors
Solder pins
Wire wrap terminations
Stops

ACCESSORIES:
End caps
Spacers
Encoded dummy modules
Separators
Connectors

SNAP ASSEMBLY - NO TOOLS, NO HARDWARE NEEDED

Crouzet ***Motors - Switches - Timers - Counters - Pneumatic Controls***

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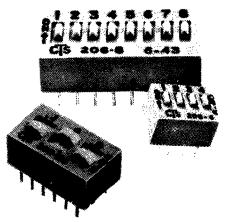
CTS® CORPORATION* DIP SWITCHES

ELECTROCOMPONENT DIVISION, ELKHART

CTS SERIES 206

CTS DIP PROGRAMMABLE SWITCHES



FEATURES
- Contact wiping on make and break
- Suitable for flow soldering on PC board or mounting with standard DIP sockets
- Long term contact corrosion resistance provided by gold plated contact arms
- All U.L. 94V-O plastic used
- Integral terminal and contact locked into plastic base rails
- Crisp, positive slide actuators
- Available with flush (low profile) actuators—SPST styles

Description

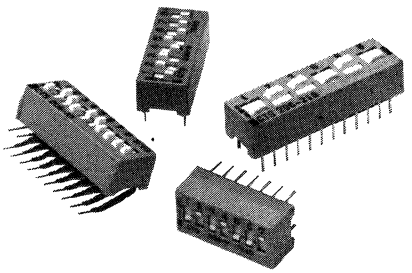
From 2 thru 10 and 12 SPST; 1 thru 6 SPDT; 1 thru 6 DPST; 1, 2, or 3 DPDT and 1, 2 or 3 4PST slide switches per switch package on .100" DIP centers

Initial Contact Resistance
50 milliohms

Maximum Contact Resistance
100 milliohms after 10,000 cycles switching 50 mA @ 24 VDC

Maximum Non-Switching Rating
100 mA or 50 VDC

Insulation Resistance
Across open switch and between adjacent closed switches: 1×10^9 ohms



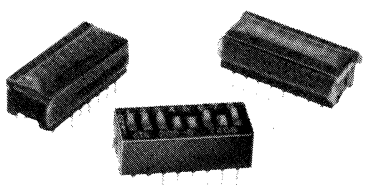
RA's available for all 206 series versions.

Dielectric Breakdown
Between adjacent switches minimum: 500 VDC

Switch Capacitance
Between adjacent switches maximum: 5.0 pF

CTS SERIES 208

CTS DIP PROGRAMMABLE SWITCHES



FEATURES
- Contact wiping on make and break
- Suitable for flow soldering on PC board or mounting with standard DIP sockets
- Economical version with non gold contacts
- All U.L. 94 V-O plastics used
- Integral terminal and contact locked into plastic base rails
- Crisp, positive slide actuators

Description

From 2 thru 10 and 12 SPST switch package on .100" x .300" DIP centers-SPST Styles

Initial Contact Resistance
100 milliohms

Maximum Contact Resistance
500 milliohms after 2000 cycles switching 50 mA @ 24 VDC

Maximum Non-Switching Rating
100 mA or 50 VDC

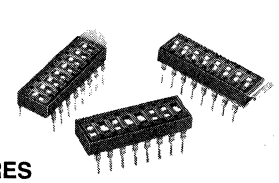
Insulation Resistance
Across open switch and between adjacent closed switches: 1×10^9 ohms

Dielectric Breakdown
Between adjacent switches minimum: 500 VDC

Switch Capacitance
Between adjacent switches maximum: 5.0 pF

CTS SERIES 207 AUTO-DIP™ SWITCH

AUTOMATICALLY INSERTABLE, WAVE SOLDERABLE, BOARD WASHABLE DIP SWITCH



FEATURES

Optimized Contact System
- Redundant, wiping contacts
- Contactor does not rub on plastic or deflect during actuation

Optimized Mechanical Features
- Fully sealed to withstand insertion shock, wave solder temperatures, board washing
- Positive detent separate from contactor
- Closed windows prevent particle contamination
- .050" actuator travel
- Molded .300" integrated circuit package outline

Premium Materials
- Gold contacts, solder coated terminals
- Beryllium copper contactor
- 260°C housing heat deflection temperature assures contact and seal integrity after wave soldering
- All plastics rated U.L. 94 V-O
- Permanent laser marking

ELECTRICAL AND MECHANICAL SPECIFICATIONS

Contact Resistance
25 milliohms maximum initial
50 milliohms maximum at end of life

Actuation Life
5000 cycles switching
50 mA@6 VDC or 2mA@50 mVDC

Nonswitching Rating
100 mA or 50 VDC

Insulation Resistance
$1 \times 10^9\Omega$ minimum between insulation terminals

Dielectric Strength
200 VAC minimum

Switch Capacitance
5 pF maximum between adjacent closed switches

Temperature Range
0 to 85° C operating – 40 to 70°C storage

Allowable Wave Solder Time
Up to 4 seconds with 260°C solder

Shock
No mechanical damage or changes of switch settings with 25 G applied for 6 milliseconds

Vibration
No mechanical damage or changes of switch settings during or after testing, when tested in 3 mutually perpendicular planes at 10-50 Hz sweep or at 60 Hz constant vibration. Amplitude .06"

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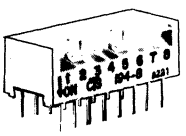
CTS® CORPORATION* DIP SWITCHES

ELECTROCOMPONENT DIVISION, ELKHART

CTS SERIES 194

CTS DIP SWITCHES



FEATURES

- Electrical switching occurs at 50% of actuator rotation angle
- Contact wiping on make and break
- Enclosed actuators shield contacts from foreign particles throughout life of switch
- The gold plated, over-center design provides positive detent action
- Reliable tape top seal optional/ bottom epoxy seal standard
- Insert molded base halves of thermoset material ensure mechanical integrity of contacts and terminals through soldering operations
- All U.L. 94 V-O plastics used

Description
Side actuated 2 thru 10 and 12 section SPST switching functions per package on .100″ x .300″ DIP centers

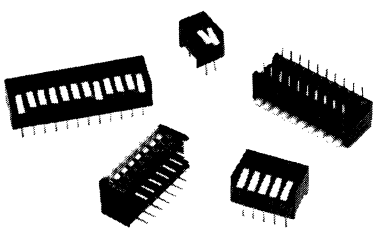
Initial Contact Resistance
50 milliohms maximum

Insulation Resistance
Across open switch and between adjacent closed switches: 1×10^9 ohms minimum

Maximum Contact Resistance
100 milliohms after 7000 cycles switching 50 mA @ 24 VDC

CTS SERIES 195

CTS DIP SWITCHES



FEATURES

- Electrical switching occurs at 50% of actuator rotation angle
- Contact wiping on make and break
- Enclosed actuators shield contacts from foreign particles throughout life of switch
- Economical version with non gold contacts over-center design provides positive detent action
- Reliable tape top seal optional/ bottom epoxy seal standard
- Insert molded base halves of thermoset material ensure mechanical integrity of contacts and terminals through soldering operations
- All U.L. 94 V-O plastics used

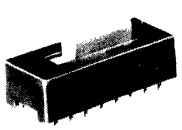
Description
Side actuated 2 thru 10 and 12 section SPST switching functions per package on .100″ x .300″ DIP centers

Initial Contact Resistance
100 milliohms maximum

Insulation Resistance
Across open switch and between adjacent closed switches: 1×10^9 ohms minimum

Maximum Contact Resistance
500 milliohms after 2000 cycles switching 50 mA @ 24 VDC

CTS SERIES 197



FEATURES

- Designed for automatic insertion
- Integral terminal and contact locked into thermoset base rails
- Contact wiping on make and break
- Break before make contacts
- Useful in "service/operate" applications, low level signal routing, digital circuit programming, etc.
- Long term contact corrosion provided by gold plated/inlaid contacts
- All U.L. 94 V-O plastics used

Description
4PDT slide actuated switch package on .100″ x .300″ DIP centers

Initial Contact Resistance
50 milliohms maximum

Maximum Contact Resistance
100 milliohms after 2000 cycles switching 50 mA @ 24 VDC

Insulation Resistance
Across open switch and between adjacent closed switches: 1×10^9 ohms minimum

Dielectric Breakdown
Between adjacent switches minimum: 500 VDC

Switch Capacitance
Between adjacent switches maximum: 5.0 pF

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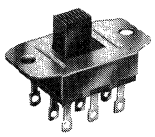
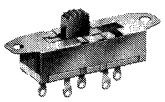
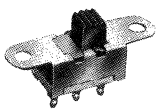
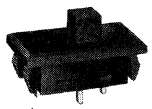
DISCOVER CW Switches

Custom designs. Custom performance. Countless combinations. From America's largest slide switch manufacturer.

Slide Switches

	 Standard Switches	 Miniature Switches	 Micro Miniature Switches	 Fully Enclosed Micro Miniature Switches
Circuitries	SPST, SPDT, DPST, DPDT, 3PDT, 4PDT, SP3POS, DP3POS, 3P3POS, 4P3POS, DP4POS.	SPST, SPDT, DPST, DPDT, 3PDT, SP3POS, DP3POS, 3P3POS, 4P3POS, SP4POS, DP4POS, DP5POS.	SPST, SPDT, DPDT, SP3POS.	SPST, SPDT (Plug-in or snap-in versions)
Ratings	3A AC/.5A DC @125V through 13A AC/.5A DC @125V	.5A AC/.5A DC @125V through 8.5A AC/.5A DC @125V	.5A AC/.5A DC @125V	.5A AC/.5A DC @125V
Momentary Versions	SPST, SPDT, DPDT, 3PDT. Also, SP3POS, DP3POS and 3P3POS are available momentary in only one direction.	SPST, SPDT, SP3POS, DP3POS.	SP3POS (momentary both directions to center)	Not Available
Side Actuated Versions	SPDT (maintained or momentary), DPDT, DP3POS.	SPDT, DPDT, 3PDT, SP3POS, DP3POS, SP4POS, DP4POS, DP5POS.	SPDT	SPST
Terminal Options	Solder, Wirewrap, PC, Faston	Solder, Wirewrap, PC.	Solder, Wirewrap, PC.	Solder, PC, Faston
Button Options	.344″ (Standard) .031″ through .750″ (optional). Black is standard; optional colors available.	.200″ (Standard) .125″ through .453″ (optional). Black is standard; optional colors available.	.120″ through .250″ Black is standard; optional colors available.	.110″ through .250″ Black is standard; optional colors available.
Agency Listings	UL, CSA	UL, CSA	UL	UL, CSA
Endurance	10,000 cycles no load (minimum) 6,000 cycles rated load (minimum)	10,000 cycles no load (minimum) 6,000 cycles rated load (minimum)	10,000 cycles no load (minimum)	6,000 cycles at rated load (minimum)
Bifurcated/Redundant Contacts	DPDT, 4PDT. Make before break or break before make.	SPDT (maintained or momentary), DPDT, SP3POS. Make before break or break before make.	Not Available	Not Available
CW Catalog	S2120-II/S2120-VIIA	S2120-III/S2120-VII	S2120-IV	S2120-V

All CW switches are available with a complete range of options including: unique ratings, button height and color, markings, and glamour caps. Contact factory for literature requests or your unique requirement.

DISCOVER CW

CW Industries, 130 James Way,
Southampton, PA 18966
TEL: 215-355-7080
FAX: 215-355-1088

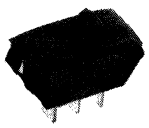
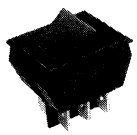
Ask for our switch information kit
EM-S2120/2121

Some of the most innovative and versatile switches on the market today. Customized or off-the-shelf!

Switches

DISCOVER CW

Panel Mount Rocker Switches

	 "Mini-Rocker" Switch	 "Soft-Styled" Rocker Switch	 "Hi Gloss" Rocker Switch	 Panel Mount Slide Switch
Circuitries	SPST, SPDT, DPST, DPDT, SPDT-Center Off, DPDT-Center Off	SPST, SPDT, SPDT-Center Off	SPST, SPDT, DPST, DPDT	SPST, SPDT
Mounting	Pop-In	Pop-In	Pop-In	Pop-In or Chassis Mount
Ratings	8A @125V AC/4A @250V AC 13A @125V AC/10A @250V AC ½HP @125V-250V AC 16A @125V AC/16A @250V AC ¾HP @125V-250V AC 10A @14V (T)/3A @125V (L) 10 (4)A 250~(VDE)	8A @125V AC/4A @250V AC 13A @125V AC/10A @250V AC ½HP @125V-250V AC 5A @14V (T)/6A @125V (L) 16A @125V AC/12A @250V AC ¾HP @125V-250V AC 10A @14V (T) 12 (6)A 250~(VDE)	8A @125V AC/4A @250V AC 13A @125V AC/10A @250V AC ½HP @125V-250V AC 5A @14V (T)/6A @125V (L) 16A @125V AC/12A @250V AC ¾HP @125V-250V AC 10A @14V (T) 12 (6)A 250~(VDE)	8A @125V AC/4A @250V AC 13A @125V AC/10A @250V AC ½HP @125V-250V AC 5A @14V (T)/6A @125V (L) 16A @125V AC/12A @250V AC ¾HP @125V-250V AC 10A @14V (T) 12 (6)A 250~(VDE)
Panel Cutout	.756″ × .508″	.550″ × 1.125″	.550″ × 1.125″ (Single Pole) .872″ × 1.071″ (Double Pole)	.550″ × 1.125″ (Pop In) 1.125″ Mounting Centers (Chassis Mount)
Panel Thickness	.050″ To .150″	.025″ To .180″ (up to .170″ for Center Off and Illuminated)	.025″ To .180″ (Single Pole) .025″ To .150″ (Double Pole)	.025″ To .180″
Momentary Versions	SPST, SPDT, DPST, DPDT, SPDT-center off, DPDT—center off	SPDT—center off	Not Available	Not Available
Illuminated Versions	SPST, SPDT, DPST, DPDT	SPST	Not Available	Not Available
Lamp Options	Neon 125V (STD) Neon 250V Incandescent 14V	Neon 125V (STD) Neon 250V Incandescent 14V	Not Available	Not Available
Agency Listings	UL, CSA, VDE	UL, CSA, VDE	UL, CSA, VDE	UL, CSA, VDE
Endurance	100,000 cycles no load, minimum 25,000 cycles rated load (up to 16A 125V AC) 10,000 cycles rated load @16A 250V AC	100,000 cycles no load, minimum 25,000 cycles rated load (up to 16A 125V AC)	100,000 cycles no load, minimum 25,000 cycles rated load	100,000 cycles no load, minimum 25,000 cycles rated load
Button/Rocker Options	Color, Markings	Color, Markings	Color, Markings	.260″ Button (std.); .344″, .500″, .625″, .750″ also available/ Color/Markings/Toppers Available
Housing Options	Color, Markings	Color, Markings	Color, Markings	Pop-In Mount or Chassis Mount, Color, Markings
Insulation Barriers	Optional	Optional	Optional	Optional

Ask for our switch information kit
EM-S2120/2121

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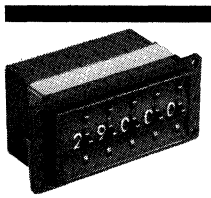
PRESENTING THE LONGEST-RUNNING SERIES IN THE BUSINESS

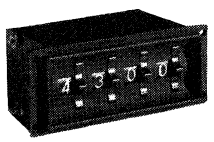
Innovative, Quality-Engineered Thumbwheel Switches Available Off-The-Shelf At Unbeatable Prices.



29000 SERIES
ECONOMY MINISWITCH

An economical miniswitch for high package density. Extra large in-line character readout. Width, .350" (8.9) and cutout height 1.020" (25.9)

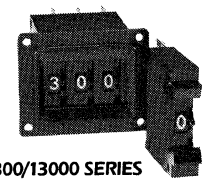
- 10, 12 or 16 Dial Positions
- Many Output Codes and Configurations
- Message Units for Longer Legends
- Optional Dial Stops to Limit Rotation
- Rear-Mounted



43000/44000/45000 SERIES
MINISWITCH

These low cost switches feature optional LED lighting and snap-together assembly. Field installable stops to limit dial rotation. Printed circuit boards with solder or pin terminations.

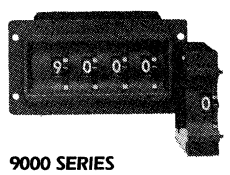
- Available in Most Popular Codes
- 10 Dial Positions
- .200" High, Up-Front Dial Characters
- 43000 —
- 500" (12.7) W x .980" (24.89) H
- 44000 —
- .315" (8.0) W x 1.220" (31.0) H
- 45000 —
- .315" (8.0) W x .961" (24.4) H



300/13000 SERIES
GENERAL PURPOSE DIGISWITCH

One of the most widely used thumbwheel switches, with more available options, output codes and special termination features than any other switch.

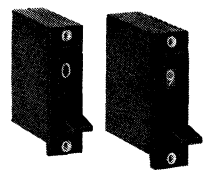
- 8, 10, 12 or 16 Dial Positions
- RFI Shielding Available
- Easy to Replace MIL-Spec Lighting
- Message Units for Longer Legends
- 13000 is Front-Mounted Version
- 300 —
- .500" (12.7) W x 1.380" (35.05) H
- 13000 —
- .500" (12.7) W x 2.00" (50.8) H



9000 SERIES
DIGISWITCH

The 9000 offers more available options, output codes and special termination features than any other fully-sealed MIL-spec switch. Rear-mounted, qualified to MIL-S-22710/12.

- 8, 10, 12, or 16 Dial Positions
- RFI Shielding Available
- Optional Replaceable MIL-Spec Lighting
- Dial Stops to Limit Dial Rotation
- Dimensions —
- .600" (15.24) W x 1.375" (34.93) H



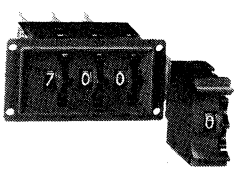
24000/28000 SERIES
LEVER SWITCH

24000: Bi-directional front panel sealed switch built to perform in any hostile environment qualified to MIL-S-22710/24.

- Optional, Replaceable MIL-Spec Lighting
- Individually Mounted Switches
- 24000 —
- .480" (12.19) W x 1.175" (29.84) H

28000: Minilever commercial switch that can be actuated in either direction.

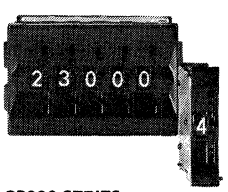
- "Upper" or "Lower" Window Location
- 90° Full Lever Travel
- 10 and 12 Dial Positions
- 28000 —
- .500" (12.7) W x .980" (24.89) H



200/700/8000 SERIES
MINISWITCH

Small switches for hostile environments, virtually impervious to sand, dust, oils, high humidity, salt spray and explosive atmospheres. Series 200 has potted wire leads, 700 — P.C.B. both qualified to MIL-S-22710/15 and /20.

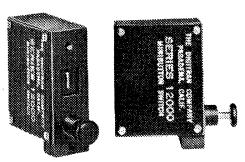
- 8, 10, 12 or 16 Dial Positions
- RFI Shielding Available
- Optional, replaceable MIL-Spec Lighting
- 8000: Commercial Version
- Dimensions:
- .500" (12.7) W x .980" (24.89) H



23000 SERIES
"SNAP-IN" SLIMSWITCH

For applications where maximum panel density, good reliability and error-proof positive setting action are required. Switch width only .315" with cutout height of 1.221."

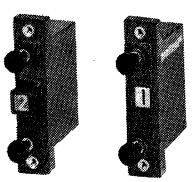
- 10 Dial Positions
- Snap-in, Front Mount — No Tools Required
- Large (.170" High) In-Line Characters



12000/53000 SERIES
MINIBUTTON

Reliable, contamination-proof switches for applications requiring panel sealing per MIL-S-22710. No supplemental panel cover or boot is required for sealing.

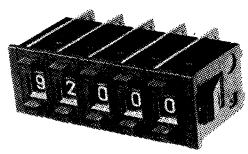
- Individually Mounted Switches
- Glass Window that Seals Switch Interior
- Metal Case — Facilitates R.F.I. Shielding
- Optional Replaceable MIL-Spec Lighting
- 12000 Series: Qualified to MIL-S-22710/17
- 12000 —
- .500" (12.7) W x .83" (21.08) H
- 53000 —
- .350" (8.89) W x 1.020" (25.91) H



63000/64000 SERIES
BI-DIRECTIONAL MINIBUTTON

Two-button bi-directional switches designed to meet all performance requirements of MIL-S-22710. Rear-mounted, panel sealed.

- 63000 — 8, 10, 12 Dial Positions
- 64000 — 16 Dial Positions
- Metal Case — No RFI Shielding Required
- Optional Replaceable MIL-Spec Lighting
- Individually Mounted Switches
- 63000 —
- .410" (10.41) W x 1.230" (31.25) H
- 64000 —
- .460" (11.68) W x 1.312" (33.53) H



92000/93000/62000 SERIES
DOUBLE PUSHBUTTON

These commercial switches are designed for applications where speed and ease of settings are important.

- Snap-together Assembly
- L.E.D. Lighting Available (92000)
- Low Cost, High Quality, High Reliability
- 10 and 16 Dial Positions Available
- Dial Stops to Limit Dial Rotation
- 92000 —
- .300" (7.62) W x .551" (14.2) H
- 93000 —
- .300" (7.62) W x .886" (22.5) H
- 62000 —
- .315" (8.00) W x .945" (24) H

NOTE: Numerals in brackets indicate millimeter equivalents.

More military and commercial thumbwheels and greater code selection than anybody else. And it's all under one roof to maintain the very highest standards of product quality and delivery.

Let Digitran integrate your digital switches into your subassembly. Contact Digitran's Subsystems Engineering and Manufacturing Services Center at (714) 391-4321. Also see our keyboards (5150) and monitors (2450).

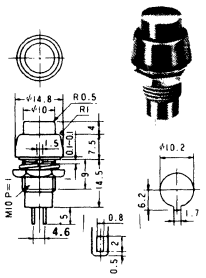
DIGITRAN®
A DIVISION OF XCEL CORPORATION
4290 East Brickell St. Ontario, CA 91761
(714) 391-4321 • FAX: (714) 391-4558

QUALITY SWITCHES of MIYAMA DSC

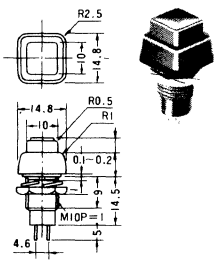
PUSH ROCKER • TOGGLE SLIDE SWITCHES (Operating Life 100,000 Cycles)

P-SERIES

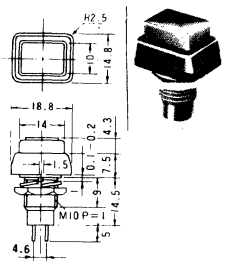
DS-450 (ALTERNATE)
DS-463 (MOMENTARY)



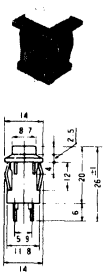
DS-453 (ALTERNATE)
DS-466 (MOMENTARY)



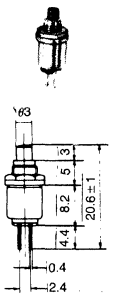
DS-458 (ALTERNATE)
DS-471 (MOMENTARY)



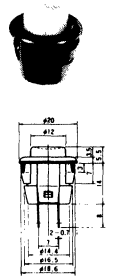
DS-430 PUSH-(ON)
DS-431 PUSH-(OFF)



MS-402
TINY PUSH-ON



DS-412

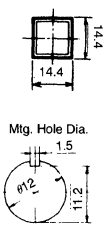


ILLUMINATED SWITCHES. Long Life (Electrical 50,000 Operations, Mechanical 100,000 Operations.)

DS-700 (ALTERNATE
DS-710 (MOMENTARY)

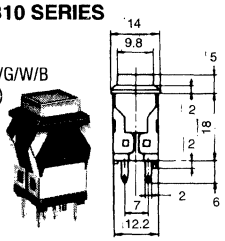


LED
FILAMENT LAMP

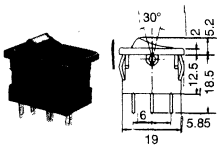


MS-800, 810 SERIES

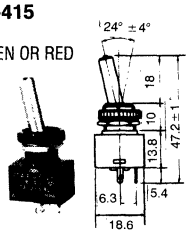
LED; R/Y/G
F. LAMP; R/Y/G/W/B
(6V, 12V, 28V)



DS-850
SNAP-IN ROCKER
W/LED
FRAM: BLK, WHT or GRAY



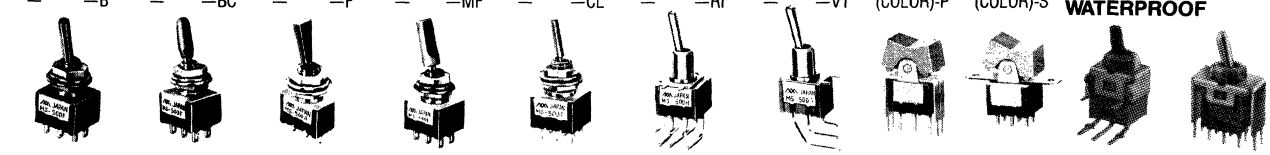
DS-415
LED
GREEN OR RED
2P



MS-500 SERIES—TOGGLE

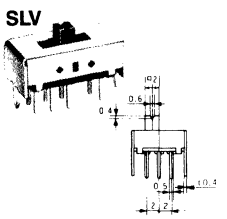
6P DPDT BODY 10mm
3P SPDT KNOB 5mm
WATERPROOF

— —B — —BC — —F — —MF — —CL — —RI — —VT (COLOR)-P (COLOR)-S

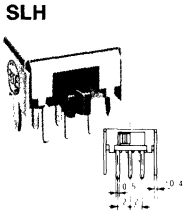


SLIDE SWITCHES

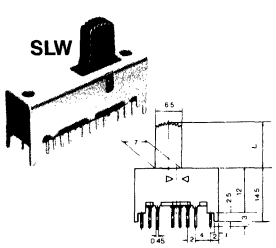
SLV



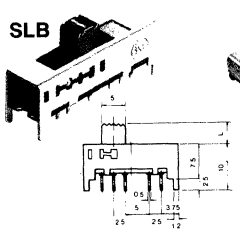
SLH



SLW

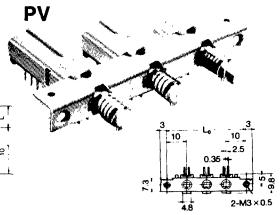


SLB



PUSH SWITCHES

PV



Part No.	DS-700 (alt) DS-710 (mom)	MS-200	MS-800 (alt/mom) MS-810 (alt/mom)	DS-850	DS-415 DS-417	DS-412	MS-402	DS-430 DS-431	P-Series DS-450	MS 500 TOGGLE	Slide Switches
Model Type	Illuminated Push Button Switches LED (Red, Green, Yellow) Filmt Lamp (6V, 12V, 28V) R/G/Y/W/B Available also W/O Lamp or LED			Rocker LED Color: Red, Yellow Green	Toggle LED/red, green	Push-button Round	Push-button	Push-button	Push-button	—	**Available in vary size, pole position**
Rating	1A 250V AC 3A 125V AC	0.4VA (20mV-28V) 0.1mA-0.1A	0.1A 30V DC	3A 250VAC 5A 125VAC	3A 125VAC	1A 125VAC 0.5A 250V	0.5A 125V AC	1A 125VAC 0.5A 250V	3A 125VAC 1A 250VAC	6A 125V AC	DC30V 0.03A DD12V 30.1A
Circuit	SPDT DPDT	A3PSPDT on-off B3PSPDT on-(on) C3PSPDT on-off-on D3PSPDT on-off-(on) E3PSPDT (on)-off-(on) F6PDPDT on-on	A DPST off-on B DPST off-(on) C DPST on-off D DPST on-(off)	2P SPST	2P (SPST) on-off 3P (SPDT) on-on	2P (SPST) DS-412 Push-(on)	2P (SPST)	2P (SPST) DS-430 Push-(on) DS-431	2P (SPST) DS-450-462 on-off DS-463-475	3P (SPDT) 6P (DPDT)	many type of Slide Switches are available PLS Call
Switching Function	on-on ALTN on-(on) MOM	G6PDPDT on-(on) H6PDPDT on-off-on I6PDPDT on-off-(on) J6PDPDT (on)-off-(on)	E SPDT on-on F F SPDT on-(on)	on-off		Color: R/W	Push-(on) Momentary	Push-(off) Color: R/B/W	Push-(On) R/W/B/Slvr	on-(on) on-off-on on-off-(on) (on)-off-(on)	
Contact Resistance	2.5VDC 1A 10mΩ max.	1mA, 0.1μW 50mΩ max.	2.5VDC 10mA 50mΩ max.	2.5VDC 1A 20mΩ max.	2.5VDC 1A 20mΩ max.	2.5VDC 1A 10Ω max.	2.5VDC 1A 20mΩ max.	2.5VDC 1A 10mΩ max.	2.5VDC 1A 20mΩ max.	200mΩ max.	DC5V. 1A 20mΩ max.
Insulation Resistance	DC.500V 100mΩ min.	DC.500V 1000mΩ min.	DC.500V 500mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.
Voltage Breakdown	AC 1500V 1 minute	AC 500V 50/60Hz 1 min.	AC 500V 1 minute	AC .1000V 1 minute	AC .1000V 1 minute	AC 1500V 1 minute	AC 1000V 1 minute	AC 1500V 1 minute	AC 1500V 1 minute	AC 1000V min.	AC 500V 1 minute
Mounting Hole Dia. mm	12		12.6 square	13 x 9	12	17.8 dia.	5.2 dia.	12.4 x 11.2	All Model 10.2 dia.	6.2	**vary size**

DSC offers a complete line of switches including Slide, Multi-Push, Subminiature, Lever, Rocker, Toggle and Illuminated Types. For Complete information on our Wide Range of Products Please Contact:
For more information please call: 212-691-9050

SEE DSC CONNECTORS IN EEM VOLUME C PAGE C-1349

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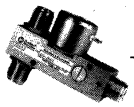
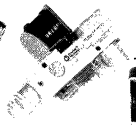
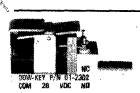
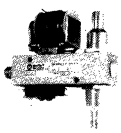
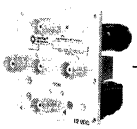
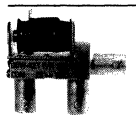
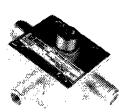
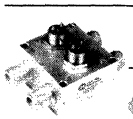
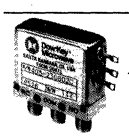
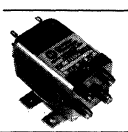
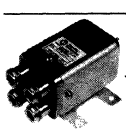
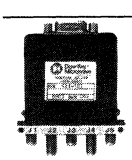
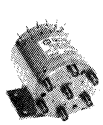
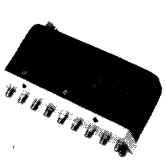
DSC DIRECT SOUND CORPORATION
150 Fifth Avenue, Suite 842, New York, NY 10011 **FAX 212-807-1598**

DowKey® Microwave CORPORATION

DOW-KEY SERIES NO.	CONTACT ARRANGEMENT	CONNECTOR OPTIONS	IMPEDANCE (OHMS)	FREQUENCY (MAX)	INSERTION LOSS (dB TYP OPERATING)	ISOLATION (dB TYP OPERATING)	POWER RATING (CW) AT 100 MHz	POWER RATING (CW) AT MAX FREQ.
RF SWITCHES								
 60 SERIES								
60	SPDT	BNC N UHF C	50	2000 MHz	0.1	50	1000W	200W
 260 SERIES								
260 260B	DPDT BYPASS	BNC N UHF	50	2000 MHz	0.1	50	1000W	200W
 61 SERIES								
61	SPDT	BNC	50	2000 MHz	0.1	50	150W	50W
 66 SERIES								
66	SPDT	F	75	1000 MHz	0.1	70	100W	20W
 77 SERIES								
77	SPDT	F BNC	75 50	2000 MHz	0.1	40	100W	20W
 46/164 SERIES								
 54 SERIES								
54/55/56/62	SPDT	BNC TNC	50	4000 MHz	0.1	70	100W	50W
46 164	DPDT SPDT	BNC SMB SMA	50	4000 MHz	0.1	50	125W	50W
 78 SERIES								
78	MULTI-THROW MANUAL	BNC UHF	50	2500 MHz	0.1	50	1000W	200W
 115/116 SERIES								
115 116	SP3T SP4T	BNC	50	3500 MHz	0.1	50	200W	50W
 167 SERIES								
167	TRANSFER	N UHF	50	1000 MHz	0.1	40	1000W	100W
 169 SERIES								
169	SPDT	BNC	50	1000 MHz	0.1	50	100W	20W
HIGH POWER SWITCHES								
 310 SERIES								
310	SPDT	SC N HN	50	1000 MHz	0.1	30	2000W	500W
 312 SERIES								
312	BYPASS	SC N HN	50	1000 MHz	0.1	30	2000W	500W
 313 SERIES								
313	TRANSFER	SC N HN	50	1000 MHz	0.1	30	2000W	500W
MICROWAVE SWITCHES								
 401 SERIES								
401 AVAILABLE IN 5 MS AND HI-REL/SPACE	SPDT	SMA	50	26.5 GHz	.1 TO .5	70	200W	25W
 403 SERIES								
403	SPDT	SMA	50	26.5 GHz	.1 TO .5	70	200W	25W
 411 SERIES								
411	TRANSFER	SMA	50	26.5 GHz	.1 TO .5	70	200W	25W
 402 SERIES								
402	SPDT	BNC N TNC	50	16.0 GHz	.1 TO .5	70	1000W	100W
 412 SERIES								
412	TRANSFER	BNC N TNC	50	16.0 GHz	.1 TO .5	70	1000W	100W
 421 SERIES								
421	FIVE PORT TERMINATED	SMA	50	18.0 GHz	.1 TO .5	90	100W	10W
 461 SERIES								
431 TO 461	SP3T TO SP6T	SMA	50	18.0 GHz	.2 TO .5	70	90W	30W

IN-LINE SERIES OF MULTITHROW SWITCHES



IN LINE MULTITHROW SERIES

443	SP4T	SMA	50	18.0 GHz	0.4	60	100W	10W
473	SP7T	SMA	50	18.0 GHz	0.7	60	100W	10W
483	SP8T	SMA	50	18.0 GHz	0.8	60	100W	10W
493	SP9T	SMA	50	18.0 GHz	1.0	60	100W	10W
4A3	SP10T	SMA	50	18.0 GHz	1.0	60	100W	10W
4C3	SP12T	SMA	50	18.0 GHz	1.0	60	100W	10W

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Hermetic Switches & Sensors

Tilt
Motion Sensing
Position Sensing
Specials/Assemblies

DURAKOOL INC.
An American Electronic Components Company

From Standards to Specials, Durakool Engineers a Dependable Switch to Fit Your Application.

When your application calls for a switch with long contact life and quiet, dependable performance, ask for Durakool. The industry leader in mercury technology and hermetic sealing for over 50 years, Durakool has established a reputation of quality and engineering expertise which gives added value to *your* product.

When you choose a Durakool switch, you can be confident that it has been manufactured using the most modern, cost-effective methods and equipment. Durakool also utilizes modern quality assurance procedures including Statistical Process Control (SPC).

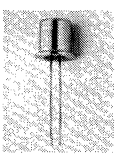
So, whether you need motion sensing, position sensing, or general power switching capabilities, Durakool sales engineers will work with you to provide the switch that best suits your application.

The products listed below are representative of hundreds of available designs.

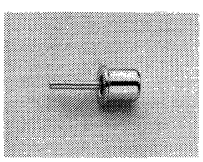
A 1/2 Series

Applications:
Small appliances (Electronic irons)
Auto vanity mirror light
Auto door handle control switch
Man-down alarms
Geophone Position Sensor

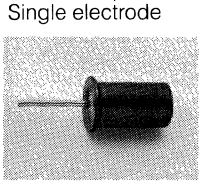
A 1/2 Short-4770
Tip-over/position
Dual electrode



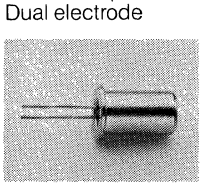
A 1/2 Short-4929
Tilt/motion/position
Single electrode



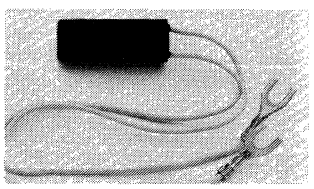
A 1/2 N-3677
Tilt/motion/position
Single electrode



A 1/2-4859
Tilt/motion/position
Dual electrode



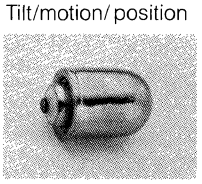
A 1/2-001
Tilt/motion/position
(Cased)



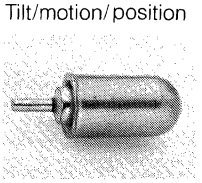
A1 Series

Applications:
Auto trunk light
Freezer lid light
Gas and water meter tamper sensor
RV automatic leveling device
Auto cruise control deceleration sensor
Outboard motor ignition safety shut-off

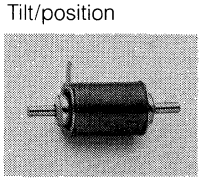
A1 Short-009
Tilt/motion/position



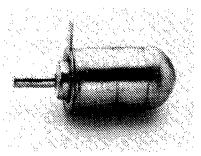
A1N-2622
Tilt/motion/position



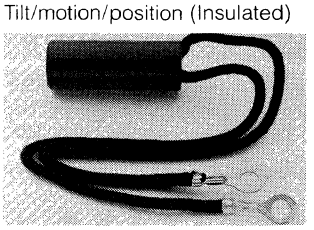
A1-SPDT-3619
Tilt/position



A1-3018
Anti-vibration/ tilt



A1-001
Tilt/motion/position (Insulated)



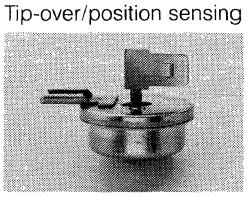
G-Series

Applications:
Tilt switches for general power switching

TO3 Series

Applications:
Space heater safety shut-off
Auto seat belt activation sensor
Spotlight on/off power control
Dangerous incline indicator for lawn equipment/RV
Gasoline pump impact safety shut-off

TO3-1016
Tip-over/position sensing

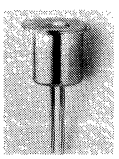


TO3-Specials
Tip-over/motion sensing

TO7 Series

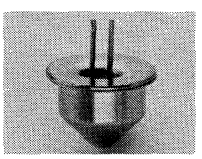
Applications:
Fence perimeter alarm sensor
Parking meter tamper sensor

TO7-4765
Jitter/vibration•Double electrode



TO8 Series

Applications:
Telephone privacy/mute switch
Auto seat belt activation sensor
Gas meter tamper sensor
Vending machine tamper sensor
VCR theft alarm

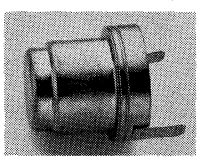


TO8-4539
Tip-over
Omni-directional

TO8-Specials · Motion sensors

Wide Angle Series

Wide hysteresis for liquid level switching



4236 Wide angle tilt

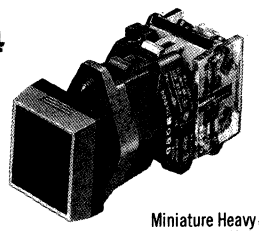
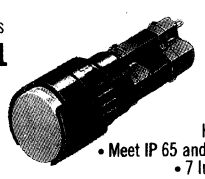
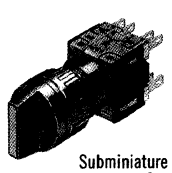
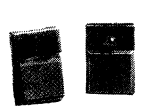
Specialty Switches and Custom Molded Assemblies

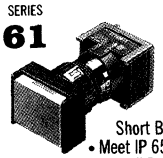
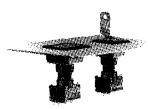
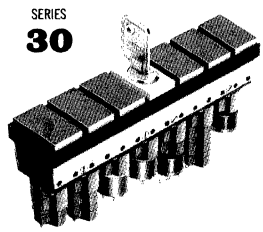
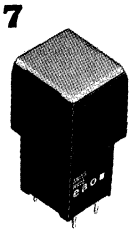
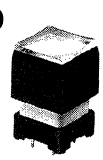
Applications:
Liquid level control for sump pumps
Military gyro systems
Liquid level control for gasoline and misc. fluids

For information on the full line of Durakool hermetic switches and sensors, or for engineering or selection assistance, contact Durakool today.

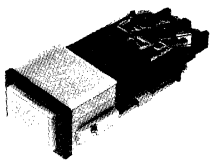
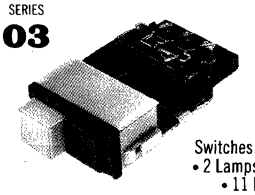
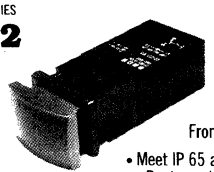
Durakool, Inc.
1010 North Main St. • P.O. Box 280
Elkhart, Indiana 46515
(219) 264-1116

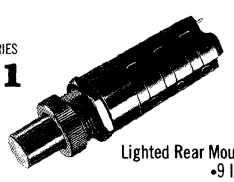
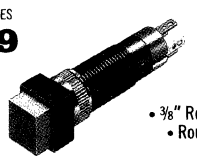
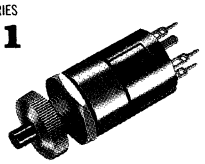
eao ■ THE WORLD'S FINEST SWITCHING

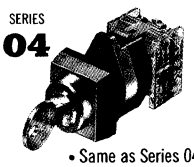
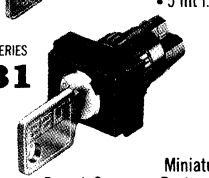
OIL/WATERTIGHT	ELEMENT TYPE/RATING
SERIES **04**  Miniature Heavy Duty • Meet IP 65 and NEMA 4 & 13 • 7/8" Round Mounting Hole • 12 Int'l. Approvals	Slow Make/Break Snap Action to 8 poles Rating: 600 V/10 A
SERIES **14**  Rugged, Short Back of Panel Depth • Meet IP and NEMA 4 & 13 • 7/8" Round Mounting Hole • 9 Int'l. Approvals	Snap action to 4 poles, form Z contacts 250 V/5 A per pole Low Level: 2 N.O., 2 N.C., 1 N.O., 1 N.C., make before break Rating: 50 V/0.1 A
SERIES **51**  Highly Stylized • Meet IP 65 and NEMA 4 & 13 • 7 Int'l. Approvals	Same as Series 14
SERIES **52**  Subminiature Lighted Rotary • Same as Series 51	Same as Series 14
SERIES **96**  Washable Sealed Switch • Meet IP 67 & Exceeds NEMA 4 & 13 • PCB Mountable	Snap Action SPDT, Low Level Rating: 50 V/100mA, 3 VA max.

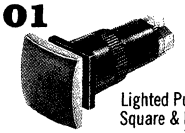
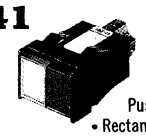
NEW MODULAR SYSTEM	ELEMENT TYPE/RATING
SERIES **61**  Short Back of Panel Depth • Meet IP 65 and NEMA 4 & 13 • 5/8" Round Mounting Hole • 4 Int'l. Approvals  With Flush Mount Panel Adapter	Snap Action 1, 2 & 3 poles 1 N.O., 1 N.C. or in combination Rating: 250 V/6 A
INTERLOCKS	
SERIES **30**  Mechanical Interlocks, 2-20 Stations • Many Interlock Systems Available • 6 Int'l. Approvals	Same as Series 14
PCB MOUNTABLE	
SERIES **97**  LED Miniatures	Low Level 1 N.O., 2 N.O., 1 N.C., 1 N.O., 1 N.C. non-shorting Rating: 50 V/100mA
SERIES **99**  Washable Keyboard Pushbutton, • Incandescent or LED **Series 96** • See Oil/Watertight	Same as Series 97 (above)

PRODUCTS DESIGNED WITH STYLE... eao

POWER SWITCHES	ELEMENT TYPE/RATING
SERIES **02**  Rugged Design for Power Applications • Rectangular Mounting Hole • 11 Int'l. Approvals	Snap Action SPDT 1 or 2 Switch Elements Rating: 380 V/10 A
SERIES **03**  Switches and Indicators • 2 Lamps, Large Screen • 11 Int'l. Approvals	Same as Series 02
SERIES **22**  Front of Panel Mount • Meet IP 65 and NEMA 4 & 13 • Rectangular Mounting Hole • 8 Int'l. Approvals	Snap Action 1 PST N.O., 2 PST 1 N.O. & 1 N.C. Many combinations Double air break Rating: 380 V/10 A

MINIATURES	
SERIES **11**  Lighted Rear Mount Pushbutton •9 Int'l. Approvals	Same as Series 14
SERIES **19**  Lighted Pushbutton • ⅜" Round Mounting Hole • Round or Square Bezel	Snap Action SPST 1 N.O. Rating: 50 V/2 A
SERIES **21**  Unlighted Rear Mount Pushbutton	Same as Series 14

KEYLOCKS	ELEMENT TYPE/RATING
SERIES **04**  Heavy Duty • Same as Series 04 Oil/Watertight • 2 & 3 Position	Same as Series 04 Oil/Watertight
SERIES **15**  Round Front • Mounts in ¾" Round Hole • 5 Int'l. Approvals	Same as Series 14
SERIES **31**  Miniature Keylock • Round, Square or Rectangular Bezel • Mounts in ⅝" Round Hole **KEYLOCKS ALSO AVAILABLE IN SERIES 02, 03, 22, 32, 51, 61, 99**	Same as Series 14

GENERAL PURPOSE	
SERIES **01**  Lighted Pushbutton, Round, Square & Rectangular Bezel • 12 Int'l. Approvals	Same as Series 14
SERIES **31**  Short Back of Panel Depth • Available With Buzzers, Flashers, Fuse Switch and Readouts	Same as Series 14
SERIES **41**  Two-Lamp Lighted Pushbutton & Indicator • Rectangular Mounting Hole • 10 Int'l. Approvals	Same as Series 14

You can feel the difference!

eao

EAO SWITCH CORPORATION

P.O. BOX 552, MILFORD, CT 06460-9979
TELEX: EAO MFRD 964347. FAX: (203) 877-3694
TELEPHONE: (203) 877-4577

electro-mech
LIGHTED PUSH-BUTTON SWITCHES

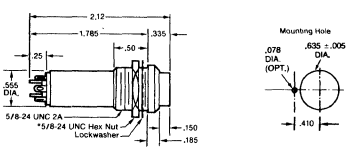
DISPLAY ASSEMBLIES/ INTERLOCK SWITCH ASSEMBLIES/INDICATORS

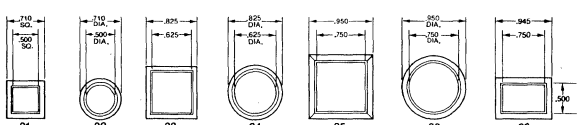
ELECTRO-MECH provides a perfect blend of quality standard products with in-depth experience in answering unique requirements. Proven engineering designs are illustrated by the excellent performance characteristics of each ELECTRO-MECH lighted push-button switch, indicator, and display assembly. Low-bounce, long-life contacts, new innovations in legends, displays, field-service, packaging– all standard features. Whatever your applications, ELECTRO-MECH is prepared to answer your specific needs. Choose from any of the most popular models.

Technical specifications apply to all ELECTRO-MECH Switch models unless otherwise specified:

- **Ratings: 30 Volts DC or 115 Volts AC; 2 amps resistive, 1 amp inductive**
- **Weight: 0.8 oz. (approx.)**
- **Operating Pressure: 2 lbs. + 1 lb.**
- **Plunger Travel: 3/16" (approx.)**
- **Actuations: 100,000**
- **Accommodates all "switchlines" standard lenses. Uses one T1-3/4, AN3140-327, 328, 330 bulb or neon lamp, 3 actuation modes standard**
- **Lenses: Available in ½" to 1" round and square, plus various rectangular sizes.**

MOUNTING SPECIFICATIONS

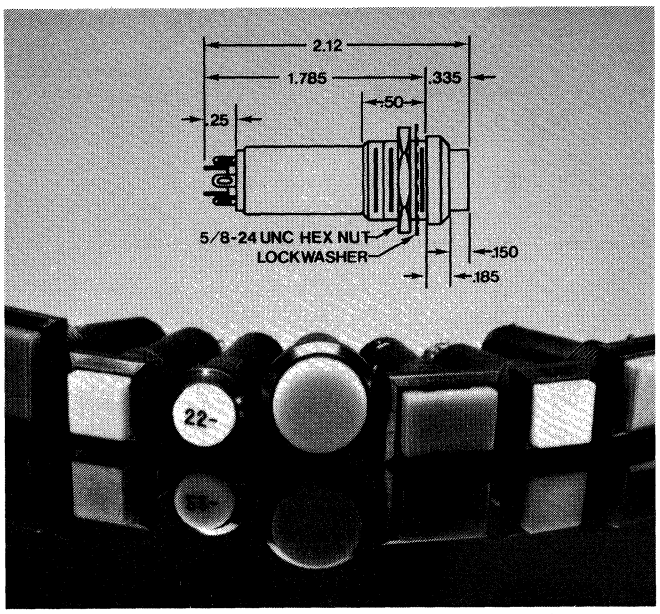




SWITCH FUNCTIONS	SPST N.O.	SPST N.C.	DPST N.O.	DPST N.C.	DPST 1 N.O., 1 N.C.	SPDT	DPDT
MOMENTARY	2*-128	2*-129	2*-130	2*-131	2*-132	2*-149	2*-150
PUSH-ON PUSH-OFF	2*-228	2*-229	2*-230	2*-231	2*-232	2*-249	2*-250
PUSH-ON REMAIN-IN PUSH-OFF	2*-828	2*-829	2*-830	2*-831	2*-832	2*-849	2*-850
N.O. POS	2-5		1-2, 4-5		1-2	1-2	1-2, 4-5
N.C. POS		2-5		2-3, 5-6	5-6	2-3	2-3, 5-6
COMMON POS			2, 5	2, 5		2	2, 5

*—Indicate style of switch (21- through 26, and 29)

SERIES 20
A NEW CONCEPT OF FAST EASY SWITCH INSTALLATION AND DISPLAY DESIGN VERSATILITY



FEATURES:

- **Momentary or alternate action**
- **Mounts in a ⅝" dia. round hole**
- **High density mounting ability—less than ¾" centers**
- **Low profile appearance in one unitized housing**

ELECTRO-MECH's Series 20 Switches are provided in display configurations.

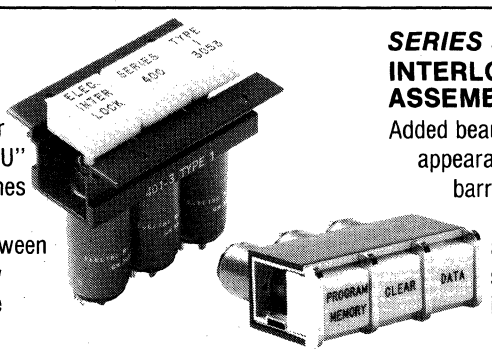
These low profile units are available in any switching mode with independent circuitry from SPST to DPDT including a separate indicator circuit. The all plastic, unitized housing assures ease in handling (no adapters, clamps or brackets). Just drop in round hole and secure with a nut from behind panel.

Series 20 Switches have the same internal parts as the all metal 6100 Series Switches including positive action, reliable circuitry and proven low bounce characteristics made possible by our unique design concept of silver slide bar action.

Available options include gold plating for dry circuit applications. Round slotted nuts for mounting switches on close centers.

SERIES 400
MULTI-STATION SUB-PANEL ASSEMBLIES

Multi-station switch assemblies designed for sub-panel mounting by means of a flanged "U" channel. All standard ELECTRO-MECH switches can be incorporated with several types of mechanical interlocking/lockout actions between stations. Up to 12 stations in one or two row configurations. The standard center distance between switches is ⅝", ¾", ⅞" and 1".



SERIES 500
INTERLOCKING SWITCH ASSEMBLIES

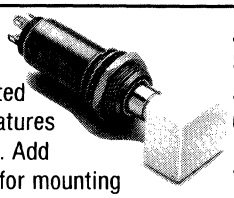
Added beauty and long-lasting appearance with handsome chrome barriers between each switch or indicator. Independent or interlocking action. Ten types of tracking action and switching sequences. Up to 12 switches in single or dual row, ⅞" or 1" centers.

ELECTRO-MECH COMPONENTS, INC. • 1826 N FLORADALE AVE. | • SO. EL MONTE, CA 91733 • (818) 442-7180/• FAX: (818) 350-8070 • TWX: 510-601-8764

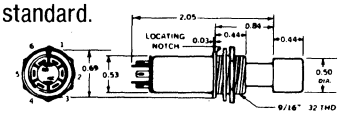
electro-mech
LIGHTED PUSH-BUTTON SWITCHES

COMMUNICATIONS/INDUSTRIAL CONTROLS/DISPLAYS
COMPUTER PERIPHERALS/INSTRUMENTATION

SERIES 2100

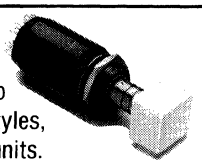


This version of our standard illuminated Pushbutton Switch features silver slide bar action. Add BR after part number for mounting on ⅝" centers. Utilizes AN3140-T 1¾"or Neon bulb. All other specifications same as standard.

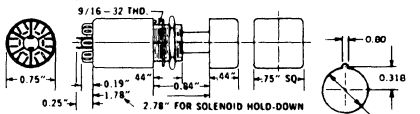


	1 PST		2 PST		1 N.O.		
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.C.	1 PDT	2 PDT
Momentary	2128	2129	2130	2131	2132	2149	2150
Push-on/ Push-off	2228	2229	2230	2231	2232	2249	2250

SERIES 2600



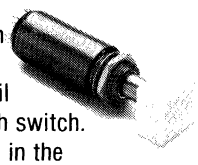
Standard models are available from 2PST to 6PDT in 116 different styles, including non-lighted units. Virtually any standard ELECTRO-MECH lens may be used with the 2600 Series.



ILLUMINATED

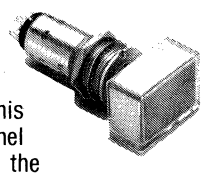
	Mom.	Push On Push Off	Push On Remain In Push Off	Snap Feel Mom.
2 PDT	2650	2750	2850	2550
3 PDT	2651	2751	2851	2551
4 PDT	2652	2752	2852	2552
5 PDT	2653	2753	2853	2553
6 PDT	2654	2754	2854	2554

SERIES 3000

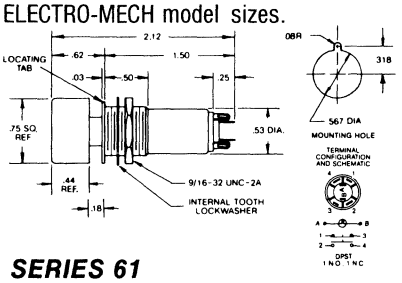


Illuminated Pushbutton switches with an integral hold-down coil which is activated with switch. Holds the push-button in the depressed position until coil is de-energized returning it to relaxed position. Available in all circuit configurations up to 6 PDT. Same specifications as standard model.

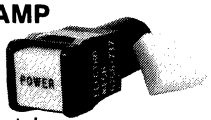
SERIES 6100



High-density packaging requirements are answered with this shorter, front panel mount, providing the same quality design as standard ELECTRO-MECH model sizes.

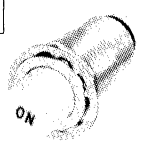


SERIES 4000 10 AMP



Low profile matches standard industry models. Momentary or Alternate Action design takes any standard lens size. 30 VDC or 115 VAC, 10 A Resistive, 5 A Inductive.

SERIES 5000



An exceptionally short momentary switch available in circuit configurations up to 2 PDT.

	1 PST		2 PST				
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.O. 1 N.C.	1 PDT	2 PDT
MOMENTARY	5128	5129	5130	5131	5132	5149	5150

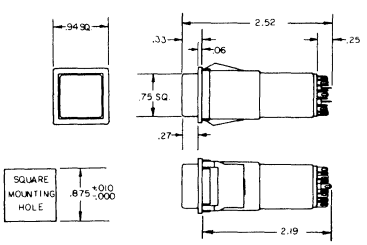
Designer Group Switches

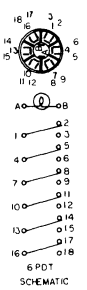
¾" sq., ¾" x 1½", ¾" x ⅞", ½" sq.

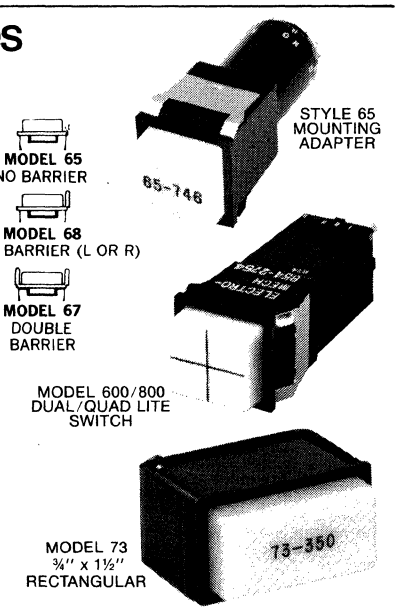
These ELECTRO-MECH Standards feature typical switch functions and mounting options for design flexibility. A choice of dual/quad display units are also available.

All Designer Group units feature:

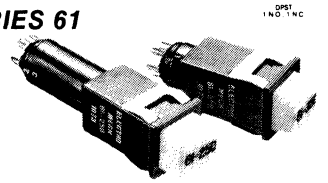
- **1PST TO 6PDT**
- **Momentary: Alternate action; push-on remain-in; push-on, push-off and momentary snap-feel.**







SERIES 61



ELECTRO-MECH's Series 61 switches are provided in ½-inch square, snap-in or hardmount configurations. Each low-profile unit is available in any function from SPST to 2PDT, each controlled with an independent circuit. The all plastic, unitized housing, helps insulate switch from other surrounding components. The 61 Series is also available in a standard PC Board mounting configuration.

SERIES 60
MOMENTARY SWITCH

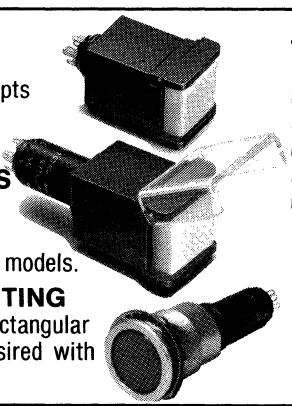
Rear mounted "U" bracket accepts switch installation from front of panel.

LG SERIES SAFETY LENS

Available on all 67-single-station, double-barrier lighted push-button bezel switch models.

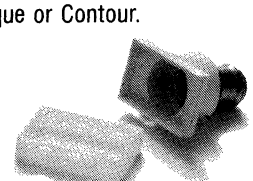
EL SERIES FLUSH MOUNTING

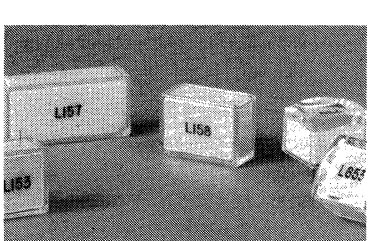
Available in round, square or rectangular styles. Specify switch model desired with "EL" suffix (i.e. 73 EL-2654).



SERIES 150
INTERCHANGABLE LENSES/FILTERS

Displays may be changed or buttons replaced. Non-wearing, clear-acrylic lens and filter buttons. Available in standard, Opaque or Contour.

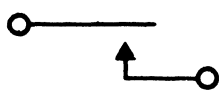




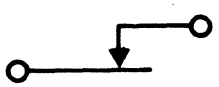
ELECTRO-MECH COMPONENTS, INC. • 1826 N FLORADALE AVE. • SO. EL MONTE, CA 91733 • (818) 442-7180 • FAX: (818) 350-8070 • TWX: 510-601-8764

MINIGLOSSARY
RELAY CONTACT FORMS

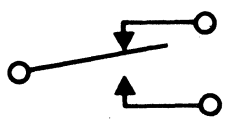
A
Make
SPST-NO



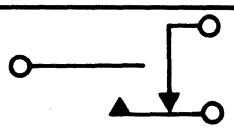
B
Break
SPST-NC



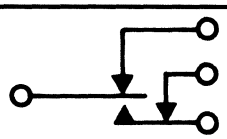
C
Break, Make
(Transfer)
SPDT



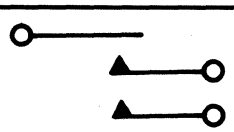
D
Make, Break
(Continuity
Transfer)



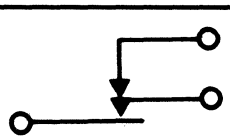
E
Break,
Make,
Break



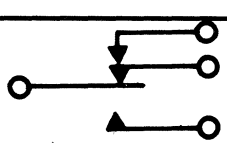
F
Make,
Make



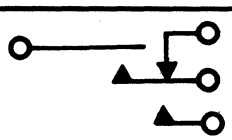
G
Break,
Make



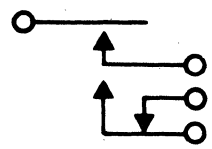
H
Break,
Break,
Make



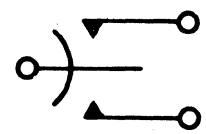
I
Make,
Break,
Make



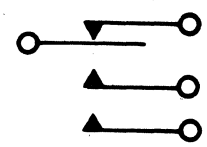
J
Make,
Make,
Break



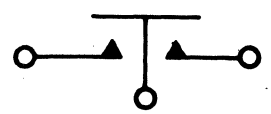
K
Center off
SPDT



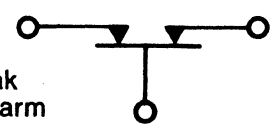
L
Break,
Make,
Make



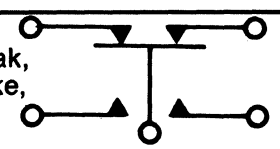
U
Double
make
Contact
on arm



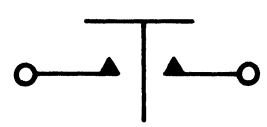
V
Double break
Contact on arm



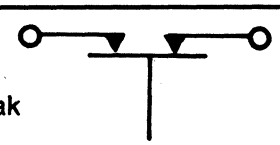
W
Double break,
Double make,
Contact
on arm



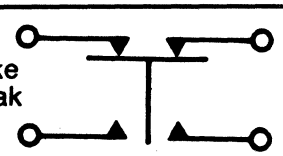
X
Double
make



Y
Double break



Z
Double make
Double break
SPDT-DB



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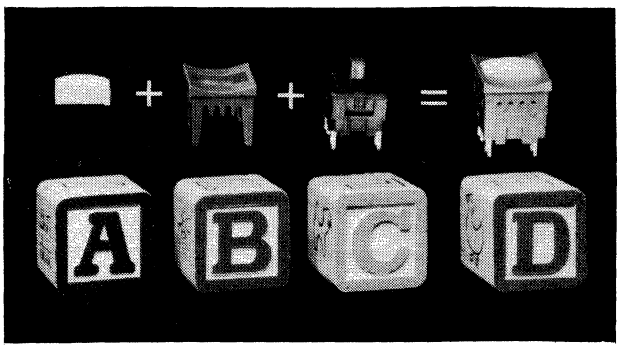
26 North Fifth Street, Minneapolis, MN 55403
612-375-9639 FAX 612-375-1905 800-677-8719

MOD/EX 420 Series Switches



For Distinctive Front Panel Layout
- Compact Size - ideal for keypad layout
- Features progressive building block approach
- Alternate or momentary action
- Gold or silver contacts
- Wide range of button or cover choices
- Single or multiple, round or square LEDs available
- Eight color choices
- Custom printing available

Mechanical Data

Key Travel	2.5 ± 0.3 mm
Key Pressure	200 ± 50 grams
Operating Life	
Momentary	1,500,000 cycles
Alternate	500,000 cycles
Temperature Range	
Working Temperature	-25° C to +75° C
Storage Temperature	-65° C to +85° C
Environmental Endurance	
Damp heat, steady state	56 days, 40° C, 93 RH
Soldering	255° C 5 sec. Max.
	235° C 2 sec. Min.

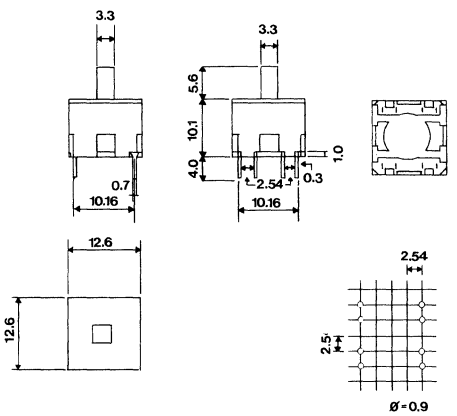
Electrical Data

Initial Contact Resistance	50 mΩ
Load (@ 1 Cyc./sec.)	
Current max.	250 mA*
Voltage max.	120 V*
Effective max.	9 Watts AC
Effective max.	5 Watts DC
Current carrying cap. non-switching	0.5 A
*Total not to exceed max. power load	
Dielectric Spec	
Contact to adj. contact	1000 V for 2 minutes
Insulation Resistance	
Bewteen adj. contacts	5 x 10^8 Ω
Capacitance	
Between adj. contacts	< 0.5 pF
Contact Bounce	< 5 m sec.

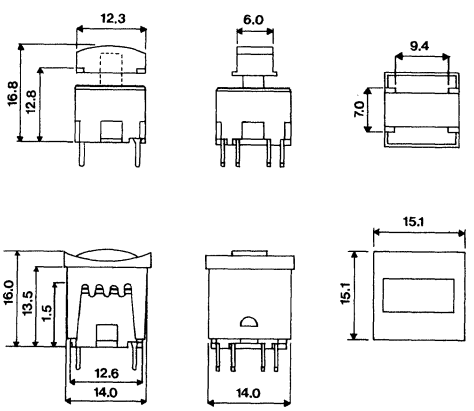
Materials Data

Housing & Key	Nylon/glass reinforced
Contacts	
Fixed	Phosphor Bronze
	Silver or gold available in contact area
Moving	Stainless Steel
	Silver or gold available in contact area
Spring	Stainless Steel
Latch Pin	Stainless Steel or Phosphor Bronze
Contact Lubricant	Silicon Grease
Module Buttons & Covers	ABS

Switch



Button & Cover



Dimensions in Millimeters

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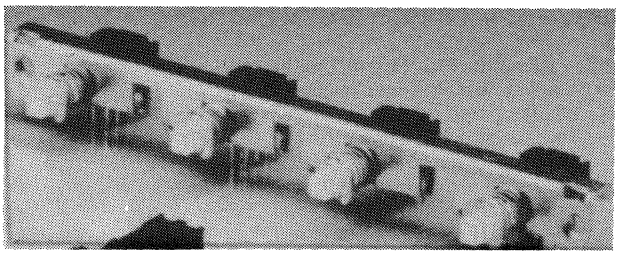
MTK Series Switches

Miniature Switches - use ganged or individually

Ultra light feel - Short Stroke

Available features include:

- Wiping "knife contacts" for smooth, silent actuation
- Up to six poles per module
- Mounting chassis
- Optional terminal length
- Snap-on buttons
- Interlocked assemblies



Mechanical Data

Functions Available	Momentary, Alternate Action Interlocked
Contact Configuration	2 pole, 4 pole, 6 pole
Switch Timing	Black body - non-shorting (BBM) Standard Gray body - shorting (MBB) Optional
Available Spacing	10, 12.5, 15, 17.5, and 20 mm center to center
Contacts	Moving - wiping "knife-type", Fixed - PC pins bottom only
Mounting	Individual or chassis mounting
Overall Travel	2.5mm
Travel to Lock	1.5mm
Maximum Soldering Time and Temperature	260 ± 5 C ±1 sec.
Operating Temp. Range	-10°C to +60°C

Electrical Data

Switching Voltage Max.	30V DC
Switching Current Max.	100mA
Withstand Voltage	500 V AC (50-60 Hz)
Operating Life	≥1 x 10^5 cycles
Contact Resistance	20 mΩ max @ 1 Khz - initial 40 mΩ - after life - no load 100 mΩ - after life - under load
Insulation Resistance	100 MΩ @ 500 V DC

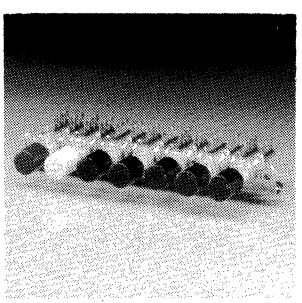
Material Data

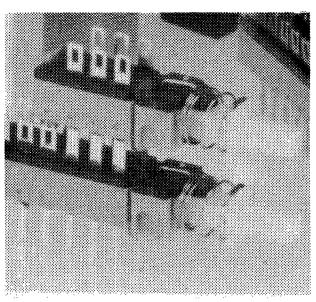
Housing	PPHOX9 (NORYL) UL94HB
Plunger	Duracon UL94HB
Terminal Board	Laminate UL94HB
Moving Contacts	Phosphor bronze, 1 micron silver
Fixed Contacts	Brass - .5 micron silver
Alternate Action Pin	Stainless steel
Alternate Action Staple	Phosphor bronze
Plunger Return Spring	Baked zinc plated steel

TA Series Pushbutton Switches

Modular Construction

- Solder lugs on top for hand wiring
- PC at bottom for flo-soldering
- Ease of maintenance...switch plunger with sliding contacts is removable from the front without disturbing electrical connections
- Enclosed housing protects inner contact area from dust and foreign intrusions
- Fixed terminals are "staked" in position providing an extra seal to prevent wicking of solder or flux





Mechanical Data

Housing	Polycarbonate (UL 94HB)
Plunger	Duracon (UL 94HB)
Moving Contacts	Bimetal Brass/AgNi
Sliding Contacts	0.01 mm, Ag 90%, Ni 10%
Fixed Contacts	Brass 0.005 mm with silver plating
Moving Contact Return Spring	Stainless steel spring
Plunger Return Spring	Baked & Zinc plated steel
Alternate Action Staple	Highly resisted steel wire, chrome plated
Terminal Die Bond	High strength bonding red resin
Release Bar	Steel/Zinc plated
Chassis	Steel/Nickel plated or Steel/Zinc plated
Release Bar Spring	Stainless Steel
Specials	Valox (UL 94VO), gold plating, available on request

Electrical Data

Contact Resistance	Initial - 5 mΩ max; after 25,000 cycles, 20 mΩ max.
Current/Voltage Ratings	0.5A @ 100V AC, 0.2A @ 250V AC, 1A @ 25V DC
Dielectric Strength	Contact Gap - 1500 V RMS Min. (1 min.)
Insulation Resistance	Adjacent contacts - 2 x 10 ohms min. (Dry condition). 3 x 10 ohms min. (100% relative humidity after 96 hrs @ 70 F); Life Test - 100,000 cycles min.
Approval	UL File # E121922

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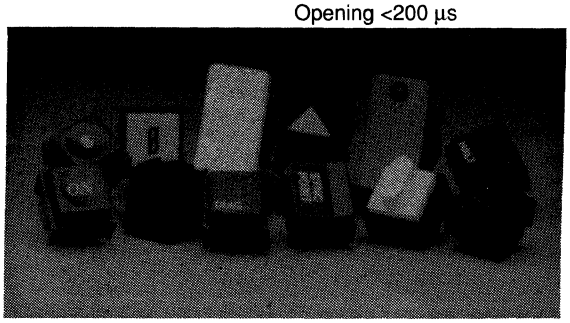
320 Series Push Button Switches

Our Most Dynamic Line

- Tactile feel pushbuttons...a distinctive difference
- Flexibility of layout...for single key or keyboard construction
- Choice of contact design for SPST, SPDT and SPST two output requirements
- .1" installation grid for standardization of layout

Mechanical Data

Travel	.7mm (.028")
Operating Force	120 grams
Snap Time	Closing <50 µs Opening <200 µs



Electrical Data

Type of Contact	Single pole single throw/ 1 input/1 or 2 outputs; Single pole double throw/ 1 input/1 output; Break before make (BBM)
Contact Rating	25 mA/50v (DC)
Initial Resistance	50 mΩ after 1 x 10^5 cycles at maximum
Switching Load	100 mΩ
Life @ maximum switching load	320 (E1-2) 10^5 switching cycles 320 (E1-1 & U1-1) 10^6 cycles
Climatic application class per DIN 40040	(HRF -25° to +75° C)

Materials Data

Housing	PC-GF
Knob	ABS or equivalent
Contacts (Fixed)	CuZn Ag
Switch Contact	CrNi Au

MiniTast Switches

Miniature Switches for Digital Electronics

Feather-Light Switching

- Reliability and long life
- Snap action contacts, tested to 10 million switching cycles at full load
- Self-cleaning contacts - maintenance free
- High quality basic materials, no functional fatigue
- Dust-proof by compact design
- Optional LEDs



	1100/1110 Series	1200 Series	1300 Series
Mechanical Data			
Contact	1 Form C (SPDT)	2 Form C (DPDT) 1 Form C (SPDT)	1 Form A (SPST)
Travel	1.5mm	2.5mm	1.5mm
Force	1.2Gr	1.5Gr	1Gr
Life	10 x 10^6 Opns @ full load	5 x 10^5	10 x 10^6 Opns @ full load
Temperature range	-25°C	-25°C	-25°C
To DIN 40040	+85°C	+75°	+85°C
Mechanical Function	Momentary	Momentary or alternate action	Momentary
Electrical Data			
Max Switching Voltage	60V	60V	60V
Max Switching Current	250mA	100mA	100mA
Max Switching Power	15W resistive load	6W resistive load	6W resistive load
Bounce Time	1ms	2ms	2ms
Contact Resistance	20 mΩ	50 mΩ	50 mΩ
Test Voltage	500 V AC	500 V AC	500 V AC
Materials Data			
Contacts	Silver 10 microns or Gold 3 microns	Silver 10 microns or Gold 3 microns	Silver 10 microns or Gold 3 microns
Body and Cap	Polycarbonate	Body - Polycarbonate black; Cap - Polycarbonate black or gray	Polycarbonate

Subsidiary of Stein Industries, Inc.
ELECTRONIC COMPONENTS GROUPE
26 North Fifth Street, Minneapolis, MN 55403
612-375-9639 FAX 612-375-1905 800-677-8719

SigmaTast 4500 Series Input Switches

High Quality Input switches for electronic devices

- With standoffs for PCB Mount
- Watertight body available
- Sealed terminals standard
- Gold contacts standard
- Micro-switch type coil spring over center contact system
- Short travel...2mm
- Tested to 5 million operations with momentary action
- Lower cost, 500,000 cycles, 5500 Series available



Mechanical Data

Housing/Cap Material	PC-ABS
Operating Stroke	2mm (.079")
Overtravel	1mm (.039")
Function	Momentary/Alternate Action
Contact Bounce	≤ 2ms
Mounting	PCB for flo-solder
Material	Polycarbonate
Contacts	Cu Sn gal./Ag/Au
Duration of Life	5 x 10^6 momentary, 5 x 10^5 alternate action
Operating Force	<200 grams
Classification of Applications	HSF DIN 40040/IP 67 DIN 40050
Solder Specification	265° C (509 F) for 5 sec.

Electrical Data

Voltage Rating	24V
Test Voltage Cont-Cont	150V
Current Rating	12mA
Continuous Current	120mA
Power Rating	240mW
Insulation Resistance	>10°Ω
Contact Resistance	≤20mΩ
Capacitance Cont-Cont	≤1pF
Contact Configuration	SPDT

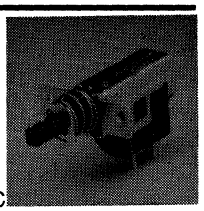
TL Series Tact Switches



Featuring TL1105 Switches

Contact Type	Mechanical
Circuit	SPST
Switching Volt Max	12V DC
Switching Current Max	50mA
Operating Force	120 ±30 grams
Overall Travel	0.25 ±0.1mm
Initial Contact Resistance	≤5mΩ
Contact Bounce	≤5m sec.
Operating Life	≥1 x 10^5 cycles
Operating Temp. Range	-20°C to 70°C

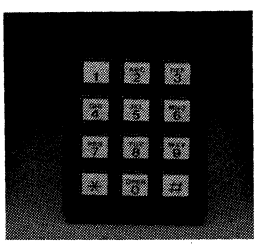
PS Series Power Switches



Featuring Model SSBS

Circuit	SPST
Rating	15A 125V AC 10A 125V AC
Insulation Resistance	≥100mΩ
Contact Resistance	≤20mΩ
Dielectric Strength	1000V AC 1 min.
Overall Travel	3.5mm
Travel to Lock	2.5mm
Approvals	UL, CSA

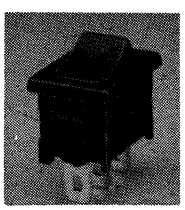
JP Series Keyboards/Keypads

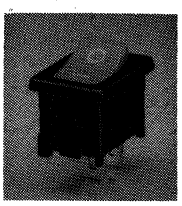


Featuring JP7202L

Contact	Conductive Rubber
Rating	DC 25V 5mA
Contact Resistance	500 Max
Bounce	≤10ms
Operating Force	75g +/-30g
Stroke	1.4 +/-0.3mm
Operating Life	≥1 x 10^6 cycles
Body Color	Black
Key Color	White
Ink Color	Black

RS Series Rocker Switches





Including RS 1066 Products

Circuit	RS 1066A SPST On-Off RS 1066C SPDT On-On RS 1066D SPDT On-Off-On RS 1066E SPST On-(Off) RS 1066F SPST (On)-Off RS 1066G SPDT On-(On) RS 1066H SPDT On-Off-(On) RS 1066I SPDT (On)-Off-(On)
Rating	AC 10A 125V, 6A 250V
Insulation Resistance	DC 500V, 100MΩ Min.
Contact Resistance	50mΩ Max.
Dielectric Strength	AC 1500V 1 min.
Approvals	UL, CSA, VDE Call for specific model approvals
Note	All versions available in all black or black with "on-off" symbols as shown

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ELECTRONIC COMPONENTS GROUPE
26 North Fifth Street, Minneapolis, MN 55403
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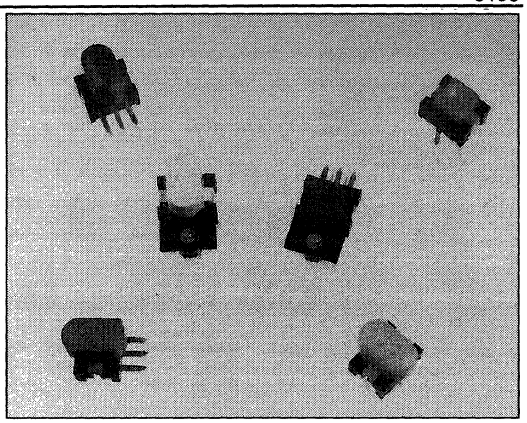
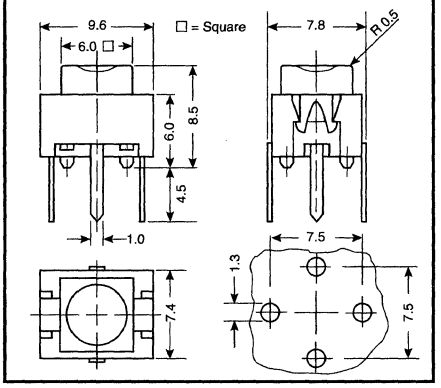
MP Subminiature Pushbutton Switches

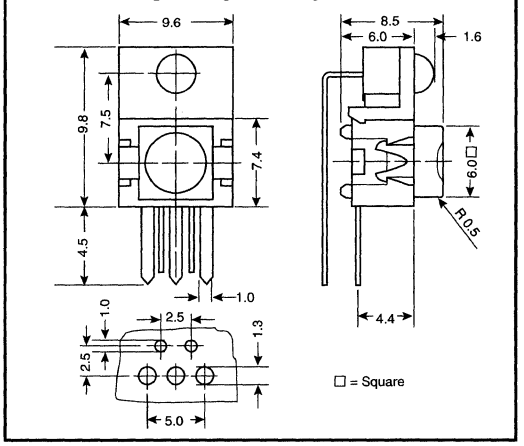


- Single pole pushbutton switch
- With or without LED
- Standard mount and right angled versions
- Self-stacking version available
- Ideal for data entry into logic circuitry
- Momentary action

Standard Body – No LED – Square Knob



Right-Angled Body + LED

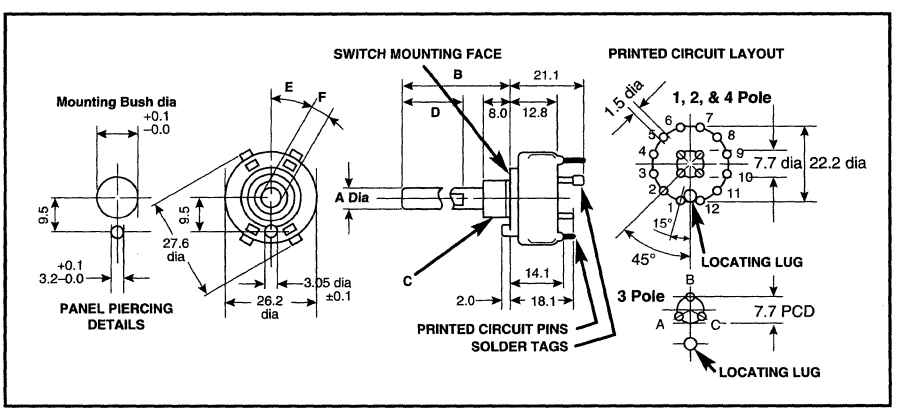


Electrical & Mechanical Specifications

Contact Rating 24V 4mA
Contact Resistance .....600 Ohms (max.)
Operating Force .....1.5N (max.)
Switch Travel 1.2mm
Operating Temperature.....–25°C to +70°C
Life (minimum) .....1,000,000 operations

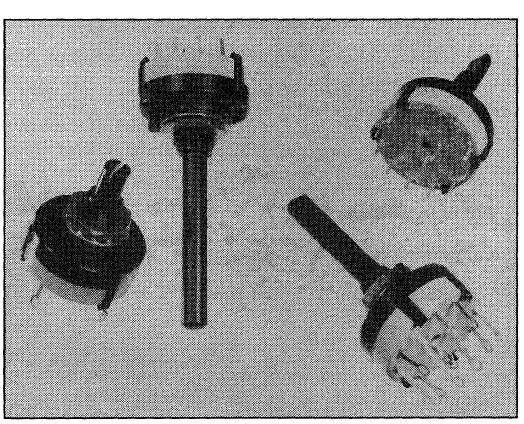
CK Rotary Switches

- Molded 27.5mm diameter single wafer switch
- Standard Indexing 30°
- Solder or printed circuit terminals
- Shorting (with 30° indexing) or non-shorting contacts
- Adjustable stop to restrict number of positions
- Special options include:
  60° or 90° indexing, continuous rotation; fixed stop, UL VO rated material, gold flashed or gold plated (2.5 microns gold over 2 microns nickel) contacts, spindles with flats, slots or knurls.



Electrical & Mechanical Specifications

Maximum working voltage .....300V AC/DC resistive load
Proof voltage.....1,000V RMS min.
Current carrying capacity .....5A (Non-switching)
Contact rating.....150mA 250V AC/DC
Insulation resistance .....25,000 Megohms min.
Operating temperature.....–30°C to +85°C
Life .....>10,000 cycles
Operating torque (nominal) .....Standard 5.6 Ncm
Light action 2.1 Ncm
End stop torque (minimum).....1.13 Nm
Molding material.....Glass filled nylon
Contact/terminal material .....Silver plated brass



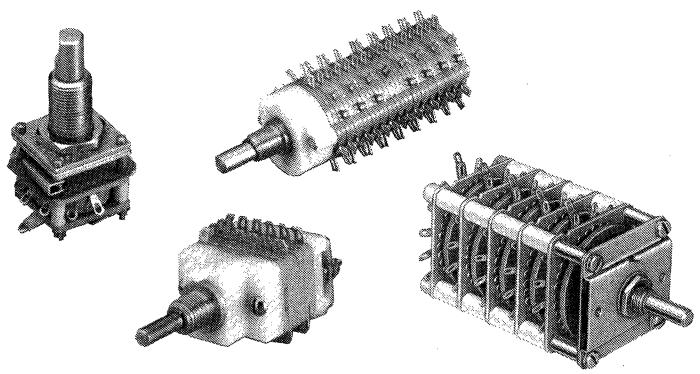
ELECTROSWITCH
UNIT OF ELECTRO SWITCH CORP.

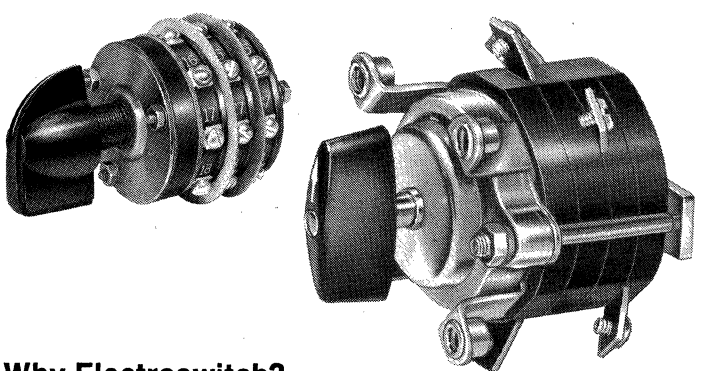
The W-I-D-E-S-T Selection of Electronic and Power ROTARY SWITCHES

• Commercial • Enhanced Commercial • Military • Electrical Utility APPLICATIONS

Switch Ratings Range from under 1 amp to 200 amps

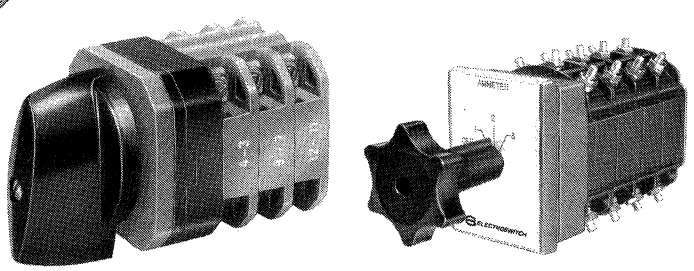
Whatever your needs...
Chances are there is a standard or custom Electroswitch product to meet your applications: from miniature electronic instrument and control switches ... to special mounts for PC boards ... to power detent-action types ... to snap-action units especially suited to DC applications ... to specialized control devices for the utility industry.





Options include:
tandem switches ... spring-return ... key-lock ... push-to-turn ... dual concentric shafts ... quick-connect terminals ... encoded contacts ... waterproof mountings ... and many, many more! **Plus Custom Designed switches** for unique needs.

Why Electroswitch?
We're now in our *fifth decade* of designing and manufacturing multipole rotary switches for demanding applications. This proven record of consistency and reliability should be a major factor in your selection of a rotary switch supplier.



Contact your nearest technical representative or the factory for detailed information and assistance in design and selection for your specific needs.

ELECTROSWITCH
UNIT OF ELECTRO SWITCH CORP.
180 King Avenue • Weymouth, MA 02188
(617) 335-5200 • Fax: (617) 335-4253

ELMA

ELMA Electronic Inc.

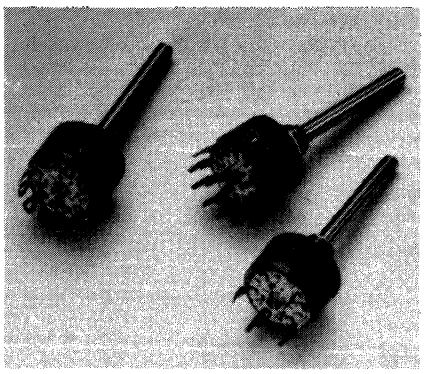
25 JAHRE ANNEE YEARS ELMA Electronic

THE HIGHEST QUALITY SWITCHES AVAILABLE FOR MEDIUM TO LOW POWER APPLICATIONS

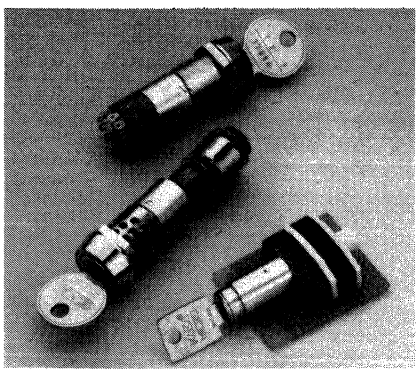
A Member Of The Sulzer Group, 41440 Christy Street, Fremont, CA 94538 • (415) 656-3400

All ELMA products are available off-the-shelf and REASONABLY PRICED

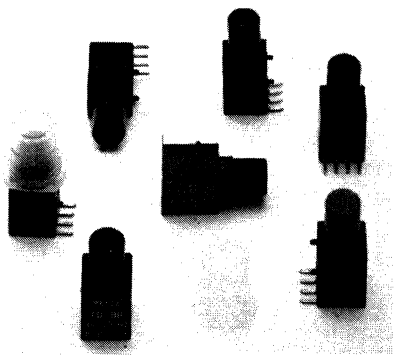
ELMA—Experience and precision for every High Quality switch application



TYPE 01



TYPE 01 AND 06 KEYLOCK



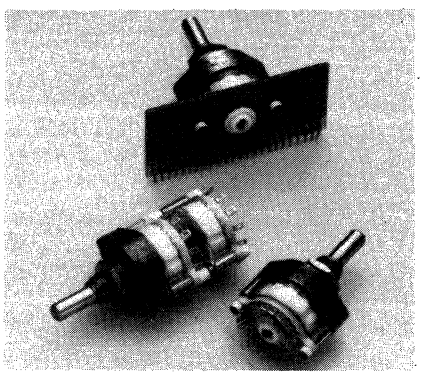
TYPE 09 PUSHBUTTON

If you are having reliability problems with your present switch, then **ELMA** has a solution for you. Our complete line of rotary, BCD, push-button, keylock, and toggle switches are among some of the best engineered switches on the market today.

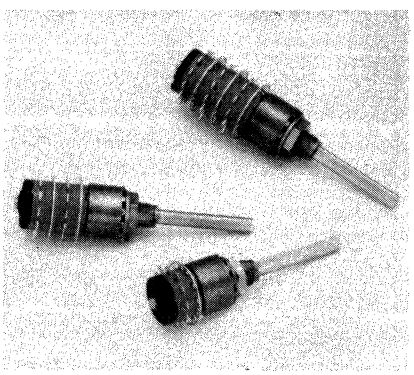
Panel and PCB Mount Rotary Switches —type 01, 04, 06, 08
These switches feature high purity hard gold plated contacts up to 200 µ in. thick for long life and high corrosion resistance. With this configuration contact resistance is guaranteed to be less than 10 m Ohm after 25 thousand complete switching cycles. All shafts are made of precision ground stainless steel for corrosion resistance and impeccable appearance. Standard switches are available with up to 25 positions and 78 poles in both shorting and non shorting versions.

Push-Button, Toggle, and BCD Switches —type 07, 09
These switches are impervious to hostile environments and can be safely cleaned with most organic solvents including chlorinated or fluorinated hydrocarbons. The coded switches are available with up to 16 positions. The push button switches can be optionally back lit with LEDs.

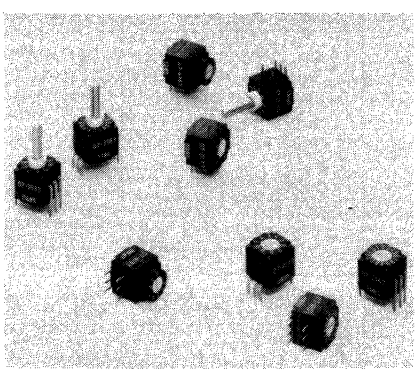
High Security Keylock Switches —type 01, 06, 08
Our keylock switches use our rotary switches combined with ultra precision Swiss made lock mechanisms. The lock mechanisms feature five high precision tumblers for long life and extreme security. Various keys can be made for the same lock to achieve access hierarchy for added flexibility.



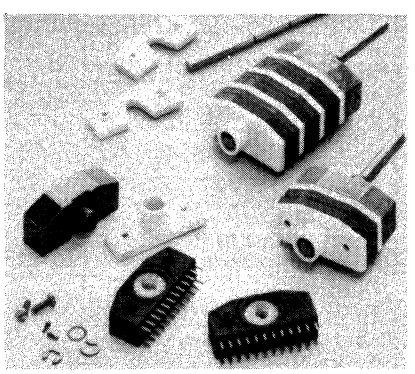
TYPE 04



TYPE 06

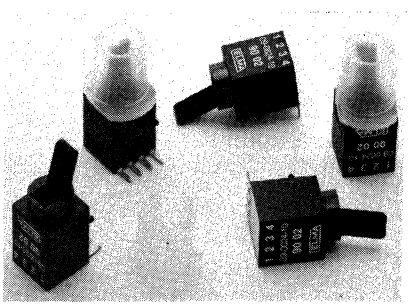


TYPE 07 ROTARY BCD



TYPE 08

ELMA also offers a complete line of high quality collet knobs to complement all our switches. Please call or write today for a free engineering catalog on our complete line of switches.



TYPE 09 TOGGLE

See Section 1400 (Cabinets, Enclosures, Racks & Chassis), section 2400 (Panel Hardware, Bezels, Dials, Knobs, etc.), section 2150 (Keyboards & Keypads) for additional ELMA products!

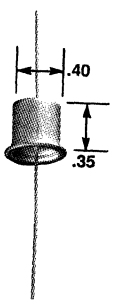
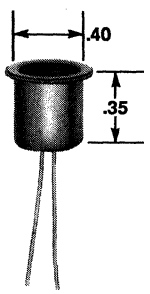
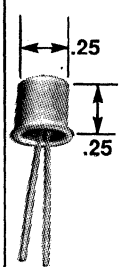
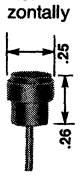
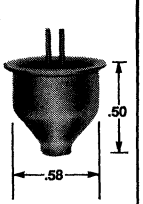
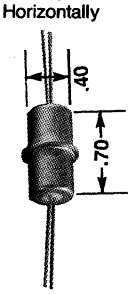
FIFTH DIMENSION INC.

Miniature Mercury Tilt Switches

- **Versatile** — Available to sense, tilt, vibration or impulses for commercial, industrial or military applications
- **Reliable** — Hermetically sealed, oxygen-free atmosphere provides typical life of 250,000 operations and more
- **Rugged** — Welded metal cases
- **Wide choice** — Omnidirectional or planar
- **Precise** — Operate to tight tolerances

Notes:

1. Response speed depends on the damping fluid used, and is related to jitter reduction. Rated on a scale of 0 to 5, with 5 being heavily damped (longest response time).
2. Switches with other dampening factors are available. Consult factory.
3. Jitter is tendency for switch to change state 3° from operational point. Ranked on a scale of 0 to 5, with 5 being very susceptible to vibrations.
4. Values shown are for switch viewed so that pins are side by side. For values with pins in line (one behind the other) ask for product data sheet.

	Omnidirectional (NO)			Omnidirectional (NC)		Miniature Omni-directional (NC)	Single Plane	Omni-directional (NC) Snap Action	Double Ended	
Dimensions							Mounts Hori-zontally 		Mounts Horizontally 	
Part Number	**TS7-0**	**TS7-0J**	**TS7-10**	**TS7B-0**	**TS7B-10**	**TS8**	**TS66**	**STS411**	**2TS7B-0**	**2TS7B-10**
Operating Angle (°) (to close from 0°)	16±8	18±8	6±5	25±12 (4)	25±12 (4)	7±5 (4)	+1.5±3	42±6 (4)	65±12 (4)	65±12 (4)
Operationg Angle (°) (to open from 0°)	12±8	12±8	4±5	35±12 (4)	35±12 (4)	13±10 (4)	−2±3	55±6 (4)	55±12 (4)	55±12 (4)
Uncontrolled angle (°) (total included)	0	20±20	0							
Switching Hysterysis (°)	4±4	6±4	2±3	10±6	10±6	6±5 (4)	3.5±2	13±5	10±6	10±6
Typical Repeatability (±°)	3	3	3	2	2	3	1	2	3	3
Load Current (resistive)										
@ 115 VAC (amps)	0.5	0.5	0.5	0.5	0.5	0.2	0.1	1.0	0.5	0.5
@ 12 VDC (amps)	1.0	0.5	1.0	1.0	1.0	0.5	0.2	2.0	1.0	1.0
Insulation Resistance @ 500 VDC (megohms)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Breakdown Voltage (VAC)	1000	1000	1000	750	750	600	1000	1000	750	750
Typical Contact Resistance @1 MA (ohms)	0.3	0.7	0.5	0.15	0.50	0.25	0.5	0.1	0.15	0.50
Maximum Operating Temperature (°C)	125	125	125	125	125	125	135	125	125	125
Minimum Operating Temperature (°C)	−35	−35	−20	−35	−20	−35	−35	−35	−35	−20
Speed of Response (relative) (1)	0	0	2	0	2	0	0	1	0	2
Contact Jitter (relative) (3)	4	5	2	3	2	3	4	0	3	2

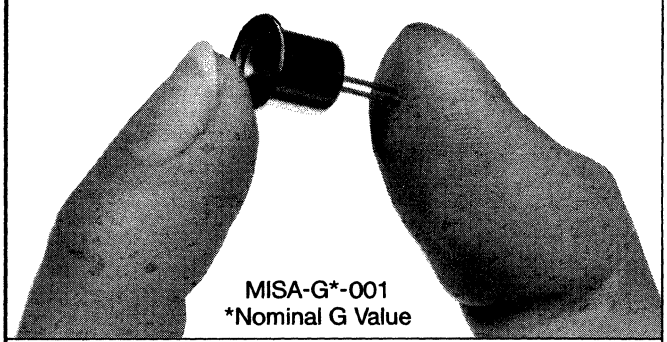
FIFTH DIMENSION INC.
801 New York Avenue, Trenton, NJ 08638-3982 • Tel: (609) 393-8350 • FAX (609) 599-9508

FIFTH DIMENSION INC.

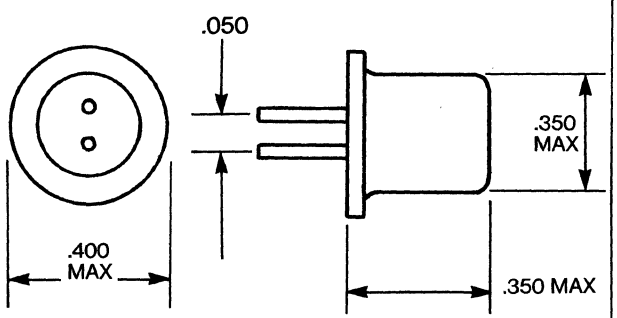
Mercury Impulse Switches

Patented under one or more of the following: 3,831,118, 3,976,960 and 4,683,355 (others pending)

Lo-G Impact Switches: 2 to 10 G



MISA-G*-001
*Nominal G Value

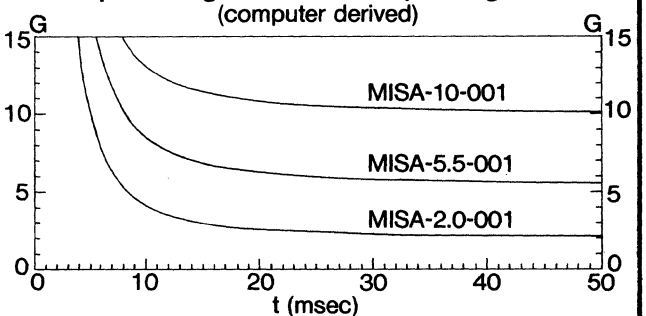


- High resistance to transverse loads
- Mountable in any position — responds to axial loads
- No contact bounce
- No mechanical springs — liquid-phase mercury design
- Hermetically-sealed welded metal case
- High repeatability

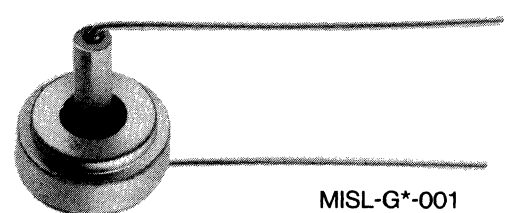
Specifications

Contact Type:
SPST, normally open, non-latching
Sensitivity: 2 to 10 G
(G is nominal centrifugal switching value)
Contact Resistance, max. (ohms): 10
Rated Load: 0.1 amp @ 10 VDC to 0.01 amp @ 200 VDC
Insulation Resistance @ 500 VDC: 1,000 megohms
Breakdown Voltage (VDC): 750
Operating Temperature Range (°C): −35 to +125
Storage Temperature Range (°C): −65 to +125

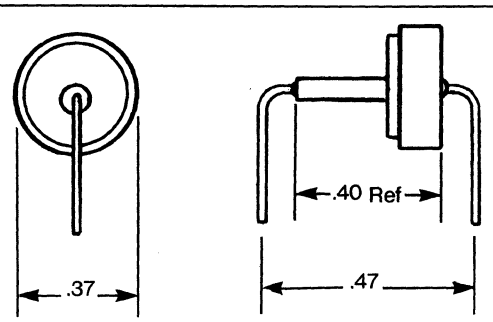
Impulse Magnitude—G vs. Operating Time
(computer derived)



Hi-G Impulse Switches: 200 to 2,000 G's



MISL-G*-001
*Nominal G Value



- Mercury wetted, bounce free
- Mountable in any position — responds to axial loads
- Hermetically-sealed welded steel case
- Used for ordnance fuzing applications
- Can be used for repetitive applications

Specifications

Contact Type: SPST, normally open, non-latching
Sensitivity (nominal): 200-2,000 G* (special designs to 20,000 G) (G is nominal centrifugal switching value)
Tolerance (standard): G max.: G min.=3:1
Operate Time (G level dependent):
0.1 milliseconds typical
Release Time (following G decay):
proportional to the integral of Gdt
Typical Contact Resistance (ohms): 0.15
Rated Load: 2.0 amp @ 5 VDC to 0.1 amp @ 200 VDC
Insulation Resistance @ 500 VDC: 1,000 megohms
Breakdown Voltage (VDC): 1,000
Operating Temperature Range (°C): −35 to +125
Storage Temperature Range (°C): −65 to +125

FIFTH DIMENSION INC.
801 New York Avenue, Trenton, NJ 08638-3982 • Tel: (609) 393-8350 • FAX (609) 599-9508

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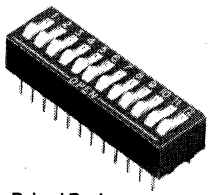
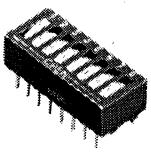
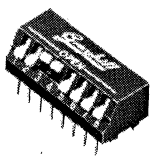
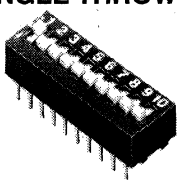
SPST DIP Switches

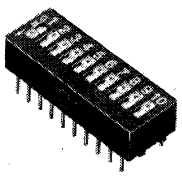
SINGLE POLE/SINGLE THROW DIP SWITCHES

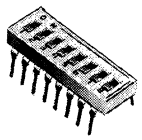

Raised Rocker

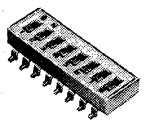

Recessed Rocker


PIANO-DIP®


Raised Slide


Recessed Slide


Machine Insertable


Surface Mount

- **High Pressure, Reliable Contact**
- **Sealed Bases as Standard**
- **Shock and Vibration Immunity**
- **Top Seal Option at Minimal Price**

ROCKER DIP SWITCHES—SERIES 76
Raised and Recessed Rockers and PIANO-DIP®

Rated to make and break 1 mA, 5 Vdc: or 50 mA, 30 Vdc: or 150 mA, 30 Vdc for 10,000 operations per position. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Width is .380"(9,65mm); height is .315"(8,0mm) for raised rocker style, .267"(6,27mm) for recessed style, .301"(7,65mm) for the PIANO-DIP® switch.

SLIDE DIP SWITCHES—SERIES 78
Raised and Recessed Slide Types

Rated to make and break 1 mA, 5 Vdc; or 50 mA, 30 Vdc; or 150 mA, 30 Vdc for 10,000 operations. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Width is .380"(9,65mm); height is .315"(8,0mm) for raised slides and .265" (6,73mm) for recessed slides.

MACHINE INSERTABLE, MIDIP® SWITCH–SERIES 90
Compatible with leading TO-116 IC insertion equipment. Rated to make and break 10 mA, 30 Vdc; or 10 mA, 50 mVdc for 2,000 operations per position. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Terminals are molded (sealed) into base.Top seal is polyimide film. Width is .290"(7,37mm) max.; height above board is .180"(4,57mm) max.

SURFACE MOUNTABLE SWITCHES–SERIES 90HBW
Compatible with surface mount assembly, including infrared reflow and vapor-phase soldering temperatures up to 260°C. Rated to make and break 100 mA, 6Vdc; or 10 mA, 50 mVdc for 2,000 operations per position. Contacts are copper alloy, gold plated 10 microinches minimum over nickel. Non-conductive parts are UL94V-0 rated plastic; top seal is polymide film. Width is .290"(7,37mm) max.; height above board is .190"(4,83mm) max. Outline conforms to S0GN-0004 per EIA Standard PDP-100.

MILITARY QUALIFIED DIP SWITCHES
Switch part numbers containing the letter M are qualified to MIL–S–883504 per the following slash sheets: 76MSB Type = /01; 76MRSB Type = /02; 78MB Type = /04; 76MPSB Type = /11. These switches may also be ordered by the appropriate "M" number cross reference. For additional qualified DIP switches with double throw circuitry, see next page; for qualified switches with gold terminals, contact Grayhill.

*TOP SEAL OPTION
To order top tape sealed, add suffix S to part number. Part numbers for the Surface Mountable switches and Military Qualified switches already have the suffix. See also paragraph above.

For pricess, contact your local Sales Office, an authorized Distributor, or GRAYHILL.

Available From Your Local GRAYHILL Distributor

Switch Type	No. of Stations	Switch Length	Part No.* Standard	Part No.* Military
Raised Rocker Type	2	0.28	76SB02	76MSB02S
	3	0.38	76SB03	76MSB03S
	4	0.48	76SB04	76MSB04S
	5	0.58	78SB05	78MSB05S
	6	0.68	76SB06	76MSB06S
	7	0.78	76SB07	76MSB07S
	8	0.88	76SB08	76MSB08S
	9	0.98	76SB09	76MSB09S
	10	1.08	76SB10	76MSB10S
	12	1.28	78SB12	78MSB12S
Recessed Rocker Type	2	0.28	76RSB02	76MRSB02S
	3	0.38	76RSB03	76MRSB03S
	4	0.48	76RSB04	76MRSB04S
	5	0.58	76RSB05	76MRSB05S
	6	0.68	76RSB06	76MRSB06S
	7	0.78	76RSB07	76MRSB07S
	8	0.88	78RSB08	78MRSB08S
	9	0.98	76RSB09	76MRSB09S
	10	1.08	76RSB10	76MRSB10S
	12	1.28	76RSB12	76MRSB12S
PIANO-DIP® Side Actuated Rocker Type	2	0.28	76PSB02	76MPSB02S
	3	0.38	76PSB03	76MPSB03S
	4	0.48	76PSB04	76MPSB04S
	5	0.58	78PSB05	78MPSB05S
	6	0.68	76PSB06	76MPSB06S
	7	0.78	76PSB07	76MPSB07S
	8	0.88	76PSB08	76MPSB08S
	9	0.96	76PSB09	76MPSB09S
	10	1.08	76PSB10	76MPSB10S
Raised Slide Type	2	0.28	78B02	78MB02S
	3	0.38	78B03	78MB03S
	4	0.48	78B04	78MB04S
	5	0.58	78B05	78MB05S
	6	0.68	78B06	78MB06S
	7	0.78	78B07	78MB07S
	8	0.88	78B08	78MB08S
	9	0.98	78B09	78MB09S
	10	1.08	78B10	78MB10S
Recessed Slide Type	2	0.28	78RB02	N/A
	3	0.38	78RB03	N/A
	4	0.48	78RB04	N/A
	5	0.58	78RB05	N/A
	6	0.68	78RB06	N/A
	7	0.78	78RB07	N/A
	8	0.88	78RB08	N/A
	9	0.98	78RB09	N/A
	10	1.08	78RB10	N/A
Machine Insertable Slide Type MIDIP®	2	0.27	90B02	90MB02S
	3	0.37	90B03	90MB03S
	4	0.47	90B04	90MB04S
	5	0.57	90B05	90MB05S
	6	0.67	90B06	90MB06S
	7	0.77	90B07	90MB07S
	8	0.87	90B08	90MB08S
	9	0.97	90B09	90MB09S
	10	1.07	90B10	90MB10S
Surface Mountable Slide Type	2	0.27	90HBW02S	N/A
	3	0.37	90HBW03S	N/A
	4	0.47	90HBW04S	N/A
	5	0.57	90HBW05S	N/A
	6	0.67	90HBW06S	N/A
	7	0.77	90HBW07S	N/A
	8	0.87	90HBW08S	N/A
	9	0.97	90HBW09S	N/A
	10	1.07	90HBW10S	N/A

Special Circuit DIP Switches

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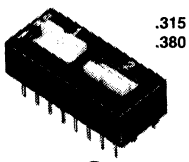
SERIES 78 SLIDE SWITCHES

- 2PST, 3PST, 4PST
- SPDT & DPDT – Separate Circuits



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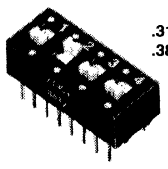

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2 POLE, 3 POLE, AND 4 POLE, SINGLE THROW SLIDE SWITCHES (FIG. A)

Rated for 10,000 operations to make and break the following loads: 1 mA, 5 Vdc; or 50 to 150 mA, 30 Vdc. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate.

Circuitry	No. of Positions	Length	Part Number
2PST	1	0.280	**78F01**
	2	0.480	**78F02**
	3	0.680	**78F03**
	4	0.880	**78F04**
	5	1.080	**78F05**
3PST	1	0.380	**78G01**
	2	0.680	**78G02**
	3	0.980	**78G03**
4PST	1	0.480	**78H0I**
	2	0.880	**78H02**

To order top sealed switches, add the suffix S to the part number in the chart.

SPDT AND DPDT SLIDE SWITCHES WITH SEPARATE CIRCUITS (FIG. B)

Rating and materials are the same as the switches in Figure A. In Single Pole/Double Throw switches, each slide operates two adjacent separate circuits, opening one of them, while closing the other. (In Double Pole/Double Throw switches, 1 slide switches 4 circuits at once, opening circuits 1 and 3, while closing 2 and 4, etc.). This circuitry, used in telephone switching systems, makes these switches form, fit, and function equivalents. For true SPDT (DPDT) circuitry, adjacent terminal pairs may be tied with a printed circuit. Dot on the cover indicates the closed position of individual terminal pairs.

Circuitry	No. of Positions	Length	Part Number
SPDT	1	0.280	**78J0I**
	2	0.480	**78J02**
	3	0.680	**78J03**
	4	0.880	**78J04**
	5	1.080	**78J05**
DPDT	1	0.480	**78K0I**
	2	0.880	**78K02**

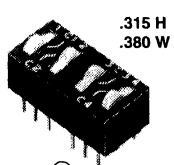
To order top sealed switches, add the suffix S to the part number in the chart.

For prices and discounts of all products on this page, contact your local Sales Office, an authorized Distributor or Grayhill.

Available From Your Local GRAYHILL Distributor.

SERIES 76 ROCKER AND TOGGLE SWITCHES

- SPDT & DPDT – With Commons
- 3 Actuation Choices
- Standard or Military Qualified



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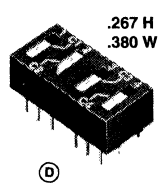

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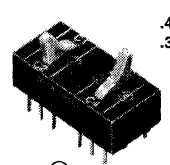

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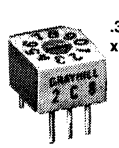
SPDT AND DPDT ROCKER AND TOGGLE SWITCHES WITH COMMON POLES (FIG. C, D, E)

Rated to make and break 50 mA 30 Vdc, and 125 mA 30 Vdc for 10,000 operations. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. SPDT (DPDT) circuits are 3 (6) terminal circuits for true SPDT (DPDT) switching and compact spacing. Common pole terminals are marked with a C, and first and second throws are marked as 1 and 2. Military versions are qualified to MIL-S-83504.

Circuitry And Type	Positions	Length	Part No. Raised	Part No. Recessed	Part No. Toggle
SPDT, Standard	2	0.380	**76SC02**	**76RSC02**	**76STC02**
	3	0.580	**76SC03**	**76RSC03**	**76STC03**
	4	0.780	**76SC04**	**76RSC04**	**76STC04**
SPDT, Military	2	0.380	**76MSC02**	**76MRSC02**	**76MSTC02**
	3	0.580	**76MSC03**	**76MRSC03**	**76MSTC03**
	4	0.780	**76MSC04**	**76MRSC04**	**76MSTC04**
DPDT, Standard	1	0.380	**76SD01**	**76RSD01**	**76STD01**
	2	0.780	**76SD02**	**76RSD02**	**76STD02**
DPDT, Military	1	0.380	**76MSD01**	**76MRSD01**	**76MSTD01**
	2	0.780	**76MSD02**	**76MRSD02**	**76MSTD02**

To order top sealed switch (not available on TOGGLE-DIP), add the suffix S to the Grayhill part number.



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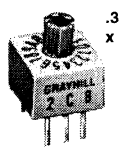

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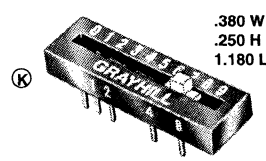

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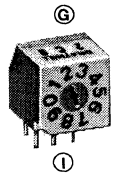

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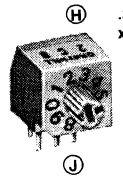

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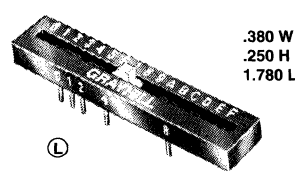

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BINARY AND HEXADECIMAL OUTPUT DIP SWITCHES

Series 74 sealed switches (FIG. G, H, I, J) are available in both BCD and Hexidecimal codes and their complements. Series 79 linear switches (FIG. K, L), in BDC and Hex, have true zero output. Series 74 switches are rated to make and break 10 mA 50 mVdc, or 125 mA, 30 Vdc for 2,000 cycles (10 positions) or 1000 cycles (16 positions); Series 79 are rated for 10 mA 50 Vdc, or 50 mA 30 Vdc, or 125 mA 6 Vdc for 2,000 cycles. A cycle is movement thru all positions and a return. See catalog for pin locations.

Circuitry and Actuator	No. Of Positions	Part No. Flush Actuator	Part No. Extended Actuator	Part No. Rt. Angle Flush	Part No. Rt. Angle Extended	Part No. Linear Action
BCD	10	**74AB10**	**74BB10**	**74AB10RA**	**74BB10RA**	**79B10**
BCD Comp	10	**74AC10**	**74BC10**	**74AC10RA**	**74BC10RA**	—
Hexadecimal	16	**74AB16**	**74BB16**	**74AB16RA**	**74BB16RA**	**79B16**
Hex Comp	16	**74AC16**	**74BC16**	**74AC16RA**	**74BC16RA**	—

For top tape seal on Series 79 switches, add the suffix "S" to the part number.

Grayhill INC. Pushbutton Switches

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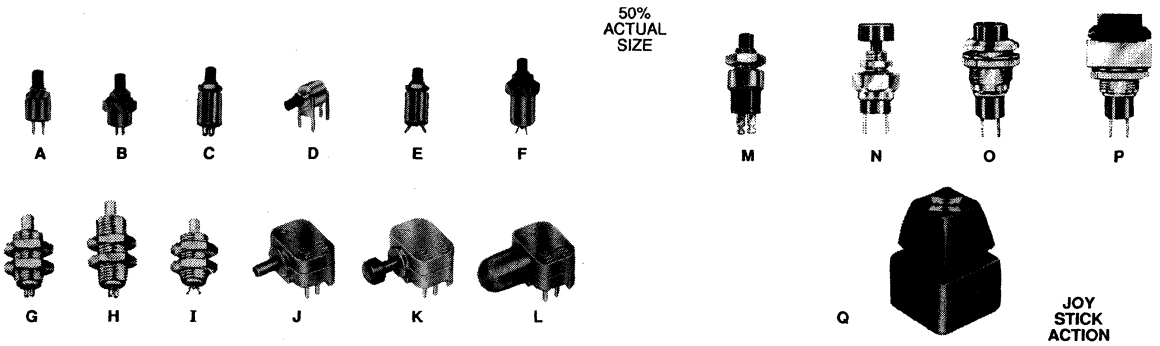
SMALL LOW CURRENT MOMENTARY SWITCHES WITH BUTT CONTACTS



SPST = Single Pole/Single Throw, Momentary
SPDT = Single Pole/Double Throw, Momentary
SP4T = Single Pole/4 Throw, Momentary
NO or NC = Normallly Open or Normally Closed

MINIATURE, BUTT CONTACT SWITCHES—FIG. A TO L

Gold contacts provide low level switching with maximum life in minimum space. PC, sealed, overtravel, right angle, and limit switch. SPST NO or NC, and SPDT types. Option: -EW

1 AMP BUTT CONTACT SWITCHES—FIG. M TO P

Small, long wearing switches with silver contacts. SPST NO in standard, UL recognized, sealed, and bezel types; SPST NC in standard and UL types. Option: -EW

4-WAY SWITCH, JOYSTICK LIKE ACTION—FIG. Q

Moves cursor on a display; arrows on cap. SP4T; center common.

OPTION -EW: BASE SEAL AND WIRE LEADS

Epoxy potting seals terminals; 6" copper wire leads are solder dipped.

ORDERING INFORMATION

Circuitry & Description	Fig.	Part No., Red or Natural Button	Part No. Black Button	Wires Suffix	Make & Break Current*	Life Operations	Behind Panel	Max. Width
NO	A	**39-1**	**39-3**	**-EW**	500 mA	1,000,000	0.315	0.253
NO, PC	A	**39-401 RED**	**39-401 BLK**	—	150 mA***	1,000,000	0.215	0.253
NO, Sealed	B	**39-351 RED**	**39-351 BLK**	**-EW**	500 mA	250,000	0.350	0.361
NO, Overtravel	C	**39-12**	**39-24**	**-EW**	500 mA	100,000	0.455	0.253
NO, PC, Right Angle	D	**39-501 RED**	**39-501 BLK**	—	150 mA***	1,000,000	0.300	0.253
NC	E	**39-2**	**39-6**	**-EW**	250 mA	250,000	0.490	0.253
NC, Sealed	F	**39-352 RED**	**39-352 BLK**	**-EW**	250 mA	100,000	0.529	0.361
NO, Limit	G	**39-101 (Natural)**	—	—	500 mA	500,000	0.650	0.505
NO, Overtravel, Sealed	H	**39-701 (Natural)**	—	**-EW**	150 mA**	100,000	0.800	0.505
NC, Limit, Sealed	I	**39-702 (Natural)**	—	**-EW**	250 mA	100,000	0.560	0.505
SPDT PC, Right Angle	J	**39-251 RED**	**39-251 BLK**	—	250 mA	500,000	0.400	0.500
SPDT PC, RA, Sealed	J,L	**39-250 RED**	**39-250 BLK**	—	250 mA	500,000	0.400	0.500
SPDT, PC, RA, Wide Button	K	**39-261 RED**	**39-261 BLK**	—	250 mA	500,000	0.400	0.500
SPDT PC, RA, Wide, Sealed	K,L	**39-260 RED**	**39-260 BLK**	—	250 mA	500,000	0.400	0.500
NO	M	**30-1**	**30-3**	**-EW**	1 Amp	1,000,000	0.592	0.375
NO, UL Recognized	M	**30-1UL**	**30-3UL**	—	5 Amps	6,000	0.592	0.375
NO, Sealed	N	**30-251 RED**	**30-251 BLK**	**-EW**	1 Amp	100,000	0.632	0.505
NO, Overtravel	M	**30-15**	**30-37**	—	1 Amp	500,000	0.677	0.375
NO, Round Bezel	O	**30-05-01-502-0303**	**30-05-01-502-0707**	—	1 Amp	1,000,000	0.930	0.640
NO, Square Bezel	P	**30-01-01-500-0303**	**30-01-01-500-0707**	—	1 Amp	1,000,000	1.110	0.640
NC	M	**30-2**	**30-6**	**-EW**	1 Amp	1,000,000	0.605	0.375
NC, UL Recognized	M	**30-2UL**	**30-6UL**	—	5 Amps	6,000	0.605	0.375
4-Way, SP4T	Q	—	**04A-K01**	—	250 mA	500,000	1.315	0.845

*At 115 Vac resistive except as noted. **at 5 Vdc. ***At 28 Vdc.

For prices and discounts, contact a local Sales Office, an authorized Distributor, or GRAYHILL
Available From Your Local GRAYHILL Distributor

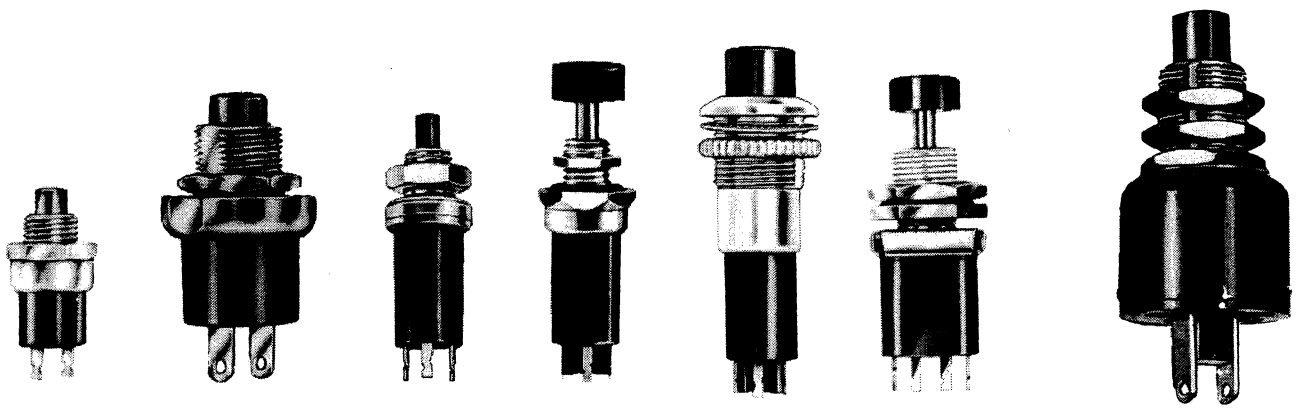
Grayhill INC. Pushbutton Switches

561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE: (708) 354-1040

LOW CURRENT WIPING CONTACT SWITCHES AND HIGH CURRENT SNAP ACTION SWITCH

ACTUAL SIZE

WIPING CONTACTS — SNAP ACTION



R S T U V W X

SPST = Single Pole/Single Throw, Momentary
SPDT = Single Pole/Double Throw, Momentary
SP4T = Double Pole/Double Throw, Non-shorting, Momentary
NO or NC = Normallly Open or Normally Closed

1/2 & 1 AMP WIPING CONTACT SWITCHES—FIG. R, S

Self cleaning contacts for use in critical contact resistance circuits. SPST NO or NC, standard, and UL recognized..

1/4 AMP WIPING CONTACT SWITCHES—FIG. T,U,V,W

Long wipe, double throw switches for low level switching. SPDT or DPDT, standard, sealed, or bezel types.

10 AMP SNAP ACTION SWITCHES—FIG. X

Rapid make and break for higher current switching; audible click. SPST NO or NC, and SPDT types.

ORDERING INFORMATION

Circuitry & Description	Fig.	Part No., Red or Natural Button	Part No. Black Button	Make & Break Current*	Life Operations	Behind Panel	Max. Width
NO	R	**23-1**	**23-4**	250 mA	100,000	0.663	0.468
NO	S	**4001**	**10–9**	1 Amp	100,000	0.965	0.800
NO, UL Recognized	S	**4001UL**	**10-9UL**	3 Amps	6,000	0.965	0.800
NC	S	**4002**	**10–10**	1 Amp	100,000	0.965	0.800
NC, UL Recognized	S	**4002UL**	**10-10UL**	3 Amps	6,000	0.965	0.800
SPDT	T	**46-101 RED**	**46-101 BLK**	250 mA	250,000	0.890	0.437
SPDT, Sealed	U	**46-150 RED**	**46-150 BLK**	250 mA	100,000	0.957	0.437
SPDT, Round Bezel	V	**46-05-05-502-0303**	**46-05-05-502-0707**	250 mA	250,000	1.179	0.640
DPDT	W	**46-200 RED**	**46-200 BLK**	250 mA	250,000	0.921	0.625
DPDT, Sealed	W	**46-270 RED**	**46-270 BLK**	250 mA	100,000	0.957	0.650
NO	X	**2201**	**7–7**	10 Amps	25,000	1.239	0.880
NC	X	**2202**	**7–8**	10 Amps	25,000	1.239	0.880
SPDT	X	**7-26 RED**	**7-26 BLK**	10 Amps	25,000	1.239	0.880

*At 115 Vac resistive.

For prices and discounts, contact a local Sales Office, an authorized Distributor, or GRAYHILL
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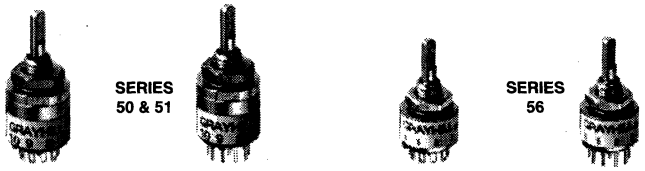
Rotary Switches

SINGLE DECK ROTARY SWITCHES

- 1/2 Inch Diameter, 200 mA Rating
- 1 to 2 Poles; 22.5°, 30°, & 36° Throws
- PC, Military, and Adjustable Styles

APPROXIMATELY 2/3 ACTUAL SIZE



SERIES 50 & 51

SERIES 56

A B C D

GENERAL INFORMATION

Rated to make and break 200 mA for 10,000 cycles (360° turn and return). Double flatted bushing is .250 inches long with a 1/4-28 UNF-2A thread. The .125 inch diameter shaft extends beyond bushing .375 inches, and flat is .250 inches long by .093 inches wide.Shaft flat is opposite point of contact for pole number 1 per circuit drawings below.

STANDARD AND MILITARY QUALIFIED SWITCHES

SERIES 50 AND 51 SWITCHES — FIGS. A AND B

SERIES 50 — 36° (10 position), 0.5 inch diameter. Length behind panel for solder lug is 0.617. Height above board for PC mount is 0.667. Circle of terminal centers is 0.320. Available in all style choices charted and explained at right. Adjustable stops have removable stop pins. Military styles are qualified to MIL-S-3786/20.

SERIES 51 — 30° (12 position) and 22.5° (16 position), 0.562 inch diameter. Circle of terminal centers is 0.382 in 30° and 0.500 in 22.5°. All other dimensions and rating same as Series 50. Available in all style choices charted and explained at right. Military styles are qualified to MIL-S-3786/35.

ECONOMICAL, SPACE SAVING ROTARY SWITCHES

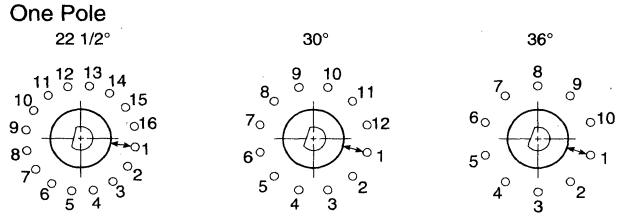
SERIES 56 — FIGURES C AND D

SERIES 56 — Economical version of Series 50 and 51. 36° (10 position) and 30° (12 position), 0.5 inch diameter. Length behind panel for solder lug is 0.480. Height above board for PC mount is 0.377. Circle of terminal centers are 0.340 (36°) and 0.366 (30°). Rated same as Series 50. Available in all style choices charted and explained at right. Also availabLe with screwdriver slotted shaft. Contact GRAYHILL.

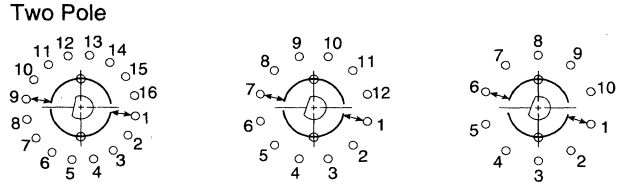
CIRCUIT DIAGRAMS

Switch is viewed from shaft end and shown in position number one. For circle of terminal centers, see above. Center to center distance of commons for the 2-pole switches is listed below the 2-pole diagrams.

One Pole



Two Pole



Series 51 = .156 **Series 51** = .156 **Series 50** = .125
Series 56 = .190 **Series 56** = .190

CHOICES

Series	Style Choices	Angle of Throw	No. of Poles	Positions Per Pole
51	A, S, P, & SP	22.5°	1	02 to 16
			2	02 to 08
	A, S, C, M, P, SP, CP, MP, CD, MD, CDP, MDP	30°	1	02 to 12
			2	02 to 06
50	A, S, C, M, P, SP, CP*, MP*,CD*,MD*,CDP*,MDP*	36°	1	02 to 10
			2	02 to 05
56	A, S, P, SP, D, SD, DP, & SDP	30°	1	02 to 12
			2	02 to 06
		36°	1	02 to 10
			2	02 to 05

*These styles are made in military style, but are not qualified.

STYLE EXPLANATION

Solder Lug Terminals

A = Basic Style
D = Plus Adjustable Stops
S = Shaft/Panel Seal
SD = Seals, Adj. Stops
C = Basic Mil. Qual.
CD* = Mil. Qual., Adj. Stop
M = Mil. Qual., Seals
MD* = Mil., Seal, Adj. Stop

PC Terminals

P = Basic Style
DP = Plus Adj. Stop
SP = Shaft/Panel Seal
SDP = Seals, Adj. Stop
CP* = Basic Mil. Qual.
CDP* = Mil. Qual., Adj. Stop
MP* = Mil. Qual. Seals
MDP* = Mil., Seals, Adj. Stop

*These styles are made in military style, but are not qualified.

PART NUMBER FORMATION

56A36-01-1-09N
① ② ③ ④ ⑤ ⑥⑦⑧

① Series: 50, 51, or 56
② Style Letters: See choices in chart
③ Angle of Throw: 22, 30, 36 (Correlated**)
④ Number of Decks: 01 only
⑤ Number of Poles: 1 or 2 (Correlated**)
⑥ Number of Positions Per Pole: 02 (min.) to max. shown in chart (Correlated**) Use AJ here for switch styles with D.
⑦ Contact Type: S = shorting; N = non-shorting
⑧ Stop Suffix: Leave blank unless ordering a 1–pole switch with the maximum positions, adding suffix as follows:
For a stop after last position, add –F.
For continuous rotation, add–C for Series 56; leave blank for Series 50 or Series 51.

**Parts of the part number are correlated to others and must agree. For example, a 30°, 2-pole switch is limited to 06 positions per pole.

For prices and discounts, contact your local Sales Office, your authorized local Distributor, or GRAYHILL.

Available From Your Local GRAYHILL Distributor

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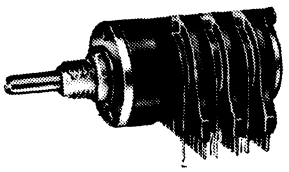
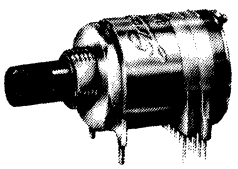
Rotary Switches

1/4 AMP ECONOMICAL ENCLOSED MULTIDECK SWITCHES – SERIES 71

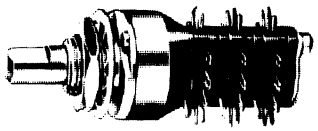
- 30° or 36°; 1-3 Decks; 1 & 2 Poles
- Adjustable & MIL-S-3786 Styles
- 1/8" or 1/4" Shaft Diameter
- Solder Lug or PC Terminal Styles
- Panel Seal or Process Seal
- Other Types Also Available



Style AF



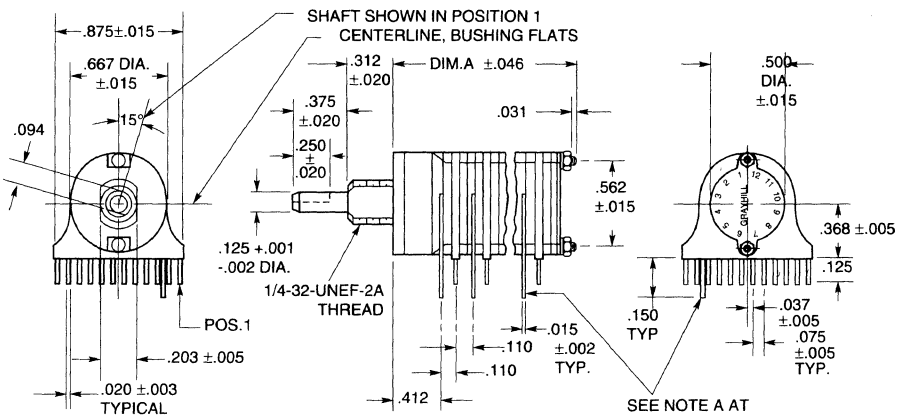
Style BT

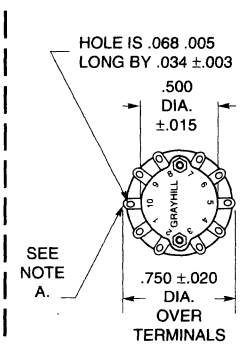


Style B

DIMENSIONS

STYLE AF SHOWN HERE. SOLDER LUG STYLES HAVE SAME DIMENSIONS EXCEPT FOR TERMINAL REFERENCES AND DIMENSIONS SHOWN IN REAR VIEW.





NOTE A: LOCATION OF COMMON FOR A 1-POLE SWITCH. CONSULT CIRCUIT DIAGRAMS IN CATALOG FOR OTHER POLES.

NO. OF DECKS	DIM. A STANDARD	DIM. A, IN STYLES COMBINING M & F	DIM. A STYLE BT
1	.761	.761	.795
2	.979	.979	1.040
3	1.197	1.415	1.285

ALL TOLER-ANCES ARE ±.010 UNLESS SHOWN OTHER-WISE

STANDARD STYLES – STYLE LETERS A, B, F

Style A shaft is 1/8" in diameter, with a 1/4" diameter bushing; style B shaft is 1/4" in diameter with a 3/8" diameter bushing. Either style shaft may be ordered with either 30° or 36° angle of throw, with either solder lug (no style letter) or printed circuit terminals (style F).

SEALED STYLES – STYLE LETTERS S AND T

Style S is shaft and panel sealed. Shaft is sealed by an "O" ring inside the bushing; the panel, by a ring at the base of the bushing.Seals do not alter dimensions when switch is mounted.

Style T is process sealed to protect against spray and immersion cleaning of PC boards. Style T is available only in 36° angle of throw, 1/4" shaft diameter, PC mount terminals, and fixed stops.

ADJUSTABLE STOP – STYLE LETTER D

Adjustable stop switches are standard switches with removable stop pins which the user can relocate as desired. They are available in either 30° or 36° angle of throw, with either shaft diameter, and with either solder lug or PC terminals.

MILITARY QUALIFIED STYLES – STYLE LETTER M

Style M switches are qualified to MIL-S-3786/39. Order by either the GRAYHILL part number or the "M" number. Military switches are available in 30° or 36° angle of throw, with either solder lug, or printed circuit terminals, in either shaft diameter. PC switches of 3 decks have a spacer deck after the second deck (see Dim. A in chart).

SPECIFICATIONS

RATING: Switches make and break 400 mA 30 Vdc (or 115 Vac), resistive, for 10,000 cycles (or 200 mA for 25,000 cycles); and 250 mA 30 Vdc, inductive (250 millihenries) for 10,000 cycles or 100 mA for 25,000 cycles. A cycle is a 360° rotation and a 360° return. For additional specifications, see the GRAYHILL catalog.

ORDERING INFORMATION

Style Choices By Shaft Size 1/8 Dia.	1/4 Dia.	No. Of Decks	No. Of Poles/ Deck	Positions Per Pole, Min.-Max. 30°	36°
A, AF, AS, ASF, AD, ADF, MA, MF, MAS, MASF	B, BF, BS, ASF, BD, BDF, BT*, MB, MBF, MBS, MBSF	01	1	02 - 12	02 - 10
			2	02 - 06	02 - 05
		02	1	02 - 12	02 - 10
			2	02 - 06	02 - 05
		03	1	02 - 12	02 - 10
			2	02 - 06	02 - 05

*Style BT is available only in 36° angle of throw.

For prices and discounts, contact your local Sales Office, your authorized local Distributor, or GRAYHILL.

Available From Your Local GRAYHILL Distributor

PART NUMBER FORMATION

71A36–02–1–10N–F

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① ② Series 71 and Style Letters from chart
③ Angle of Throw: 30 or 36
④ Number of Decks: 01, 02, or 03
⑤ Number of Poles Per Deck: 1 or 2
⑥ Positions Per Pole: Per chart, 02 minimum; use AJ for D styles
⑦ Contact Type: S = shorting; N = non-shorting
⑧ Stop Arrangement Suffix: Leave blank unless ordering a 1–pole switch with the maximum positions. Then add –C for continuous rotation, or –F for a stop after last position. Choices must agree. Example: 30°, 2-pole = 06 positions maximum.

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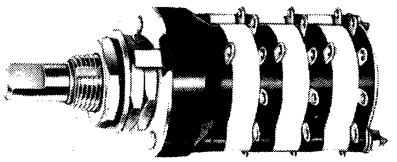
Rotary Switches

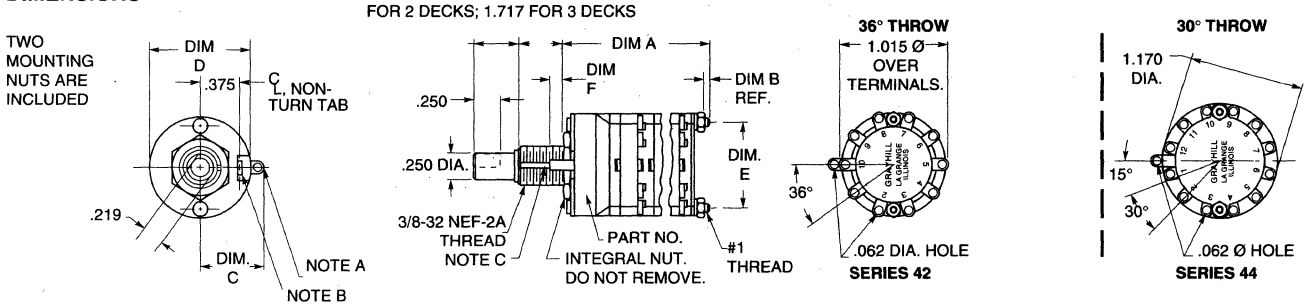
1AMP MULTIDECK ROTARY SWITCHES — SERIES 42 AND 44

SHOWN HERE
- 30° or ° Throws
- 1 to 3 Decks; 1 & 2 Poles
- Solder Lug Style, Fixed Or Adjustable Stops

ALSO AVAILABLE
- 45°, 60°, and 90° Throws
- To 12 Decks; to 6 Poles
- PC Mount, Military, Sealed, Concentric Shaft, Add-A-Pot, and UL Recognized Styles



DIMENSIONS



NOTE A: COMMON LOCATION FOR 1-POLE SWITCH. SEE CIRCUIT DIAGRAMS.

NOTE B: NON-TURN TAB .125; .031 THICK

DIM. B: .062 FOR 1-5 STANDARD DECKS

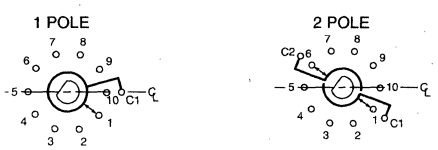
NOTE C: KEYWAY .066 WIDE BY .036 DEEP FROM .375 DIA.

DIM.	C	D	E	F
FOR 36°	.562	3.000	.830	.093
FOR 30°	.642	1.162	1.000	.121

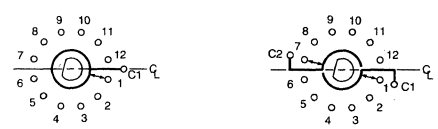
CIRCUIT DIAGRAMS

Shaft flat is opposite contact for first pole.

36° THROW

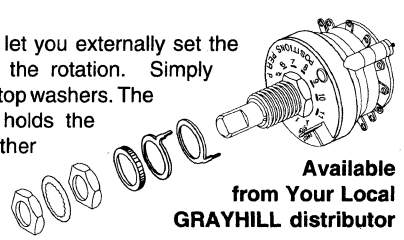


30° THROW



ADJUSTABLE STOPS

Adjustable stop switches let you externally set the switch stops which limit the rotation. Simply remove and relocate the stop washers. The panel or a knurled nut holds the washers in place. All other parts are the same as shown above.



Available from Your Local GRAYHILL distributor

SPECIFICATIONS

Switches are rated to carry 10A, and to make and break the designated loads for 25,000 cycles (360° cw and 360° ccw) of operation. Resistive loads are 1A, 115 Vac; 1A, 6-28 Vdc; and 100 mA, 115 Vdc. Inductive loads are 250 mA, 115 Vac; 100 mA, 6-28 Vdc, and 20 mA, 115 Vdc.

Contact resistance is 200 milliohms maximum after life. Insulation resistance is 50,000 megohms minimum initially. Voltage breakdown is 2,000 Vac initially, and 500 Vac minimum after environmental tests. Stop strength is 15 pound inches minimum for fixed stop switches; 12 pound-inches for adjustable stop. Shorting or non-shorting, wiping contacts have over 150 grams of contact force.

SELECTION AND ORDERING INFORMATION

Series & Angle Of Throw	Styles Available	No. Of Decks	Poles Per Deck	No. Of Positions Per Pole
42 36°	A = Standard S = Std., Shaft/Panel Seal H = Military Qualified 125° HS = Mil. Qualified, S/P Seal M = Military Qualified 85°	01-12	01 02	02-10 02-05
44 30°	UA = UL Recognized US = UL Recog., S/P Seal D = Adjustable Stops UD = Adj. Stops, UL Recog.	01-12	01 02	02-12 02-06

Adjustable stop switches and some fixed stop switches are available from your local GRAYHILL Distributor. For other angles of throw; 3 to 6 poles per deck; concentric shaft of PC styles, consult GRAYHILL catalog for complete engineering information and drawings, or contact your local sales office.

For prices and discounts, contact alocal Sales Office, an authorized Distributor, or GRAYHILL.

PART NUMBER FORMATION

44A30-02-1-12N-F

① ② ③ ④ ⑤ ⑥⑦⑧

① Series: 42 or 44 (42 = 36°; 44 = 30°)
② Style Letters: See choices in chart
③ Angle of Throw: 30 or 36 (Series, poles, positions correlated**)
④ Number of Decks: 01, 02, etc. up to 12
⑤ Number of Poles: 1 or 2 (Correlated to angle & positions**)
⑥ Number of Positions Per Pole: 02 (min.) to max. shown in chart (Correlated**) Use AJ here for switch styles with D.
⑦ Contact Type: S = shorting; N = non-shorting
⑧ Stop Arrangement Suffix: Leave blank unless ordering a 1-pole switch with the maximum positions. Then add –F for a stop after last position. (For continuous rotation and for adjustable stop styles, leave blank).

**Parts of the part number are correlated to others and must agree. For example, a 30°, 2-pole switch is limited to 06 positions per pole.

Grayhill INC. Coded Rotary Switches

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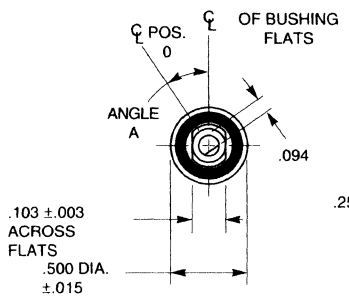
1/2" BINARY CODED (HEXADECIMAL) SWITCH–SERIES 26

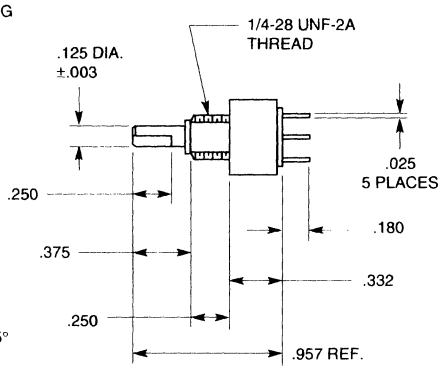
• Shaft and Panel Seal • 1 Pole, 2-16 Positions, Adjustable

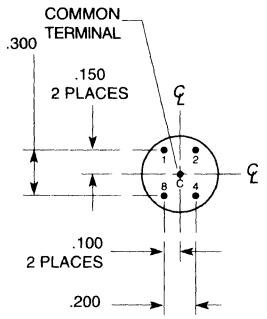


Part Number
26ASD22-01-1-AJN
(MAXIMUM 16 POSITIONS)
26ASD45-01-1-AJN
(MAXIMUM 8 POSITIONS)



ANGLE A
FOR 26ASD22-01-1-AJN = 33.75°
FOR 26ASD45-01-1-AJN = 675°





UNLESS OTHERWISE SPECIFIED TOLERANCES ARE ±.015

GENERAL SPECIFICATIONS

Rated to make and break logic compatible loads for 25,000 operations; a cycle is 360° cw and 360° ccw. Terminals are marked on the switch. All switches have all terminals, regardless of the number of active positions. Shaft flat faces active position.

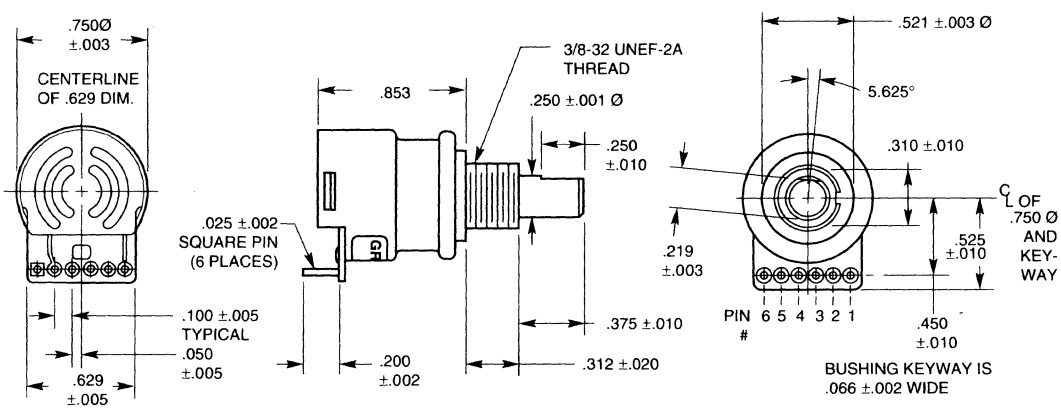
ADJUSTABLE STOPS

The switch may have continuous rotation, or be adjusted to limit the rotation. The panel seal ring can be removed to expose the stop pin holes on the front of the switch. Two stop pins are supplied with the switch. One or both may be used to limit the rotation as desired.

OPTICALLY COUPLED ROTARY ENCODER SWITCH–SERIES 61

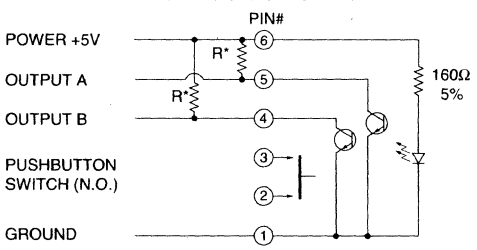
• Economical Touchscreen Alternative • 1-Hand Control of Cursor and Entry





GENERAL SPECIFICATIONS

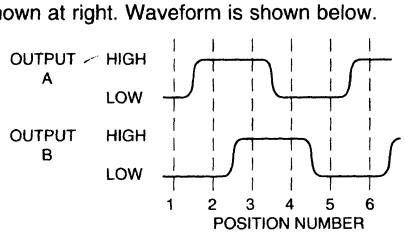
Available in 16 or 32 positions in Quadrature 2 Bit Code. Pushbutton entry switch is actuated by pushing in on the shaft. Encoder is rated at 4-6 VDC, 30 mA maximum for more than 1 million cycles (cycle = 360° cw and 360° ccw). Logic low is .5 V maximum; logic high is 3.8 V minimum. Terminal locations are as follows:



*EXTERNAL PULL UP RESISTORS REQUIRED FOR OPERATION.
8.2 KΩ IS SUGGESTED FOR TTL; 3.3 KΩ IS SUGGESTED FOR CMOS.

TRUTH TABLE

Output as related to switch position locations is shown at right. Waveform is shown below.



Q2B CODE	OUTPUTS A	B
1		
2	●	
3	●	●
4		●
5		
6	●	
7	●	●
8		●
9		
10	●	
11	●	●
12		●
13		
14	●	
15	●	●
16		

SWITCH POSITION

ORDERING INFORMATION

Positions	Part Number
16	**61C22-01-04-02**
32	**61C11-01-08-02**

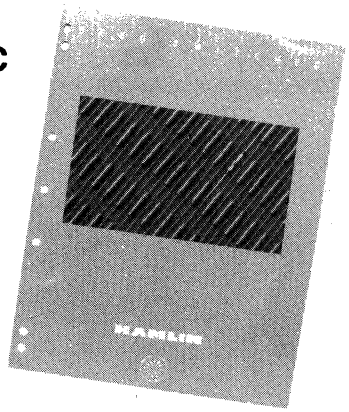
Available through your local Grayhill Distributor

For prices and discounts of the items on this page, contact a local Sales Office, an authorized local Distributor, or Grayhill.

REED SWITCHES
HAMLIN

HAMLIN INC.
612 East Lake Street
Lake Mills, WI 53551 USA
Phone 414/648-3000 • FAX 414/648-3001

QUALITY ELECTRONIC COMPONENTS SINCE 1949



As the largest western manufacturer of reed switches, we offer the most diverse product line in the business. Dry and mercury wetted magnetic reed switches are designed and produced for reliable operation under the most critical conditions. These switches are hermetically sealed for safe dependable use in hostile atmospheres. We offer the benefits of both sputtered and electro plated contacts.

For detailed product information send for the Hamlin Reed Switch Catalog. The catalog provides complete information regarding specifications, dimensions, theory of operation, magnetic actuators, and reed switch application data.

MINIATURE MAGNETIC REED SWITCHES

SWITCH MODEL NUMBER	FORM	DIM.** CODE	MAX. DC RATING	MAX. SWITCH AMPS.	MAX. DC VOLTS	A.T. PULL-IN RANGE	SPECIAL FEATURES	SWITCH LIST PRICE		ACTUATOR MAGNET	MAGNET LIST PRICE
MITI-3-105 **NEW!**	A	10	3	.25	150	10-25	Microminiature	2.50		H-31	.80
MDSR-7-105*	A	1	10W	0.500	200	10-25	Miniature Size	1.04		H-31	.88
MDRR-6-185	A	2	10W	0.500	300	12-38	High Voltage Hold-off	.98		H-33	1.05
MDRR-4-185*	A	2	10W	0.500	200	12-38	Small Size	.81		H-33	1.05
MLRR-4-185*	A	3	10W	0.500	200	12-38	.090" Diameter	.81		H-33	1.05
MLRR-4-185*	A	2	20W	1.000	2000	12-38	High Inrush	1.04		H-33	1.05
MLRR-2-185	A	4	20W	1.000	200	12-38	High Inrush	1.04		H-33	1.05
MARR-2-185*	A	4	10W	0.750	200	12-38	Hi-Rel	.96		H-33	1.05
MARR-8-185	A	4	10W	0.500	300	17-38	High Voltage	.98		H-33	1.05
MARR-5-196*	A	4	10W	0.500	1000	22-47	Breakdown 2000 Volts	2.85		H-33	1.05
MRPR-2-214*	A	5	50W	1.500	200	22-43	High C*rent	1.32		H-33	1.05
MDRR-DT-175*	C	7	3W	0.250	175	15-35	Small Size	3.45		H-33	1.05

*UL

STANDARD SIZE MAGNETIC REED SWITCHES

DRR-DTH-445	C	8	30W	0.500	250	40-100	High Breakdown	6.90		H-32	2.35
DRT-DTH-445	C	8	50W	1.500	500	40-100	Inductive Loads	8.63		H-34	2.96

HIGH CURRENT MAGNETIC REED SWITCHES

DRR-129-425	A	9	100W	3.000	400	52-102	High Current	3.85		H-34	2.96

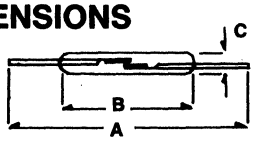
MERCURY WETTED MAGNETIC REED SWITCHES

MDC-3-328	A	6	50W	2.000	500	35-65	Mercury Wet	4.31		H-33	1.05

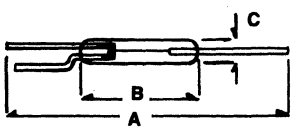
APPLICATION MANUAL — $6.50

SWITCH DIMENSIONS

FORM A



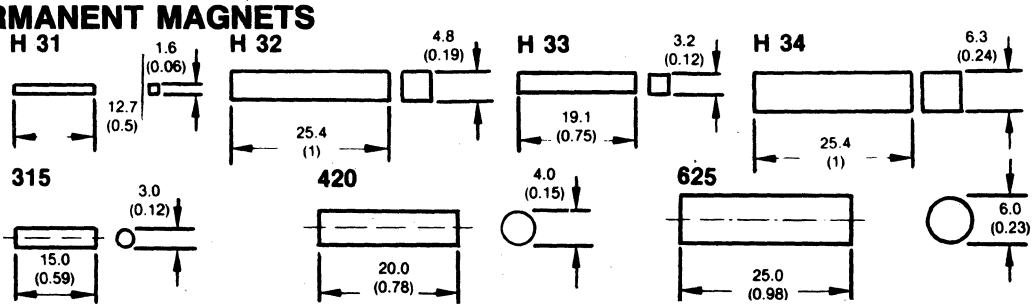
FORM C



**DIMENSION CODE		1	2	3	4	5	6	7	8	9	10
A OVERALL LENGTH NOMINAL	INCH	1.590	1.590	1.590	2.230	2.230	1.580	2.066	3.375	3.250	1.235
	MM	40.38	40.38	40.38	56.65	56.64	40.13	52.47	85.72	82.55	31.36
B GLASS LENGTH MAX.	INCH	0.500	0.600	0.600	0.800	0.800	0.550	0.580	1.562	2.000	0.270
	MM	12.70	15.24	15.24	20.32	20.32	13.97	14.73	39.67	50.80	6.86
C GLASS DIAMETER MAX.	INCH	0.070	0.105	0.090	0.105	0.112	0.100	0.105	0.218	0.207	0.070
	MM	1.78	2.660	2.280	2.660	3.300	2.540	2.660	5.54	5.250	1.77

ALNICO V PERMANENT MAGNETS

MAGNET TYPE	PRICE 1-24
H—31	.80
H—32	2.76
H—33	1.24
H—34	3.48
315	.92
420	1.33
625	1.90



HASCO / REED SWITCHES

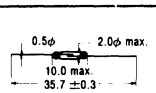
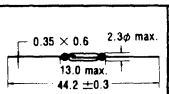
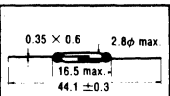
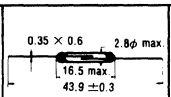
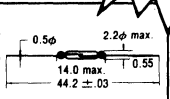
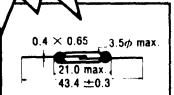
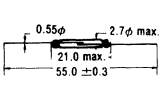
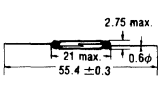
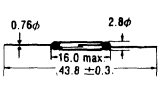
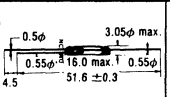
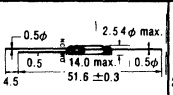
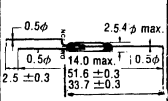
COMPONENTS INT'L., CORP.
SINCE 1976

OKI
electric industry company, ltd.

SAMPLES SENT SAME DAY!

Specifications

POLYMER FREE CONTACTS

							
		ORD-211	**ORD-221**	**ORD-225**	**ORD-226**	**ORD-228**	**ORD-234**
Electrical Characteristics	Contact	1A	1A (offset)	1A	1A RLS/OP >0.8	1A	1A
	Contact resist. (Initial) [mΩ]	150 max.	150 max.	150 max.	150 max.	150 max.	150 max.
	Breakdown voltage [DCV]	150 min.	200 min.	250 min.	150 min.	200 min.	300 min.
	Insulation resistance [Ω]	10^9 min.	10^9 min.	10^{10} min.	10^9 min.	10^9 min.	10^{10} min.
	Electrostatic cap. [PF]	0.2 max.	0.3 max.	0.3 max.	0.3 max.	0.3 max.	0.5 max.
	Contact capacity [VA]	1.0	10	10	10	10	10
	Max. conductive curr. [A]	0.3	1.0	1.0	0.5	1.0	2.0
	Max. voltage [V]	24	100	100	100	100	200
Oper. Characteristics	Operate time [ms]	0.3 max.	0.3 max.	0.4 max.	0.3 max.	0.3 max.	0.5 max.
	Bounce time [ms]	0.3 max.	0.3 max.	0.4 max.	1.0 max.	0.3 max.	0.5 max.
	Release time [ms]	0.05 max.	0.05 max.	0.05 max.	0.1 max.	0.05 max.	0.05 max.
	Resonant frequency [Hz]	8600 ±500	2750 ±250	3700 ±300	4200 ±200	5300 ±300	2200 ±300
	Max operating freq. [Hz]	500	500	500	500	500	500
Standard Coil	Coil resistance [Ω]	600	450	450	450	450	500
	No. of turns [T]	5000	5000	5000	5000	5000	5000
	Dimensions [mm]	2.0 x 10	2.9 x 15	2.9 x 15	2.9 x 15	2.9 x 15	3.6 x 20
	Type No.	8	6	6	6	6	3
Features (Contact material)		Ultra-miniature Rh	Miniature offset (Rh)	General purpose miniature (Rh)	Drop-out >0.8 (Rh) Pull-in	General purpose miniature (Rh)	Long life (Rh)
							
		ORD-229	**ORD-2210**	**ORD-2211**	**ORT-233**	**ORT-551**	**ORT-551-1**
Electrical Characteristics	Contact	1A	1A	1A	1C	1C	1C
	Contact resist. (Initial) [mΩ]	150 max.	150 max.	100 max.	150 max.	150 max.	150 max.
	Breakdown voltage [DCV]	700 min.	300 min.	200 min.	200 min.	200 min.	200 min.
	Insulation resistance [Ω]	10^{10} min.	10^{10} min.	10^9	10^9 min.	10^9 min.	10^9 min.
	Electrostatic cap. [PF]	0.2 max.	0.5 max.	0.3 max.	1.5 max.		
	Contact capacity [VA]	20	70	30W max.	3	3	3
	Max. conductive curr. [A]	2.0	2.5	0.5; in-rush 3	0.5	0.5	0.5
	Max. voltage [V]	250	100	100	30	30	30
Operating Characteristics	Operate time [ms]	0.5 max.	0.5 max.	0.6 max.	1.0 max.	1.0 max.	1.0 max.
	Bounce time [ms]	0.5 max.	0.5 max.	0.4 max.	(NC) 1.0 max. (NO) 1.5 max.	(NC) 1.5 max. (NO) 1.0 max.	(NC) 1.5 max. (NO) 1.0 max.
	Release time [ms]	0.1 max.	0.1 max.	0.05 max.	0.5 max.	0.5 max.	0.5 max.
	Resonant frequency [Hz]	2200 ±300	2350 ±250	4600 ±500	6000 ±4000		
	Max. operating freq. [Hz]	500	500	500	200		
Standard Coil	Coil resistance [Ω]	500	500	450	570		
	No. of turns [T]	5000	5000	5000	5000		
	Dimensions [mm]	2.8 x 18	3.6 x 20	2.9 x 15	3.6 x 10		
	Type No.	7	3	6	10		
Features (Contact material)		High breakdown voltage (Rh)	High power (Rh)	High inrush	Miniature transfer (Rh)	Ultra Miniature transfer (Rh)	Ultra Miniature transfer (Rh)

For a comprehensive engineering Reed Switch Catalog, contact factory. **(Also Available in Ruthenium.)**

High Reliability Supported by Unique Technology.

Flux Scanning Method:

In spite of severe control of the sealing process, there is a slight probability that foreign matter such as magnetic particles may enter the glass. After extensive study in the detection of micro impurities, OKI has adopted the highly reliable flux scanning method. In flux scanning, external magnetism is moved so that foreign matter near the reed is forced to jump to the contact part. The contact resistance then measured is used as the standard for the selection of characteristics. We have thus succeeded in remarkably improving the reliability of reed switches by replacing conventional visual checking with the latest flux scanning method.

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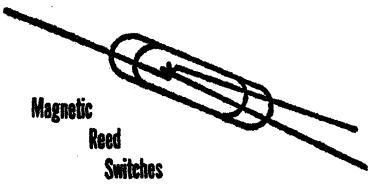
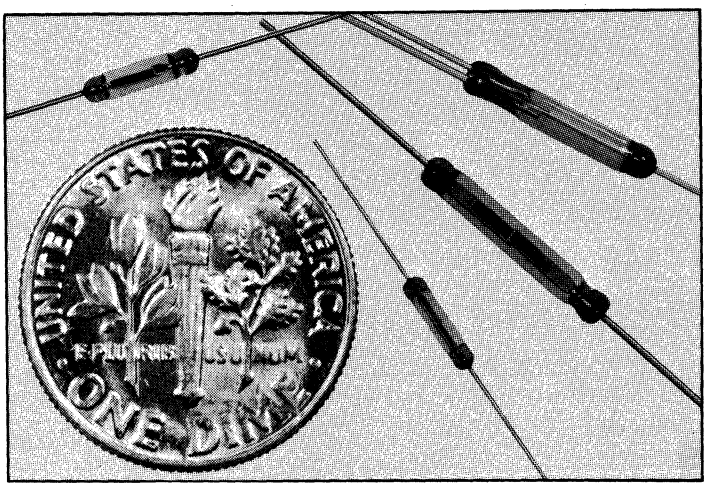
HERMETIC SWITCH





REED SWITCHES

FROM THE WORLD'S SMALLEST THROUGH THE INDUSTRY'S MOST POWERFUL

Model	Form	Max D C. Watts	Max D C. Amps	Max D C. Volts	Stock Amp-Turn Pull-In Range	Overall Length Inches	Max Glass Dia. Inches	Max Glass Length Inches	Special Features
MICRO-MINIATURE									
HSR-003	A	.01	.01	10	5-25	1.050	.055	.210	AVAILABLE IN HI-REL AND COMMERCIAL GRADES
HSR-042	A	0.3	.01	100	10-35	1.850	.090	.370	
HSR-370	C	3	.10	28	15-35	1.490	.072	.485	
MINIATURE									
HSR-1015RF	A	10	.5	200	40	2.090	.101	.800	STANDARD OR RADIO FREQUENCY CONTACT PREPARATION
HSR-1017	A	12	.5	200	15-40	2.190	.115	.850	
HSR-520	C	3	.25	100	15-40	2.000	.125	.600	
STANDARD									
HSR-190	A	15	1.0	250	40-80	3.230	.210	2.100	FULL SIZE ECONOMICAL
HSR-780	A	25	1.5	1500	60-100	3.200	.215	2.000	
HSR-630	C	25	1.0	200	40-80	3.390	.210	1.300	
HIGH POWER									
HSR-134	A	100	3.0	100	60-100	3.390	.210	1.300	POWER SWITCHING IN 100 TO 200 WATT RANGE
HSR-V205	A	200	3.0	2500	100-150	3.230	.210	2.100	
HSR-834	C	100	3.0	500	60-100	3.390	.210	1.300	
HIGH VOLTAGE									
HSR-790	A	50	2.5	1000	60-100	3.230	.215	2.000	UP TO 10,000 VDC DIELECTRIC
HSR-V7K	A	50	3.0	5000	60-125	3.230	.210	2.100	
HSR-V10K	A	50	3.0	7500	100-150	3.230	.210	2.100	

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FAX 405-224-9423

idec CORPORATION

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Regional Offices: Schaumburg, IL: (708) 706-3880; Fort Pierce, FL: (407) 461-4994

A Series Pushbuttons, Selector & Keylock Switches

Dimensions in **inches** (mm).

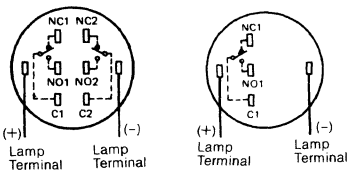
Features

- Compact .630"(16mm) diameter mounting
- Switching from 3A, 250V AC/DC maxmium down to 1mA, 5V AC/DC
- Oiltight IP65 or enclosed IP40 construction
- 1 Form C and 2 Form C contact configuration
- Pushbutton units available in non-illuminated and illuminated models
- Round, square and rectangular lens/buttons available in standard and large size
- Choice of LED and incandescent lamp
- Momentary or alternate switch action
- Keylock and selector switches available in 2 and 3 postions

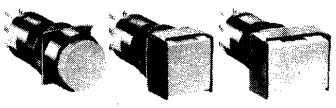
Contact Ratings

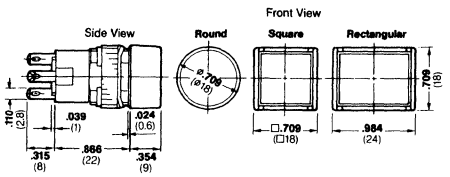
Contact Configuration: 1 or 2 Form C
Contact Material: Gold-clad Silver
Maximum Switching Load: 3A, 250V AC/DC
Minimum Switching Load: 1mA, 5V AC/DC

Terminal Arrangements

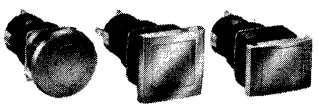


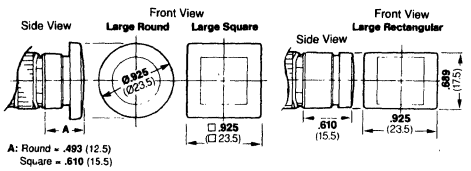
Standard Lens/Buttons





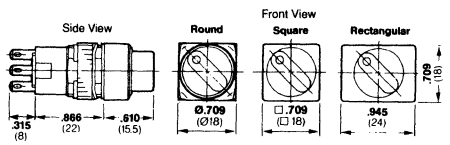
Large Lens/Buttons





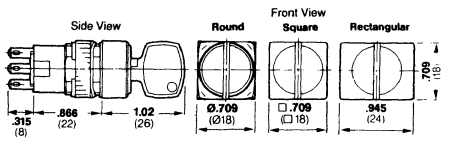
Selector Switches



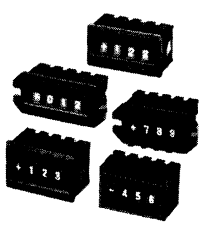


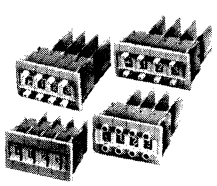
Keylock Switches

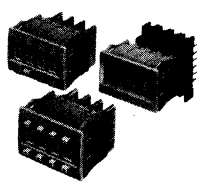


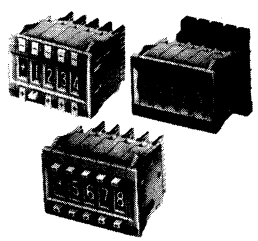


Thumbwheel Switches









Specifications	DL Series	DE & DJ Series	DF & DK Series	DG Series
No. of Positions	10	10	10, 12, 16	10, 12, 16
Output Codes	2-Position Repeat, BCD BCD Complementary	2-Position Repeat, BCD, Decimal	Decimal, BCD, Complementary BCD, BCD w/Odd Parity, Duodecimal, Hexadecimal	Decimal, BCD, Complementary BCD, BCD w/Odd Parity, Duodecimal, Hexadecimal
Terminal Style	Solder, PC Board	Solder, PC Board	Solder, PC Board	Solder, PC Board
Operator Style	Thumbwheel, Dual Button, Pen-Touch	Thumbwheel, Dual Button, Set-Lock, Pen-Touch	Thumbwheel, Dual Button, Set-Lock,	Thumbwheel, Dual Button, Set-Lock,
*** Unit Assembly**	Snap-Fit	Snap-Fit	Snap-Fit	Snap-Fit
Panel Mounting	Front & Rear	Front & Rear	Front & Rear	Front & Rear
Operational Voltage	50V AC, 5V to 28V DC	50V AC, 5V to 28V DC	50V AC, 5V to 28V DC	50V AC, 5V to 28V DC
Oprational Current	0.1A (Resistive Load)	0.1A (Resistive Load)	0.1A (Resistive Load)	0.1A (Resistive Load)
Thermal Current	0.5A (Non-Switching)	0.5A (Non-Switching)	0.5A (Non-Switching)	0.5A (Non-Switching)
Mechanical Life	50,000/oper. minimum	300,000/oper. minimum	1,000,000/oper. minimum	1,000,000/oper. minimum
Front Mount Unit Size - W x H	.197 (5) x .708 (18) .200 (5.08) x .708 (18) .236 (6) x .708 (18)	DE: .236 (6) x .708 (18) DJ: .300 (7.62) x .708 (18)	DF: .315 (8) x .944 (24) DK: .300 (7.62) x .944 (24)	.315 (8) x 1.30 (33)

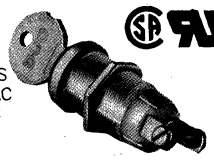
Dimensions in inches (mm)

SWITCHLOCKS

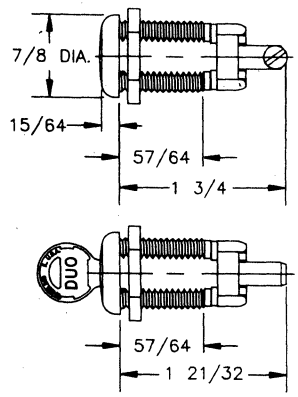
Illinois Lock Company

A DIVISION OF THE EASTERN COMPANY

LQ1

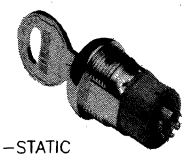


ELECTRICAL RATINGS
5 Amps @ 115 VAC
5 Amps @ 24 VAC

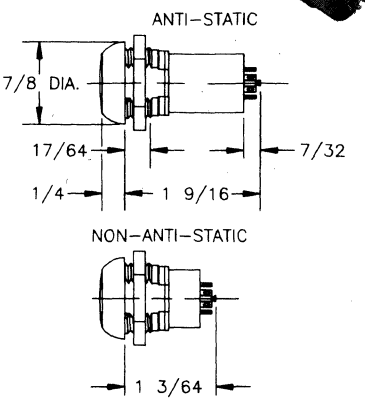


AVAILABLE WITH THE 'DUO' HIGH SECURITY MECHANISM.

LQ17CC

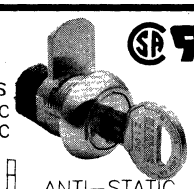


ELECTRICAL RATINGS
200 m.A. @ 28 VDC
150 m.A. @ 115 VAC

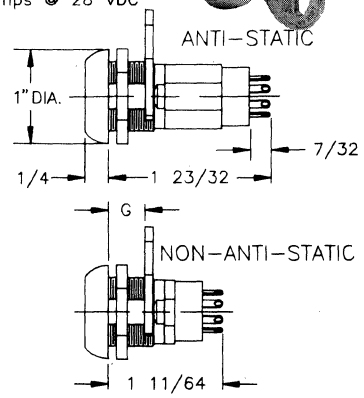


STANDARD & 20KVDC ANTI-STATIC
CENTER COMMON SWITCHES

LQ20



ELECTRICAL RATINGS
4 Amps @ 125 VAC
2 Amps @ 250 VAC
4 Amps @ 28 VDC

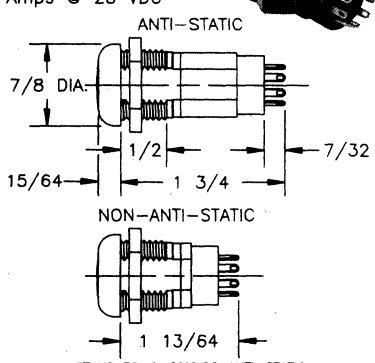


STANDARD & 20KVDC ANTI-STATIC
ROTARY SLIDE SWITCHES

LQ23



ELECTRICAL RATINGS
4 Amps @ 125 VAC
2 Amps @ 250 VAC
4 Amps @ 28 VDC



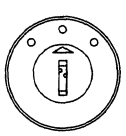
STANDARD & 20KVDC ANTI-STATIC
ROTARY SLIDE SWITCHES

LQ21

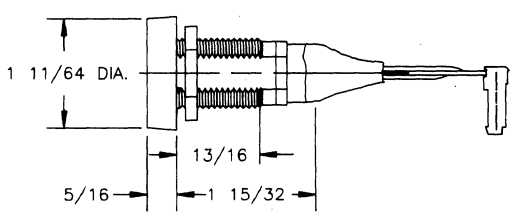
SWITCHLOCK WITH ILLUMINATED POSITION INDICATORS
GREEN, RED, YELLOW, & ORANGE L.E.D.'S

ELECTRICAL RATINGS
4 Amps @ 125 VAC
2 Amps @ 250 VAC
4 Amps @ 28 VDC
OR
ELECTRICAL RATINGS
200 mA @ 28 VDC
150 mA @ 115 VAC

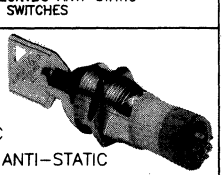
AVAILABLE WITH:
* 36°, 45°, OR 90° INDEXING
* MAINTAINING-MOMENTARY OR DOUBLE-MOMENTARY
* HARNESSING TO YOUR SPECIFICATIONS
* UP TO 4 L.E.D.'S



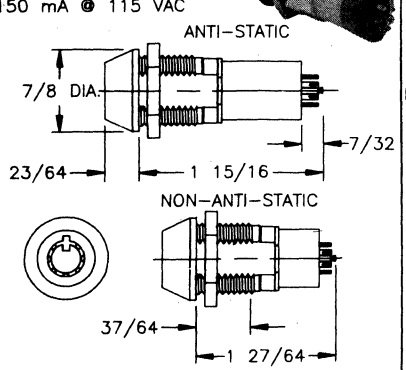
NEW!
NOW AVAILABLE WITH BI-COLOR L.E.D.'S



LQ13CC

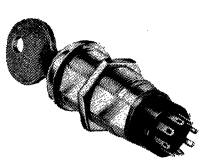


ELECTRICAL RATINGS
200 mA @ 28 VDC
150 mA @ 115 VAC

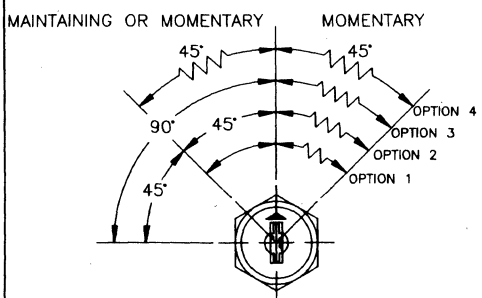


STANDARD & 20KVDC ANTI-STATIC
CENTER COMMON SWITCHES

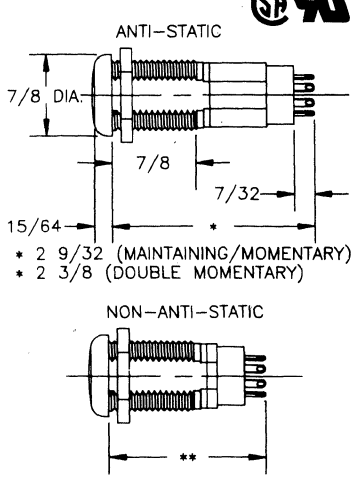
LQ14



ELECTRICAL RATINGS
4 Amps @ 125 VAC
2 Amps @ 250 VAC
4 Amps @ 28 VDC



STANDARD & 20KVDC ANTI-STATIC
ROTARY SLIDE SWITCHES



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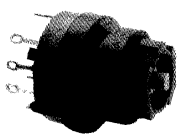
SWITCHLOCKS

Illinois Lock Company

A DIVISION OF THE EASTERN COMPANY

VERSATILE SWITCHLOCK LINE OFFERING VARYING LEVELS OF SECURITY ALONG WITH A WIDE RANGE OF ELECTRICAL RATINGS IN A CONVENIENT SNAP TOGETHER UNIT.

ALL NEW!!!



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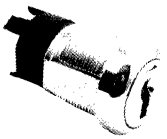
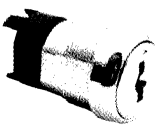


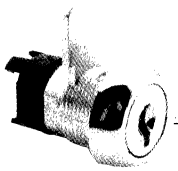
LQ25 5 TUMBLER MECHANISM. SINGLE BITTED KEY.



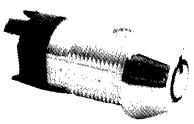
LQ26 4 TUMBLER MECHANISM. SINGLE BITTED KEY.



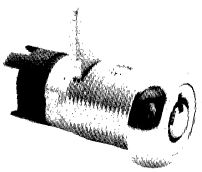
LQ27 6, 8, OR 10 TUMBLERS. DOUBLE BITTED KEY.



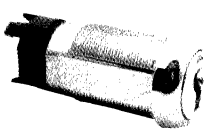
LQ28 CAM/SWITCHLOCK. 4 TUMBLER MECHANISM. SINGLE BITTED KEY.



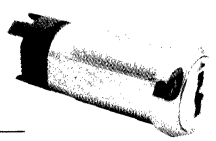
LQ29 7 PIN TUMBLERS. TUBULAR KEY.



LQ30 CAM/SWITCHLOCK. 7 PIN TUMBLERS. TUBULAR KEY.



LQ31 MAINTAINING/MOMENTARY OR DOUBLE MOMENTARY. 5 TUMBLER MECHANISM. SINGLE BITTED KEY.



LQ32 THE 'DUO' MECHANISM. FEATURING A 14 TUMBLER SECURITY MECHANISM WITH A TRIPLE BITTED KEY.

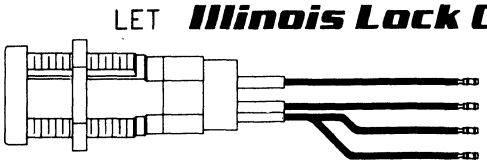
ELECTRICAL RATINGS

A SERIES
CONTACT RATING: Switch–2.5 AMPS @ 125 V AC or 28 V DC; 150 mA @ 250 V AC or DC (UL/CSA).

H SERIES
CONTACT RATING: 12 AMPS @ 125 V AC or 28 V DC; 6 AMPS @ 250 V AC; 1 AMP @ 125 V DC (UL/CSA).

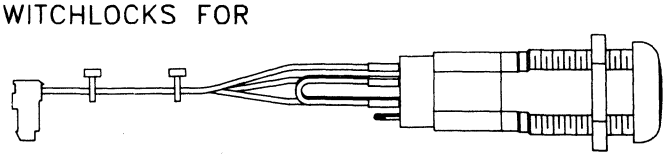
Y SERIES
CONTACT RATING: 4 AMPS @ 125 V AC or 28 V DC; 2 AMPS @ 250 V AC (UL/CSA).

LET **Illinois Lock Company** BE YOUR HARNESS SUPPLIER.



SEND US YOUR REQUIREMENTS AND YOU CAN RECEIVE YOUR SWITCHLOCK QUOTATION WITH AND WITHOUT THE WIRE HARNESS.

WORLD'S LARGEST SELECTION OF SWITCHLOCKS FOR STANDARD AND OEM APPLICATIONS.



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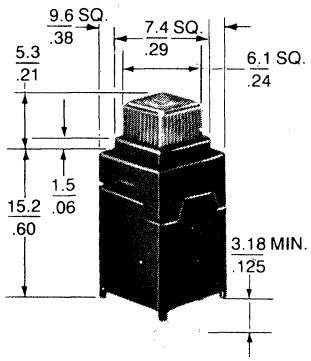
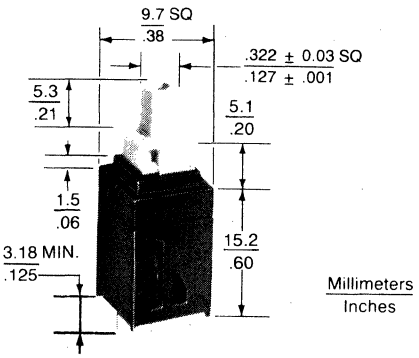
ITW PUSHBUTTON SWITCHES

SERIES 39 LED MINIATURE

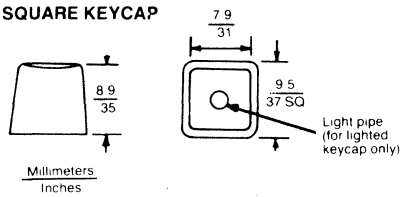
STANDARD SWITCH



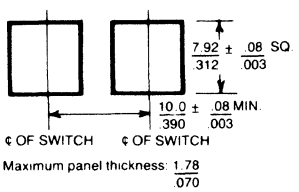
KEYCAP SWITCH



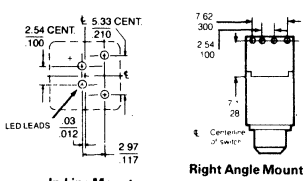
SQUARE KEYCAP



PANEL CUTOUT RECOMMENDATIONS



RECOMMENDED P.C. BOARD PATTERNS



In-Line Mount — Right Angle Mount

FEATURES:

- Circuitry: SPST-NO-DB
- Momentary or maintained
- Bifurcated silver plated contacts
- Available in LED, lighted, non-lighted and indicator only versions
- Button styles: Standard–lighted & non-lighted; Keycap: Square–lighted and non-lighted; Rectangular–non-lighted
- Variety of colored lens and keycaps
- Electrical Rating: .25 amp @ 30 VDC max. RES
- CONNECTOR MOUNTING OPTIONS:
  39-800001–In-line mount connector
  39-800002–Right-angle mount connector

KEYCAP STYLE BUTTONS

Part No.	Lighted	Color
80-390101	Yes*	White
80-390102	Yes*	Light Grey
80-390103	Yes*	Dark Grey
80-390104	Yes*	Black
80-390105	No	White
80-390106	No	Light Grey
80-390107	No	Dark Grey
80-390108	No	Black

*Requires light pipe–P/N 80-390100

SWITCHES

Part No.	Lighted	LED Color	Button Color	Button Style	Switch Action
39-12101	Yes*	—	Clear	Standard	Momentary
39-12111	Yes*	—	Red	Standard	Momentary
39-12113	Yes*	—	Green	Standard	Momentary
39-12502	No	—	White	Standard	Momentary
39-12503	No	—	Red	Standard	Momentary
39-12506	No	—	Yellow	Standard	Momentary
39-12509	No	—	Black	Standard	Momentary
39-12601	Yes	Red	Clear	Standard	Momentary
39-12611	Yes	Red	Red	Standard	Momentary
39-12712	Yes	Green	Green	Standard	Momentary
39-12801	Yes	Yellow	Clear	Standard	Momentary
39-12813	Yes	Yellow	Yellow	Standard	Momentary
39-13101	Yes*	—	Clear	Standard	Maintained
39-13111	Yes*	—	Red	Standard	Maintained
39-13113	Yes*	—	Yellow	Standard	Maintained
39-14611	Yes	Red	Red	Standard	Maintained
39-22100	Yes*	—	—	Keycap	Momentary
39-22500	No	—	—	Keycap	Momentary

*LED not included–LED support P/N–80-390003 supplied in bulk

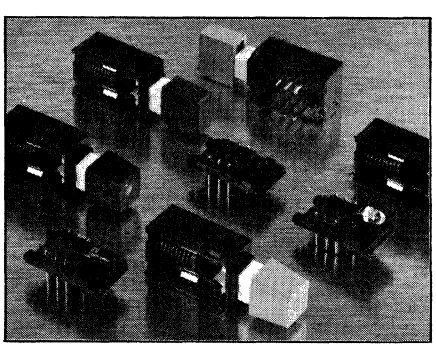
SERIES 39 PUSHBUTTON KIT

This kit is filled with over 300 Series 39 switches, buttons, keycaps, light pipes, connectors to build hundreds of Series 39 switch combinations.

To order: 39-KIT

SERIES 39 MR. CLEAN

Wave Solderable Miniature Pushbutton



DESCRIPTION

Only the terminal base of this unique switch is exposed to the soldering and cleaning process. The Mr. Clean Series 39 base is compatible with fluorinated, chlorinated and aqueous cleaning methods. After the cleaning process is complete, the switch body is snapped onto the switch base for a contaminant-free, reliable switch.

Bifurcated, silver plated switch contacts provide the proven switching integrity required for logic loads. The Mr. Clean Series 39 switch has a unique wiping, self-cleaning action that maintains contact reliability.

SWITCH SPECIFICATIONS

Characteristics:
Contact rating: 0.25 AMP @30 VDC max. resistive
Dielectric withstanding voltage: 1,000 VRMS
(1 milliamp max. leakage)

Life: Momentary: 250,000 cycle.
Maintained: 25,000 cycles
Button travel: .120 nominal
Operating Force: 8 Oz. nominal
Resistance to solder heat: 500°F (260°C) for 2 Sec.

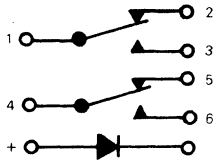
ITW Switches 6615 W. Irving Park Rd. • Chicago, IL 60634
(312) 282-4040 • FAX (312) 545-4450

ITW PUSHBUTTON SWITCHES

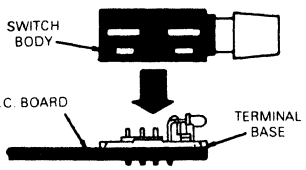
SERIES 39 MR. CLEAN

Wave Solderable Miniature Pushbutton

SCHEMATIC DPDT (FORM CC)



INSTALLATION

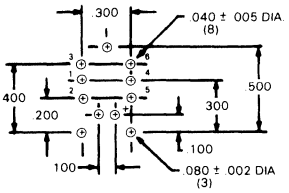


PANEL CUTOUT RECOMMENDATIONS

SAME AS OTHER SERIES 39 SWITCHES

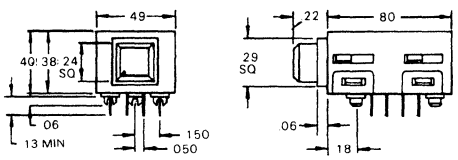
RECOMMENDED P.C. BOARD

HOLE PATTERN (COMPONENT SIDE)



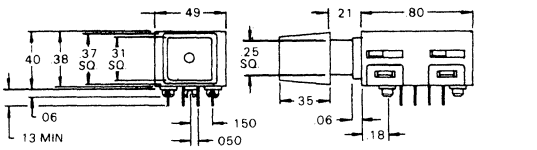
• Button Style Assemblies **39 - 4 2 3 2 08**

FORM	FUNCTION	LIGHTING OPTION	BUTTON COLOR
2 Switch module and terminal base unassembled	2 DPDT-SB. momentary 3 DPDT-SB. maintained	1 Non-lighted 2 High-bright red LED 3 High-bright green LED 4 High-bright yellow LED	**NON-LIGHTED** 06 Black **LIGHTED** 08 Red 09 Green 10 Yellow

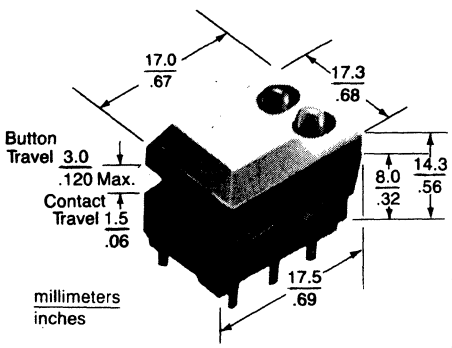


• Keycap Style Assemblies **39 - 5 2 2 1 01**

FORM	FUNCTION	LIGHTING OPTION	KEYCAPS
2 Switch module and terminal base unassembled	2 DPDT-SB. momentary 3 DPDT-SB. maintained	1 Non-lighted 2 High-bright red LED 3 High-bright green LED 4 High-bright yellow LED	01 Plunger (Keycap and Light Pipe ordered separately) *see in other section



SERIES 61 MINIATURE PC MOUNT DATA SWITCH



The above dimensions are for 1½ station keycaps.
For single station keycap substitute 12.3 (.48) for 17.3 (.68)

FEATURES

- Infinite flexibility of keytop styles
- Unique light pipe design
- Tactile feel
- Short travel
- Momentary or alternate
- Gold or silver contacts
- Gamma style button cap also available
- Anti-static windows (up to 15KV protection)

TECHNICAL DATA

CONTACT ARRANGEMENT	SPDT
Travel	≤ 3 mm/.12 in.
Housing and key top material	ABS or Polyester
Contact Material	Brass + Ni + Ag or Au
Operating Life — momentary	3,000,000 cycles
Operating Life — Alternate	500,000 cycles
Temperature range	-25 + 85°C/-13° + 185°F

LED SPECIFICATIONS

	ALPHA		
Color	Red	Green	Yellow
Typical Ratings			
Forward Voltage (v) @ 20 mA	1.7	2.1	2.1
Intensity (mcd) @ 10mA	0.8	3.8	3.8
Forward Current (mA)	40	30	20
Reverse Voltage (v)	5	5	5

ORDERING INFORMATION

KEYCAP COLORS
Where XX
00 — Red
04 — Black
06 — Light Grey
08 — White

LEDS

(Left Position) Where Y[1]	(Right or center position) Where Y[2]
0 — No LED	0 — No LED
1 — Red	1 — Red
2 — Green	2 — Green
3 — Yellow	3 — Yellow

	Momentary Gold	Alternate Gold		Momentary Gold	Alternate Gold
	61-101XX00	61-201XX00		61-1A2XX0Y[2]	61-2A2XX0Y[2]
	61-102XX00	61-202XX00		61-105XXY[1]Y[2]	61-205XXY[1]Y[2]
	61-1A1XX0Y[2]	61-2A1XX0Y[2]		61-106XXY[1]Y[2]	61-206XXY[1]Y[2]

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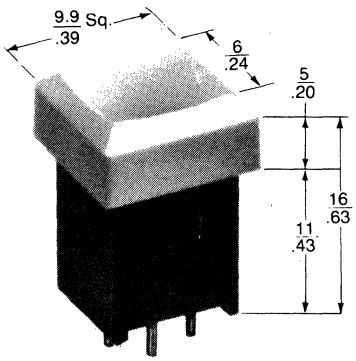
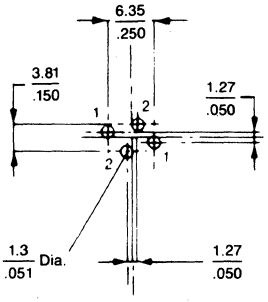
ITW PUSHBUTTON SWITCHES

SERIES 60 DATASWITCH



PCB Pin Layout
(Component Side)



FEATURES:

- Circuitry: SPST-NO momentary
- PCB terminals
- Switch is .39" square
- Square and rectangular buttons; variety of colors
- Designed for flow soldering and automatic cleaning. Solvents must be compatible with 'ABS' and glass-loaded 'Noryl'.
- Legends can be engraved or printed onto switch tops
- Contact Rating: 20 ma-35 VDC

SWITCHES/LED SUPPORT/BUTTONS

Part No.	Description	Color
60-1000	Switch/rectangular button	—
60-2000	Switch/round button	—
60-4001	Button/square*	Black
60-4002	Button/square*	Red
60-4003	Button/square*	Green

*Button caps fit on 60-1000 switch

SERIES 60 PUSHBUTTON KIT

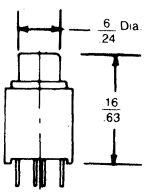
This kit includes 66 switches (2 styles), 144 caps (all colors and sizes) and 60 LED supports which lets you build all possible Series 60 combinations. To order: 60-KIT

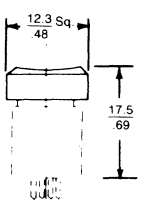
SWITCH WITH ROUND BUTTON



SQUARE CAP

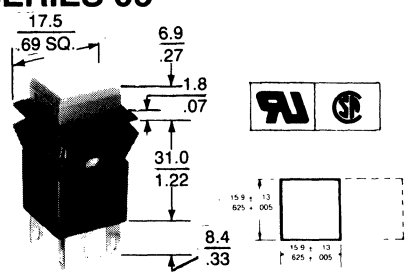






Millimeters
Inches

SERIES 05



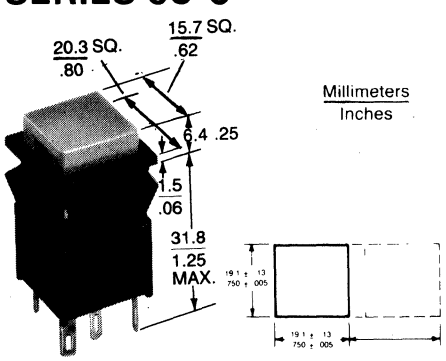
FEATURES

- Single and double pole
- Momentary and maintained action
- Contacts are silver plated
- Lighted & non-lighted LED or T-1¾ wedge base incandescent lamp
- .110 quick disconnect or PC board terminals
- Circuitry options:
  05 — SPST-NO, SPDT, DPST-NO
  05-6 — SPST-NO
- Options include: variety of colored lens caps, hot stamping and pad printing, lens barriers
- Ratings: 05 — 1 amp RES, 125 VAC, UL Recognized and CSA Certified 10 MA @ 5VDC
  05-6 — 1 or 3 amps @ 125 VAC max., available UL Recognized and CSA certified

SWITCHES

Part No.	Lamp Type	Terminal	Circuitry/Action
05-115	Incandescent	.110 QC	SPST-NO/Mom.
05-125	Incandescent	.110 QC	DPST-NO/Mom.
05-135	Incandescent	.110 QC	SPDT/Mom.
05-145	Incandescent	.110 QC	SPDT/Maint.
05-165	Incandescent	PCB	SPST-NO/Mom.
05-215	None	.110 QC	SPST-NO/Mom.
05-235	None	.110 QC	SPDT/Mom.
05-265	None	PCB	SPST-NO/Mom.
05-62125	Incandescent	.110 QC	SPST-NO/Mom.
05-65125	Incandescent	PCB	SPST-NO/Mom.

SERIES 05-6

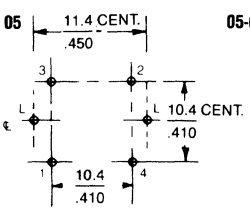


Millimeters
Inches

BUTTONS

Part No.	Lamp Type	Color
80-050007	Incandescent	White
80-050008	Incandescent	Red
80-050009	Incandescent	Green
80-050011	Incandescent	Yellow
80-050014	Incandescent	Clear
80-050602	Incandescent	White
80-050603	Incandescent	Red
80-050604	Incandescent	Green
80-050606	Incandescent	Yellow
86-050017	LED/Red	Black

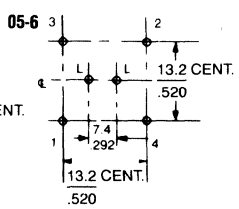
05



All P.C. Board hole sizes 1.0 ± .05 diameter.
.040 ± .002

Panel thickness range .79 mm–2.4 mm (.031"–.093").

05-6



P.C. Board pattern recommended hole size 1.0 ± .05 diameter.
.040 ± .002

PANEL THICKNESS RANGE 1.57–3.18 mm (.062–.125")

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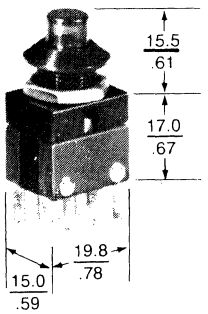
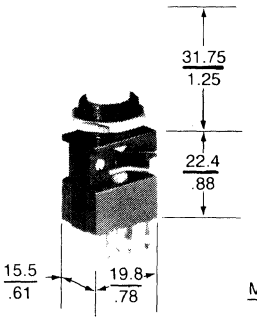
ITW PUSHBUTTON SWITCHES

SERIES 01

01-700



01-768



Millimeters
Inches

FEATURES

- Momentary or Maintained
- 1 or 2 poles
- .110 quick connect terminals
- Illumination: LED, T-1¾ flange base incandescent lamp
- Bushing size: 15/32" or 5/8"
- Ratings: UL–10.1 amps at 125/250 VAC CSA–10.0 amps at 125 VAC
- Series 01-7: One-piece plastic housing
- Assortment of lens cap styles and colors
- Bezel adapter and dress nuts available

BUTTONS/BEZELS/LAMPS

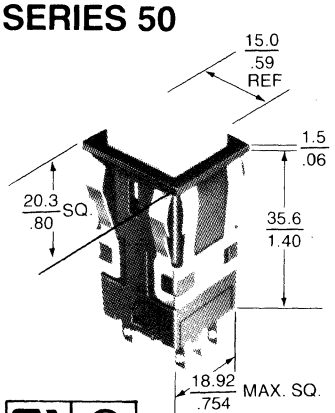
Part Number	Description
01-911411*	¾" square/white
01-911412*	¾" square/red
01-921411	¾" square/white
01-921412	¾" sq/red button
01-941411	¾" rd/white button
01-951912	⅞ × 1⅛/red button
70-2150	Bezel adaptor
80-010085	Screw base lamp, 6V
80-701319	Flat black bezel nut
80-040028	Flange base lamp, 6V
80-040031	Flange base lamp, 28V

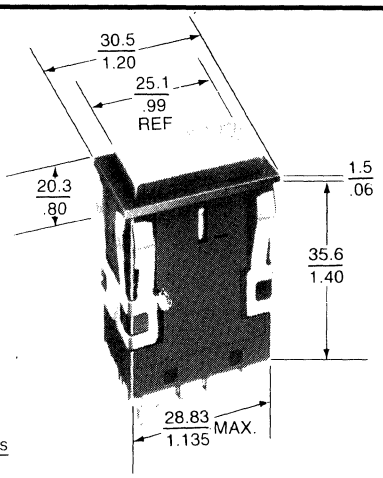
*For 01-748XXX Switch

SWITCHES

Part Number	Bushing	Lamp Type	Contacts	Ckty/Action
01-700152	15/32-32	Red/LED	Silver	SPDT, Form Z/mom
01-748210	15/32-32	screw base	Silver	DPDT, Form C/maint
01-748510	15/32-32	screw base	Silver	SPDT, Form C/mom
01-748610	15/32-32	screw base	Silver	DPDT, Form C/mom
01-768230	5/8-32	flange base	Silver	DPDT, Form Z/maint
01-768610	5/8-32	flange base	Silver	DPDT, Form C/mom

SERIES 50





Millimeters
Inches

FEATURES

- Square, rectangular and indicator only versions available
- LED or T-1¾ wedge base incandescent lamp available
- Circuitry options: SPDT or DPDT
- Gold or silver contacts
- Momentary or maintained action
- Terminals: .110 quick connect or .025 × .025 PC board available
- Panel cutouts: Square–.750"; Rectangular–.750" × 1.141"
- Ratings: UL Recognized File No. E27957 CSA Certified File No. LR42096
- Three button heights available–.19", .32", & .43" high (above front panel)
- Variety of button cap colors
- Optional center and end barriers

BUTTONS/LAMPS

Part No.	Description
50-51C10G	Square, .19, Green
50-51C10R	Square, Red
50-51C10W	Square, .19, White
50-51F10K	Rectangular, Black
50-51F10R	Rectangular, .19, Red
50-51F10W	Rectangular, White
80-011368	Lamp, 6V
80-011367	Lamp, 28V

SWITCHES

Part No.	Lamp Type	Style	Terminal	Circuitry/Action
50-21BBA2AA	None	Square	.110 QC	SPDT/mom
50-21CBA2AA	Incandescent	Square	.110 QC	SPDT/mom
50-21CBA2AD	Incandescent	Square	.110 QC	DPDT/maint
50-21CBA2BA	Incandescent	Square	.110 QC	SPDT/mom
50-21CBA2BB	Incandescent	Square	.110 QC	SPDT/maint
50-21CBA3BA	Incandescent	Square	PCB	SPDT/mom
50-21FBA2AA	Incandescent	Rectangular	.110 QC	SPDT/mom

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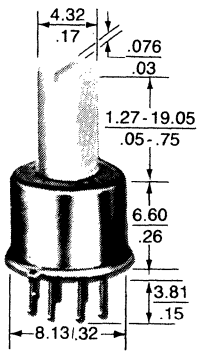
ITW ROTARY SWITCHES

SERIES TO-5 SPASAVER ROTARY



FEATURES

- Subminiature package size (.36" diameter)
- Up to 8 positions at 45° indexing, 1 pole
- Low energy switch contacts (gold over nickel plating)
- Glass to metal sealed header
- 0.025" PC terminals on 0.200" bolt circle
- Shaft diameter 0.172"
- Shaft length 0.31" or 0.44" from PC board
- Contact rating: 500 ma @ 125 VAC
- Life expectancy: in excess of 10,000 operations
- Options available: Vinyl protective boot and plastic knob

ORDERING INFORMATION

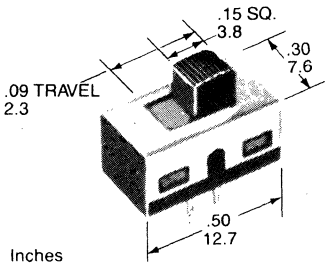
Part Number	Positions	Shaft Length
030-202-018	2	.18"
030-202-030	2	.30"
030-303-018	3	.18"
030-404-005	4	.05"
030-404-018	4	.18"
030-505-005	5	.05"
030-505-018	5	.18"
030-808-005	8	.05"

*Shaft length measures with no bushing. With bushing .30" actuator is flush with top of bushing.

ITW SLIDE SWITCHES

MINI MIKE™

Miniature Snap-Action Slide



FEATURES

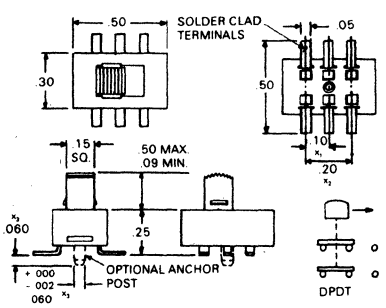
- Available in SPST, SPDT, DPDT, Form Z circuits
- Contacts are hard gold over barrier
- Terminal types—PC, right angle
- Some versions UL recognized
- Various Actuator Lengths
- Temperature range: –40°C to +100°C

Part No.	Circuit	Mount	Height	Color	Rating
023-021-031	SPST	Right Angle PC	.20	Black	1 amp @ 125 VAC
023-021-040	SPST	PC	.20	Black	1 amp @ 125 VAC
023-021-105	SPDT	PC	.20	Black	250 ma @ 30 VDC
023-021-112	SPDT	Panel	.20	Black	250 ma @ 30 VDC
023-021-113	DPDT	Panel	.20	Black	100 ma @ 125 VAC
023-021-114	DPDT	PC	.20	Black	100 ma @ 125 VAC
023-021-304	Form Z	PC	.14	Black	500 ma @ 125 VAC

MR. CLEAN® SMD

Contamination-Free Surface Mounted Slide Switch

Part No. 224-440-020



FEATURES

- Low cost anti-contamination two-piece construction
- Optional anchoring pin insures stability
- Eliminates solder flux and cleaning residue problems
- Designed specifically for surface mount applications
- 24mm tape or tube with terminal bases for automatic insertion
- Compatible with medium size pick and place machines handling standard SOIC and PLCC components
- Conforms to EIA Packaging Spec. #481A
- Glass-filled Ryton base withstands any type IR or VaporPhase processing
- Gold contacts are ideal for high reliability and low energy use

HOW IT WORKS

① Mount lower base half onto P. C. board manually or automatically. Then solder same as other components on board. Clean board in standard manner.

② After board is cleaned and dried—simply snap the clean uncontaminated upper switch half in place—by hand. No tools, special equipment or orientation needed.

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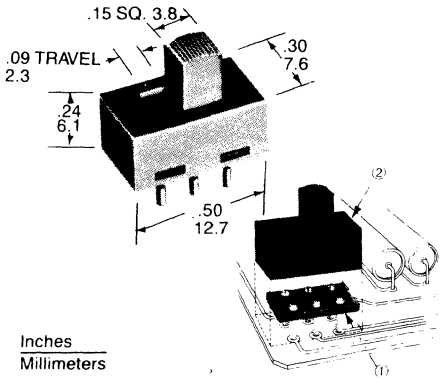
ITW SLIDE SWITCHES

MR. CLEAN®

Wave Solderable, Miniature Slide



FEATURES

- Surface mount version available
- Low cost
- Anti-contamination design
- Unique 2-piece assembly
- Gold contacts
- Insert molded base
- Standard configurations: SPDT, DPDT,
- Life expectancy (mechanical): 10,000 actuations
- Temperature range: – 40°C to + 100°C

Part No.	Circuit	Terminal	Rating
124-240-020	SPDT	PC	250 ma @ 125 VAC
124-440-020	DPDT	PC	250 ma @ 125 VAC

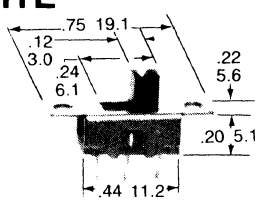
HOW IT WORKS

(1) Insert lower base half into P.C. board by hand or with automatic insertion equipment. Then wave solder same as other components on board. Clean board in standard manner to remove excess flux.

(2) After board is cleaned and dried — simply snap the clean uncontaminated upper switch half in place — by hand. No tools, special equipment or orientation needed.

ECONOMITE®

Miniature Slide



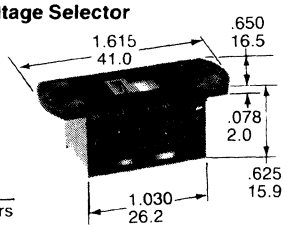
FEATURES

- Available in SPDT, SP 3-position, DPDT
- Choice of actuators and terminals
- Silver plated contacts standard
- Rating: 125 VAC, 12 VDC resistive

Part No.	Circuit	Current	Mounting	Contacts
043-000-132	SP 3 pos	0.3 amp	PC	Silver plated
043-200-227	DPDT	0.5 amp	PC side	Silver plated

SERIES SE

Line Voltage Selector



CEE24

FEATURES

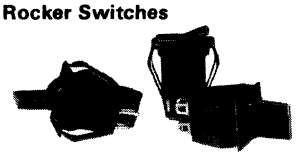
- Variety of terminals
- Top of flush handle stamped to indicate which voltage is selected; various markings available
- Snap-in version available
- Electrical Life: 10,000 cycles
- Handle Height: Flush or 11/32
- International Approvals: UL-CSA-VDE-SEV-SEMKO Designed to meet requirements of CEE Publication 24 and the IEC
- Contact Ratings: UL, CSA & SEV–10 amp 125 VAC; 5 amp 250 VAC
  VDE–4A 125 V ~ 2 (0.5)A 250V ~ T85

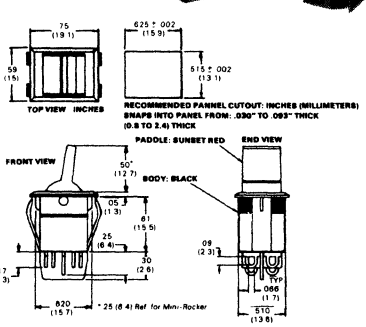
Part No.	Terminals	Dimensions
18-000-0016	Solder	1.615L x .650W x .625H
18-000-0019	Right-angle	1.030L x .650W x .625H
18-000-0022	PC	1.030L x .650W x .625H
18-000-0040	Solder	Snap-in .677 x 1.240 Cutout

ITW ROCKER SWITCHES

SERIES P271/R271

Double-Pole Mini-Paddle and Rocker Switches





FEATURES

- Highly reliable double pole Mini-Paddle or Rocker Switches in the smallest sizes ever
- DPST or DPDT circuits available
- Large diameter solder terminal holes for faster soldering operations
- UL, CSA, VDE and SEMKO approved versions
- Quick and easy snap-in panel mounting
- Fits tiny .625 x .515 panel cutout
- Industry standard paddle and rocker styling and color
- Electrical Ratings

	125 VAC	250 VAC
Paddle	6A	4A
Rocker	5A	3A

ORDERING INFORMATION

□ 271 — 22 □ — □ □ 9

- **Mini-Paddle or Rocker Switch**
  - **P**- Paddle
  - **R**- Rocker
- **Terminal**
  - 2-Solder
- **Paddle or Rocker**
  - 2-Sunset Red
- **Body**
  - 9-Black
- **Circuit Code**
  - 10 DPST On-Off
  - 12 DPDT Maintained
  - 2 Position
- **Non-Lighted**

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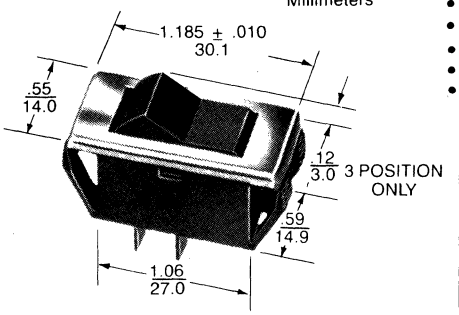
ITW ROCKER SWITCHES

SERIES 16X

Single Pole Lighted and Non-Lighted



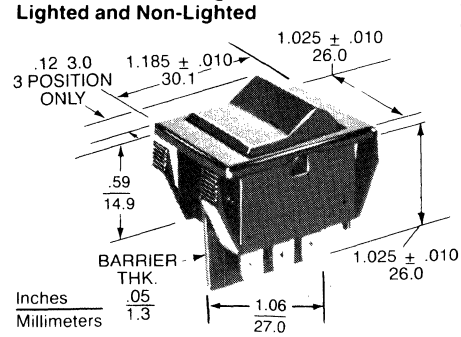
FEATURES

- Snaps into panels from .015″ (0.4) to .125″ (3.2) thick
- Recommended cutout: .48″ (12.2) × 1.08″ (27.4)
- Wide range of circuits, some VDE approved
- Variety of incandescent and neon lamps
- Terminal options — quick connect and solder lugs
- Variety of colors; including custom
- Matte or gloss finish
- Hot stamping & metal bezels
- Matching panel lights available
- Paddle versions available; non-lighted only
- Ratings: UL Recognized and CSA Approved
  - 161 Series: 10A, ½ HP, 125 VAC; 8A, ½ HP, 250 VAC, 10A, 28 VDC
  - 162 Series: 12A, ½ HP, 125 VAC; 10A, ½ HP, 250 VAC, 12A, 28 VDC
  - 163 Series: 16A, ¾ HP, 125 VAC; 12A, ¾ HP, 250 VAC, 16A, 28 VDC

Part No.	Rating	Color		Circuit	Lighted or Non-Lighted
		Rocker	Case		
161-009-009	10A	White	Black	SPST	Non
161-029-004	10A	Red	Black	SPST	Lighted
161-029-006	10A	Red	Black	SPST	Lighted
161-049-006	10A	Amber	Black	SPST	Lighted
161-099-009	10A	Black	Black	SPST	Non
161-099-029	10A	Black	Black	SPDT	Non
163-029-006	16A	Red	Black	SPST	Lighted
163-099-009	16A	Black	Black	SPST	Non

SERIES 17X

Double-Pole and Single-Pole Lighted and Non-Lighted



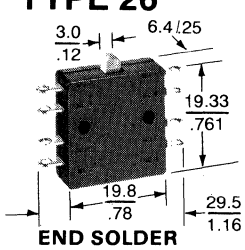
FEATURES

- Snaps into panels from 0.15″ (0.4) to .125″ (3.2) thick
- Recommended cutout: .880″ + .005/ – .000 (22.4) × 1.080″ ± .005 (27.4)
- Wide range of circuits, some VDE approved
- Variety of incandescent and neon lamps
- Terminal options — quick connect and solder lugs
- Variety of colors; including custom
- Hot stamping & metal bezels
- Matching panel lights available
- Paddle versions available; non-lighted only
- Ratings: UL Recognized and CSA Approved
  - 171 Series: 10A, ½ HP, 125 VAC; 8A, ½ HP, 250 VAC, 10A, 28 VDC
  - 172 Series: 12A, ½ HP, 125 VAC; 10A, ½ HP, 250 VAC, 12A, 28 VDC
  - 173 Series: 16A, ¾ HP, 125 VAC; 12A, ¾ HP, 250 VAC, 16A, 28 VDC

Part No.	Rating	Color		Circuit	Lighted or Non-Lighted
		Rocker	Case		
171-029-109	10A	Red	Black	SPST	Non
171-099-109	10A	Black	Black	SPST	Non

ITW BASIC SNAP-ACTION SWITCHES

TYPE 26



FEATURES

- DPDT-DB (Form ZZ) contact arrangement
- Provides the option of controlling up to 4 isolated circuits
- May be wired externally to provide two commons to form standard DPDT (Form CC) switch
- Standard contacts are fine silver or gold plated
- End or side solder terminals
- Variety of actuators available
- Ratings: UL Recognized File No. E27957 8 Amps @ 125/250 VAC 75–80% PF
- 26-888051 and 26-988051 meets requirements of MIL-S-8805/77

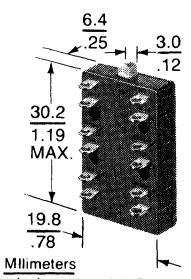
MECHANICAL CHARACTERISTICS

Pretravel: .050 max. Overtravel: .012 min. Operating Force: 12 ± 4 oz.
Release Force: 5 oz. min. Movement Differential: .020 + .010 – .005

Part No.	Circuitry	Simultaneity	Contact Material	Terminal
26-804	DPDT-DB (Form ZZ)	Simultaneous*	Silver	End Solder
26-904		Simultaneous*	Silver	Side Solder
26-888051		Ref. M 8805/77-001	Gold Plated	End Solder
26-988051		Ref. M 8805/77-002	Gold Plated	Side Solder

*Within .004″ of plunger travel

TYPE 36



FEATURES

- Uses three momentary double-break Butterly® switching mechanisms; 3PDT-DB Form ZZZ
- Standard contacts are fine silver
- End terminals
- Variety of actuators available
- Ratings: UL Recognized File No. E27957 7.5 Amps @ 125/250 VAC 75-80% PF
- Meets requirements of MIL-S-8805/78

MECHANICAL CHARACTERISTICS

Pretravel: .050 max.
Overtravel: .012 min.
Operating Force: 16 ± 4 oz.
Release Force: 4 oz. min.
Movement Differential: .020 ± .010

Part No.	Circuitry	Simultaneity	Contact Material	Terminal
36-604	3 PDT-DB (ZZZ)	Simultaneous*	Silver	End Solder

*Within .004″ of plunger travel

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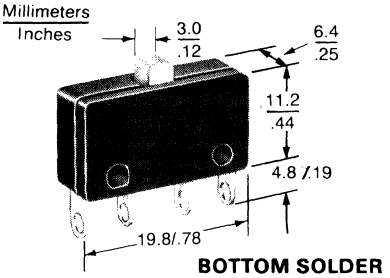
ITW BASIC SNAP-ACTION SWITCHES

TYPE 16



BOTTOM SOLDER

MIL Spec

FEATURES

- Features the Butterfly® double-break momentary mechanism
- Wide variety of terminal configurations and styles
- Gold plated or silver contacts standard
- Variety of actuators available
- Ratings: UL Recognized at 10.1 Amps @ 125/250 VAC; CSA Certified at 10.1 Amps @ 125/250 VAC
- 16-188051 meets requirements of MS25476-1; 16-388051 meets requirements of MS27217-2; 488051 meets requirements of MS27217-1

ELECTRICAL RATINGS @ 28 VDC

		Sea Level	70,000 Feet
Form C 2 Circuit	Res.	10	10
	Ind.*	3	1.5
	Lamp	3	—
Form Z 2 Circuit	Res.	10 Amps	10 Amps
	Ind.*	5 Amps	2 Amps
	Lamp	3 Amps	—

*L/R = .026

Pretravel: .050 max.
Overtravel: .012 min.
Operating Force: 5 oz. + 3 oz. – 2 oz.
Release Force: 2 oz. min.
Movement Differential: .020 ± .005
Movement Differential Type 16-403 Only: .012 ± .005

SPECIFICATIONS

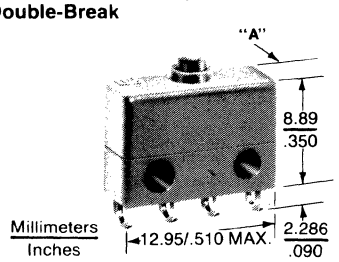
Part Number	Circuit	Temperature Index	Contacts: Fine Silver	Contacts: Gold Plated	Terminal
16-104	SPDT Form Z	To 275°F Ambient	X		End Solder
16-1042		To 400°F Ambient	X		
16-188051		Ref. MS 25476-1		X	

Part Number	Circuit	Temperature Index	Contacts: Fine Silver	Contacts: Gold Plated	Terminal
16-204	SPDT Form Z	To 275°F Ambient	X		End, Screw
16-304		To 275°F Ambient	X		Side Solder
16-388051		Ref. MS 27217-2		X	
16-4034	SPDT Form C	To 275°F Ambient	X		Bottom Solder

Part Number	Circuit	Temperature Index	Contacts: Fine Silver	Contacts: Gold Plated	Terminal
16-4044 16-40441	SPDT Form Z	To 275°F Ambient	x	x	Bottom Solder
16-40421		To 400°F Ambient		x	
16-488051	SPDT-DB Form Z	Ref. MS 27217-1		x	
16-5044	SPDT Form Z	to 275°F Ambient	x		Bottom, O.C. Taper Tab

TYPE 18

Sub-Miniature, 7 Amp Double-Break



MECHANICAL CHARACTERISTICS

Operating Force: 5 +3 oz. – 2 oz.
Release Force: 1½ oz. min.
Pretravel: .030 max.
Overtravel: .006 min.
Movement Differential: .015 ± .005

MIL Spec

FEATURES

- Single-pole, double-break
- Utilizes Butterfly® double-break mechanism
- Gold plated contacts, solder lug or PC terminals are standard
- 18-488051 meets requirements of MIL-S-8805/76
- Ratings: UL Recognized File No. E27957, 7 Amps 125/250 VAC 75–80% PF

CHARACTERISTICS

"A" Dimension	Electrical Rating	Current	Pretravel	Over-Travel	Operating Force	Release Force	Movement Differential
3.96 +0.00 −0.13 / .156 +.000 −.003	Form X or Y	7 amps 125/250 VAC 8 amps 28 VDC IND 4 amps 125/250 VAC	0.89 / .035 Max.	0.15 / .006 Min.	142 +85 −57 Grams / 5 +3/2 oz.	42 gm. Min. / 1.5 oz	0.46 ± 0.20 / .018 ± .008
	Form Z	3 amps 28 VDC IND					
5.08 / .200	Single Ckt Form Z	8 amp. RES. 7 amp IND. 28 VDC	.030 Max.	.006 Min.	5 +3/2 oz.	1½ oz. Min.	.015 ± .005
	2-Circuit Form Z	5 amp RES. 3 amp IND. 28 VDC					

SPECIFICATIONS

Part No.	Contact Arrangement	Contacts	Terminals	"A" Dimension
18-40421	SPDT-DB Form Z	Gold Plated	Solder Lug	5.08 / .200
18-488051 (MS27257-1)	SPDT-DB Form Z	Gold Plated	Solder Lug	5.08 / .200

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ITW BASIC SNAP-ACTION SWITCHES

ACTUATORS FOR TYPE 16, 26, 36

NOTE: Characteristics may vary depending on type of basic switch used in assembly

Actuator P/N & Style	Switch Series	Oper. Force	Release Force	Pretravel	Over-travel	Movement Diff.
76-1200 Roller Lever	16	4 oz max	1 oz min	.125 max	.025 min	.045 ± .011
	26	8 oz max	1½ oz min	.130 max	.025 min	.054 ± .022
	36	12 oz max	1½ oz min	.125 max	.025 min	.055 ± .022
76-1203 Roller Lever	16	2.5 oz max	1 oz min	.125 max	.025 min	.045 ± .011
76-1210 Lever	16	2.5 oz max	1 oz min	.125 max	.025 min	.047 ± .013
	26	7 oz max	2 oz min	.155 max	.025 min	.065 max
	36	9 oz max	2 oz min	.155 max	.025 min	.065 max
76-1220 Short Roller Lever	16	5 + 3 oz − 2 oz min	2 oz min	.050 max	.023 min	.020 ± .005
	26	16 oz max	5 oz min	.050 max	.012 min	.020 + .010 − .005
	36	16 ± 4 oz	4 oz min	.050 max	.012 min	.020 + .010 − .005
76-1420 Long Lever	16	1.5 oz max	10 grams min	.312 max	.080 min	.135 ± .035
	26	2½ oz max	½ oz min	.450 max	.030 min	.200 max
	36	3½ oz max	½ oz min	.450 max	.030 min	.200 max

ACTUATOR FOR TYPE 18

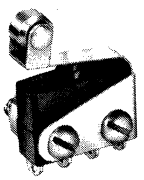


78-3000

78-3000 Spring Lever Actuator. Integral with Mounting Bracket.

MECHANICAL CHARACTERISTICS

Pretravel:	.125″ max.
Overtravel:	.030″ min.
Movement Differential:	.030 ± .015
Operating Force:	6 ± 2 oz.
Release Force:	2 oz. min.
Operating Point:	.325 ± .030



78-3100

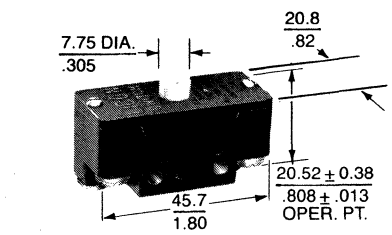
78-3100 Pivot Roller. For cam and slide operation.

MECHANICAL CHARACTERISTICS

Pretravel:	.125″ max.
Overtravel:	.030″ min.
Movement Differential:	.035 ± .015
Operating Force:	6 ± 2 oz.
Release Force:	2 oz. min.
Operating Point:	.560 ± .030

TYPE 14

20 Amp, Double-Break



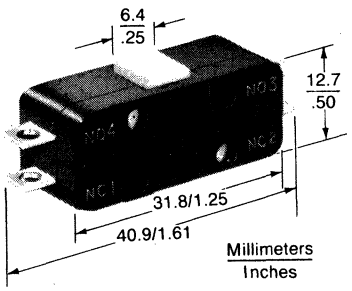
FEATURES

- Designed to handle loads up to 20 amps
- Features Butterly® double-break mechanism
- Available in standard and heavy duty mounting, with basic button, overtravel plunger or pivoted lever actuators
- Sealed button version also available
- Semirefractory contacts and offset #6 screw type terminals with cup washers are standard
- Ratings: UL Recognized File No. E27957, 20 Amps @ 125/250/480 VAC. 75-80% PF; CSA Certified No. 16388, 1 HP, 125 VAC, 2 HP 250 VAC

Part No.	Circuitry	Mounting	Terminal	Operating Force	Release Force	Pre-Travel	Over-Travel	Standard Movement Differential	Operating Point	Actuator Style
14-124	SPDT-DB Form Z	Standard	#6 Screw with Cup Washer	12 ± 3 oz.	4 oz. Min.	.074 Max.	.030 Min.	.020 ± .007	.808 ± .013	Standard Button Actuator
14-324	SPDT-DB Form Z	Standard		12 ± 3 oz.	4 oz. Min.	.074 Max.	.219 Min.	.020 ± .007	.830 ± .036	Overtravel Panel Mount
14-724	SPDT-DB Form Z	Standard		5 ± 2 oz.	2 oz. Min.	.156 Max.	.060 Min.	.046 ± .012	1.406 ± .031	Roller Lever Actuator
14-72403	SPDT-DB Form Z	Mounting Plate	—	5 ± 2 oz.	57 grams Min.	.165 Max.	.060 Min.	.046 ± .017	1.406 ± .034	Roller Lever

TYPE 11

Miniature, 10 Amp, Double-Break



FEATURES

- Available in standard and low force momentary action, as well as reset action
- Fine silver contacts are standard; Gold plated contacts also available
- Wide variety of terminals and actuators
- Ratings: UL Recognized File No. E27957; CSA File No. 16388

ELECTRICAL CHARACTERISTICS

Circuity	125/250 VAC	28 VDC
SPST-DB N.C. (Form Y) or N.O. (Form X)	10 amp (75-80% PF) ½ HP 125 VAC ¾ HP 250 VAC	10 amp IND. 15 amp RES.
SPDT-DB (Form Z)		
SPDT-SB (Form C)		4 amp IND. 6 amp RES.

SPECIFICATIONS

Part No.	Circuit	Terminal
11-102	SPST-DB N.O. (Form X)	End Solder
11-104	SPDT-DB (Form Z)	End Solder
11-204	SPDT-DB (Form Z)	#4 Screw
11-304	SPDT-DB (Form Z)	Side Solder
11-314	SPDT-DB (Form Z) Reset	Side Solder
11-504	SPDT-DB (Form Z)	Quick Disconnect .250

MECHANICAL CHARACTERISTICS

Pretravel: .050 max.
Overtravel: .015 min.
Operating Force: 8 ± 3 oz.
Release Force: 4 oz. min.
Movement Differential: .020 ± .007

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ITW BASIC SNAP-ACTION SWITCHES

ACTUATORS FOR TYPE 11

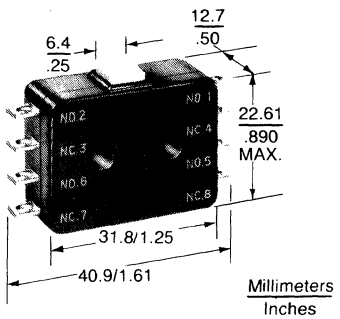
ACTUATORS MECHANICAL CHARACTERISTICS**

Part No.	Actuator	Operating Force	Release Force	Pre-Travel	Over-Travel	Movement Differential	Operating Point
71-1040	Roller Lever	3.5 oz. Max.	2 oz. Min.	.093 Max.	.062 Min.	.030 .015	.671 ± .031
71-2010	Over Travel	8 oz. ± 3 oz.	4 oz. Min.	.050 Max.	.215 Min.	.020 .005	.828 ± .015

**Mechanical characteristics when used with Basic Switch 11-104

TYPE 22

Miniature 10 Amp, Double-Break



FEATURES

- Contains two individual switching elements which function simultaneously (within .004" of plunger travel)
- Fine silver contacts are standard; Gold plated contacts also available
- Wide variety of terminals styles and actuators
- Ratings: UL Recognized File No. E27957, 10 Amps @ 125/250 VAC, 75-80% PF ½ HP @ 125 VAC, ¾ HP @ 250 VAC

ELECTRICAL CHARACTERISTICS

Circuity	Voltage	Current
DPST-DB N.O. or N.C. (Form XX or YY)	28VDC	15 amp RES. 10 amp IND.
DPDT-DB (Form ZZ)	28VDC	10 amp RES. 7 amp IND.

SPECIFICATIONS

Part No.	Circuit	Terminal
22-104	DPDT-DB (Form ZZ)	End Solder
22-204	DPDT-DB (Form ZZ)	#4 Screw
22-304	DPDT-DB (Form ZZ)	Side Solder
22-504	DPDT-DB (Form ZZ)	¼" Quick Disconnect

MECHANICAL CHARACTERISTICS

Pretravel: .060 max.
Overtravel: .015 min.
Operating Force: 17 ± 5 oz.
Release Force: 4 oz. min.
Movement Differential: .030 ± .009
Terminals: Solder (side or end)
#4 screw ¼" quick disconnect

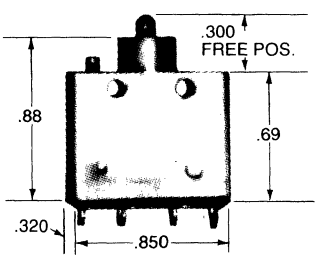
ACTUATORS–MECHANICAL CHARACTERISTICS*

Part No.	Actuator	Operating Force	Release Force	Pre-Travel	Over-Travel	Movement Differential	Operating Point
72-2080	Over Travel (2)* Plunger	17 ± 5 oz.	4 oz. Min.	.060 Max.	.215 Min.	.030 ± .007	.828 .031

(1)* when used with 22-104 Basic Switch or 22-204 Basic Switch
(2)* when used with 22-304 Basic Switch

ITW SEALED SWITCHES

TYPE 65



MIL Spec

FEATURES

- Ratings up to 15 amps resistive @ 28 VDC
- Provides the ruggedness and reliability to meet demands of industrial & military applications
- Available with variety of basic switches: Type 11, Type 16, Type 22
- Meets the (watertight) requirements per MIL-S-8805 enclosure design symbol 3
- Wide choice of circuitry, actuators and mountings
- Optional electrical connections—solder, quick disconnect or screw terminals
- Wire leads with or without connectors or plugs
- Temperature range for standard units −65°F to +185°F

SUBMINIATURE SEALED SWITCHES
(SOLDER LUG TERMINALS STANDARD)

Part No.	Actuator	Circuitry	P.T.	O.T.	O.F.	R.F.	M.D.
65-2010	Pin Plunger	SPDT-DB Form Z	.050 max.	.012 min.	24 ± 8 oz.	8 oz. min.	.010–.030
65-3010	Roller Lever	SPDT-DB Form Z	.120 max.	.025 min.	16 oz. max.	5 oz. min.	.058 max.
65-4010	Over Travel	SPDT-DB Form Z	.070 max.	.187 min.	2 ¼ lb. max.	8 oz. min.	.020 ± .010

Electrical Ratings: 5A IND — 28 VDC 5A RES — 125, 250 VAC

MINIATURE SEALED SWITCHES

Part No.	Actuator	Circuitry	P.T.	O.T.	O.F.	R.F.
65-430098	Over Travel	SPDT-DB Form Z	.070 max.	.140 min.	6 lb. max.	1.8 lb. min.

Electrical Ratings: 7.5A IND, 15A RES — 28VDC 10A RES — 125, 250 VAC

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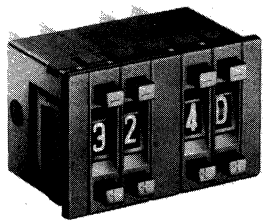
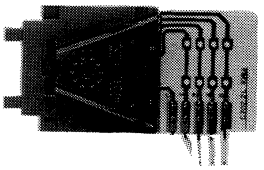
Pushwheel Switches



Front mount
Models C002,C003,C005,C006



Rear mount
Models C022,C055,C077,C088

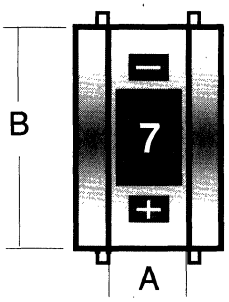


Right angle
Models C222,C777

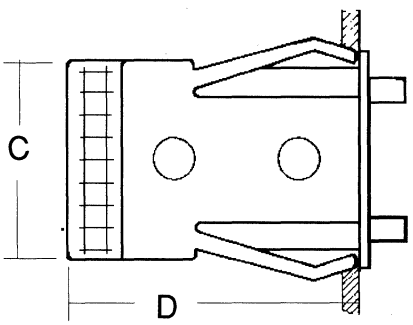
The snap-together design allows configuring custom combinations in seconds.
Switches can also be combined with modular LED displays.

call or send for free Design Guide

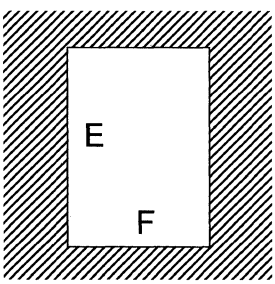
Front View



Side View

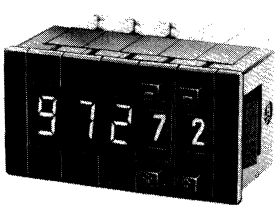


Panel Cutout



Model	Dimensions *(all dimensions are in mm)*					
front m	A	B	C	D	E	F
C002	7.62	15.0	14.0	24.0	14.0	n x 7.62 +3.2
C003	7.62	24.0	22.0	32.0	22.5	n x 7.62 +3.5
C005	10.0	33.0	30.5	38.5	31.0	n x 10.0 +10.5
C006	8.0	33.0	30.5	38.5	31.0	n x 8.0 +8.5
rear m.						
C022	7.62	15.0	14.0	24.0	14.0	n x 7.62 +3.2
C055	10.0	30.5	30.5	38.5	30.5	n x 10.0 +20
C077	8.0	18.0	24.0	35.4	19.0	n x 8.0 +16
C088	8.9	25.4				
right a.						
C222	7.62	15.0	14.0	34.5	14.0	n x 7.62 +3.2
C777	8.0	24.0	24.0	44.4	19.0	n x 8.0 +16

Switch / Display combination



IVO *INDUSTRIES*

201 Industrial Way West
Eatontown, NJ 07724

Tel. (800) 932-0489
Tel. (908) 542-5151
Fax (908) 542-2938

Price List for Pushwheel Switches

Model	C002	C022	C222	C003	C005	C055	C006	C077	C777	C088
$ Price each	**4.25**	**4.25**	**5.65**	**4.70**	**5.30**	**5.30**	**5.30**	**4.70**	**6.50**	**5.30**
Options:										
Long circuit board.	0.40	0.40	incl.	0.50	0.70	0.70	0.70	0.50	incl.	0.70
Diodes installed.....	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Resistors installed.....	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70
Stop pins installed.....	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Pc-board pins.....	1.00	1.00	incl.	1.00	1.00	1.00	1.00	1.00	incl.	1.00
Hexadecimal code.....	n/a	n/a	n/a	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Gold plating.....	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Accessories:										
Side plates (ZS).....	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Connector (ZF).....	2.20	2.20	2.20	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Spacer (ZM).....	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Blank housing (ZB)....	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Blank housing 1 LED..	n/a	n/a	n/a	5.00	6.00	6.00	6.00	5.00	5.00	n/a
Blank housing 2 LED's	n/a	n/a	n/a	6.50	6.50	6.50	6.50	n/a	n/a	n/a

Note: Prices may change without notice. Minimum order level: $ 50.00. For OEM quantities call IVO.

Part # code example

C 003 .002 K S 1 A

Pushwheel
codeswitch
Model
e.g. 003
Codes
001 = Decimal 0-9
002 = BCD
003 = + / -
004 = BCD complement
005 = BCD+ complement
007 = Hexadecimal
009 = 0 2 4 6 8
018 = BCD make-before-break
Circuit board
K = short, solder tinned *(standard)*
L = long, solder tinned
H = short, gold plated
N = long, gold plated
U = long, solder tinned, with interrupted traces (for inst. diodes,resistors,etc.)
Connection method
S = plug in *(standard)*
N = plug in, diode neg. connection
P = plug in, diode pos. connection
L = pc-board pin
C = pc-board pin, diode neg. connection
D = pc-board pin, diode pos. connection
Housing color
1 = black *(standard)*
2 = grey
Wheel color
A = white figures on black wheel *(standard)*

Switches are also available as:

- ***Kelvin Varley Decades***
- ***Resistance Decades***
- ***Comparators***
- ***Custom Assemblies***

Other IVO products include:

- ***Modular LED Displays***
- ***Annunciator Displays***
- ***Counters***
- ***Encoders***
- ***Tachometers***
- ***Hour Meters***
- ***Timers***
- ***Proximity Switches***

call or send for free Design Guide

IVO *INDUSTRIES*

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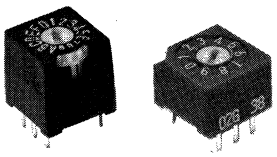
Fax (908) 542-2938

JAE Electronics, Inc.
142 TECHNOLOGY DRIVE, SUITE 100,IRVINE, CA 92718-2401
TEL: 800/JAE-PART (523-7278) • IN CA. 714/753-2600 • FAX: 714/753-2699

ROTARY DIP SWITCHES 41J/42J SERIES



SPECIFICATIONS:

No. of switching positions: 10, 16 positions • **Life:** 10,000 detent operations min. • **Operating force:** 300 g-cm max. at rotor center • **Operating temperature range:** −10°C to +60°C • **Storage temperature range:** −25°C to +75°C • **Max. recommended non-switching load:** 100 mA at 50 VDC • **Max. recommended switching load** • 100 mA at 5 VDC • **Dielectric withstanding voltage:** • 200 Vrms for one minute • **Insulation resistance:** 1000 megohms min. • **Switch circuit resistance:** 100 milliohms max. (10 mA 5 VDC) • **Weight:** 1 gram (Approx.) • **Materials: Housing:** Nylon; **Contact:** Phosphor bronze, gold over nickel; **PC disk:** Glass epoxy, gold over nickel • **Dielectric withstanding voltage:** 250 Vrms for one minute • **Weight:** 0.9 gram (Approx.).

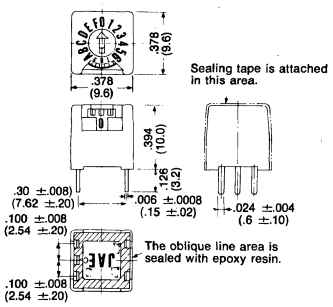
SWITCH MODEL No.:

Model No.	Code Description	Rotor Color	No. of Positions	Truth Table
41J02G	BCD 1-2-4-8	Orange	10	B02
41J12G	BCD 1-2-4-8 Complement	Yellow	10	C12
41J34G	Binary 1-2-4-8, 1 ~ 9, A ~ F Marking	Orange	16	B07
41J41G	Binary 1-2-4-8, 1 ~ 9, A ~ F, Marking Complement	Yellow	16	C16

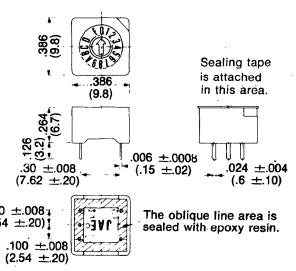
Model No.	Code Description	No. of Positions	Housing Color	Rotor Color	Truth Table
42J02G	BCD 1-2-4-8	10	Blue	Orange	B02
42J12G	Binary 1-2-4-8 Complement	10	Blue	Yellow	C12
42J34G	Binary 1-2-4-8	16	Black	Orange	B07
42J41G	BCD 1-2-4-8 Complement	16	Black	Yellow	C16

OUTLINE DIMENSIONS INCHES (mm)

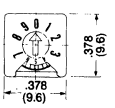
41J — 16 POSITION



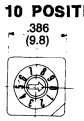
42J — 16 POSITION



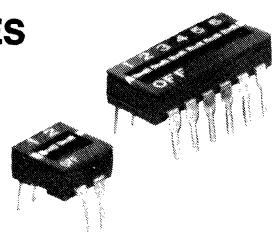
10 POSITION



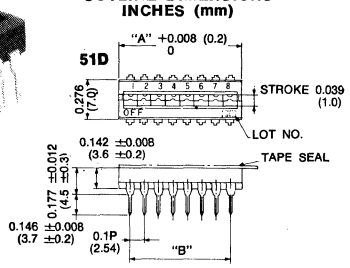
10 POSITION



SLIDE-DIP SWITCHES 5*D SERIES



OUTLINE DIMENSIONS INCHES (mm)



FEATURES

- Low profile slide-DIP switch
- Conforms to TO-116 standard IC packages (51D and 52D)
- Machine-insertable with standard automatic insertion equipment
- Recessed actuator types (51D), raised actuator types (52D) and right angle types (53D) available for virtually all applications
- Factory-sealed with removable, heat-resistant polyester tape to withstand automatic solder and cleaning processes

ORDERING INFORMATION

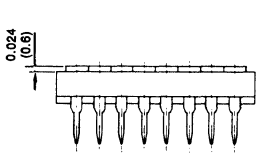
XXD-XX XX

51D: Recessed actuator type
52D: Raised actuator type
53D: Right angle type

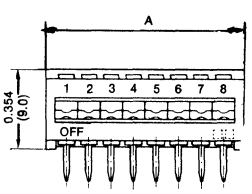
Number of poles: 02-10

Blank: Without seal tape (51D and 52D)
Bottom ON without seal tape (53D)
01: With seal tape (51D and 52D)
Bottom ON with seal tape (53D)
02. Bottom OFF without seal tape (53D)
03: Bottom OFF with seal tape (53D)

For other requirements, consult JAE.

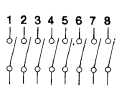


52D

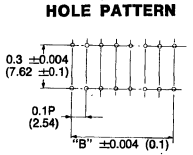


53D

CIRCUIT



HOLE PATTERN



SPECIFICATIONS:

Number of poles: 2-10 • **Contact Rating: Switching Load:** 100 mA at 50 VDC max. • **Non-switching Load:** 100 mA at 5 VDC max. • **Minimum Switching Load:** 10A at 5 VDC min. • **Contact Resistance:** 100 MΩ at 1mA, 5 VDC max. • **Insulation Resistance:** 1000 MΩ at 100 VDC • **Dielectric Withstanding Voltage:** 500 VDC for 1 minute • **Operating Force:** 600g max. **Resistance to Soldering Heat: Solder Bath:** 260°C, 10 sec. • **Hand Solder:** 350°C, 3 sec. • **Solderability:** 235°C, 2 sec. • **Operating Temperature Range:** −25°C-+70°C • **Storage Temperature Range:** −40°C-+85°C • **Life:** 2000/pole min. • **Materials:** Contact: Phosphor bronze, gold over nickel • **Actuator:** Nylon 94HB • **Housing:** PBT 94V-0.

STATION	2	3	4	5	6	7	8	9	10
A	0.263 (6.68)	0.363 (9.22)	0.463 (11.76)	0.563 (14.30)	0.663 (16.84)	0.763 (19.38)	0.863 (21.92)	0.963 (24.46)	1.063 (27.00)
B	0.1 (2.54)	0.2 (5.08)	0.3 (7.62)	0.4 (10.16)	0.5 (12.70)	0.6 (15.24)	0.7 (17.78)	0.8 (20.32)	0.9 (22.86)

JAE
JAE Electronics, Inc.
142 TECHNOLOGY DRIVE, SUITE 100,IRVINE, CA 92718-2401
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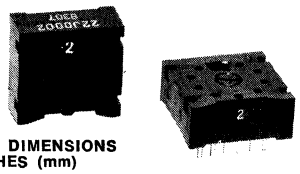
DIGITAL THUMBWHEEL SWITCHES 22J SERIES



SPECIFICATIONS:

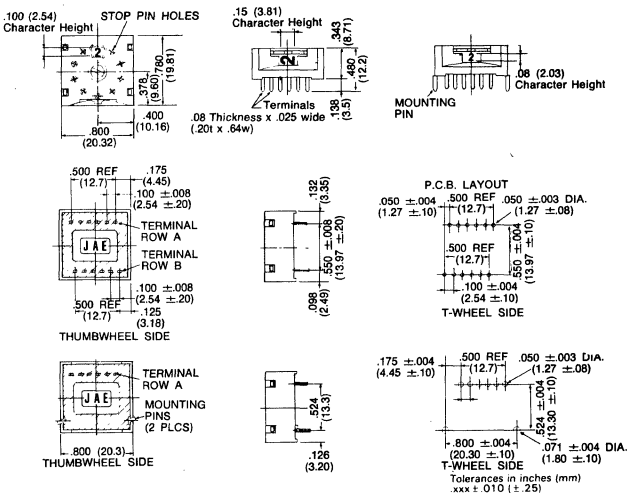
No. of switching positions: 10 positions • **Life:** 250,000 detent • **Operating force:** 400g (max.) • **Operating temperature range:** −25°C to +70°C • **Storage temperature range:** −40C° to +100°C • **Dielectric withstanding voltage:** 500 Vrms for one minute • **Insulation resistance:** 1000 megohms (100 VDC) • **Switch circuit resistance:** 0.100 ohms max. initial; 0.200 ohms max. after life test • **Weight:** 3 grams (Approx.) • **Standard color:** Black • **Electrical ratings: Max. recommended non-switching load:** 3A at 28 VDC; **Max. recommended switching load:** 0.125A at 28 VDC; **Min. recommended switching load:** 10 μA at 0.020 VDC • **Materials: Housing:** Black nylon; **Metal contacts:** Phosphor bronze for spring, gold over nickel; **Circuit disk:** Glass, epoxy, gold over nickel; **Dummy pin:** Tin-plated phosphor bronze.

SWITCH MODEL No.:

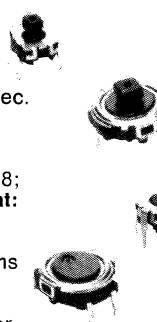
Model No.	Code Description	Number of Positions
22J**01G	DECIMAL	10
22J**02G	BCD 1-2-4-8	10
22J**12G	BCD 1-2-4-8 Complement Only	10
22J**28G	BCD 1-2-4-8 with Complement	10
22J**56G	BCD 1-2-4-8 with Separate Common To Not True Bits	10
22J**11G	2 Pole Repeating + and −	10

** To complete model number, replace ** with Orientation Number.

OUTLINE DIMENSIONS INCHES (mm)



TACTILE-PUSH SWITCHES 61/62T SERIES

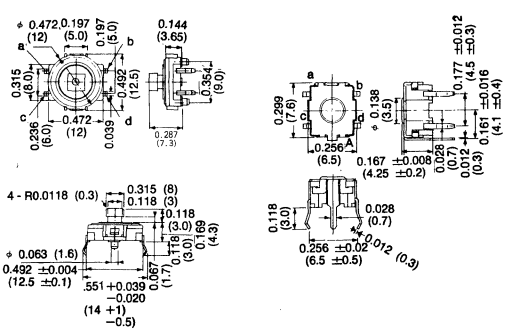


SPECIFICATIONS:

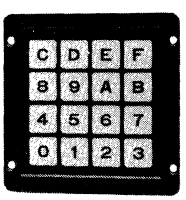
No. of switching positions: 62T Series: SPST Momentary • **Max. recommended switching load: 61T Series:** 30 mA at 12 VDC • **Min. recommended switching load:** 0.1 mA 5 VDC • **Contact bounce: 61T Series:** 4 msec. max.; **62T Series:** 10 msec. max. • **Contact resistance:** 100m ohms max. at 1 mA 5 VDC • **Insulation resistance:** 100 meg ohms min. at 250 VDC • **Dielectric withstanding voltage:** 250 Vrms for one minute • **Operating force/Stroke: 61T Series:** 140 ±30g/0.010 ~ 0.018; **62T Series:** 110 30g/0.010 ±0.004 • **Resistance to solder heat:** Solder bath 260°C 5 sec.; Hand solder 350°C 3 sec. • **Solderability:** Solder bath 230°C 2 sec.; Hand solder 230°C 6 sec. • **Shock: 61T Series:** 20G. 11 ms; **62T Series:** 50G. 11 ms • **Operating temperature range:** −25°C ~ +70°C • **Storage temperature range:** −40°C ~ +80°C • **Life: 61T Series:** 1.000.000; **62T Series:** 300.000 • **Materials: Contact:** Phosphor bronze, silver; **Pusher:** 15% GF PBT; **Housing:** 15% GF PBT.

OUTLINE DIMENSIONS INCHES (mm)

61 T SERIES **62 T SERIES**



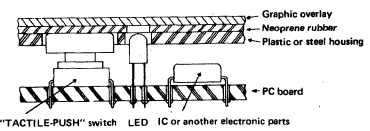
PANEL SWITCHES FP5 SERIES



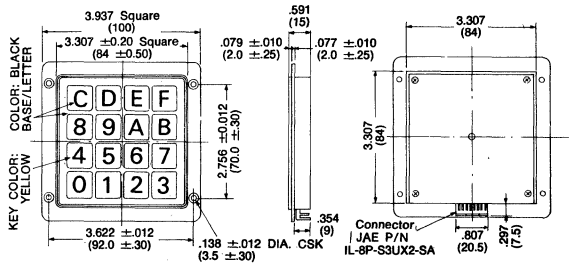
SPECIFICATIONS:

No. of switching positions: 1 SPST • **Life:** 1,000,000 cycles per key • **Contact ratings:** 300 mA, 12 VDC • **Contact resistance:** 1 ohm max. • **Contact bounce:** 4 millisecond max. • **Key travel:** 0.3 to 0.5mm (0.01 to 0.02) • **Key operating force:** 150 ±40g • **Insulation resistance:** 100 megohms min. at 100 VDC • **Dielectric withstanding voltage:** 250 Vrms for 1 minute • **Operating temperature range:** −30°C to +70°C • **Storage temperature range:** −40°C to +80°C.

STRUCTURE:

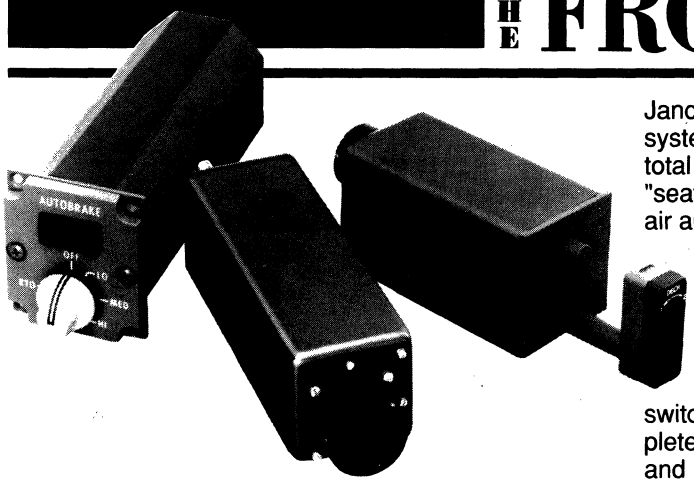


OUTLINE DIMENSIONS INCHES (mm)



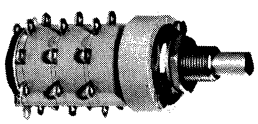
FOR COMPLETE ORDERING INFORMATION CONSULT FACTORY

THE FRONT LINE IN



Janco MIL Spec, QPL rotary switches and switching systems are engineered for maximum reliability. This total dedication to quality has earned Janco switches a "seat" on virtually every commercial, space, and military air and spacecraft in the free world. These two pages provide basic specifications for Janco's five extensive families of standard rotary switches –all extensively field proven for critical applications. Working from these proven technologies, Janco engineers can easily customize a switch optimum for your application. Or for more complex switching functions, Janco can design and build complete switching systems that combine multiple switching and related electromechanical functions while decreasing component count, weight, and overall system size.

SERIES A



Miniature Rotary Selector Switches

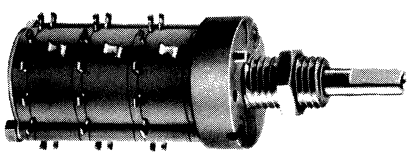
- Built to MIL-S-3786
- Life 10,000 Cycles
- Carry 10 Amp Continuous
- Make & Break 2-5 Amp Res. 115VAC/28VDC
- Torque to 5 In. Lbs.
- M Series QPL to MIL-S-3786/4

Index	Positions	Poles/Deck
15°	24	1,2,3,4,6
20°	18	1
22.5°	16	1,2,4
30°	12	1,2,3,4,6
36°	10	1,2
45°	8	1,2
60°	6	1
90°	4	1

SERIES AA

Designed for Maximum versatility, Series AA switches feature Series A configuration and performance with adjustable stops.

SERIES B

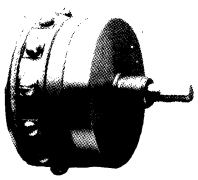


Micro-Miniature Rotary Selector Switches

- Built to MIL-S-3786
- Life 10,000 Cycles
- Carry 8 Amp Continuous
- Make & Break .25 Amp Res. 115VAC/28VDC
- Torque to 2 In. Lbs.
- M Series QPL to MIL-S-3786/13

Index	Positions	Poles/Deck
30°	12	1,2,3
36°	10	1,2
45°	8	1,2

SERIES C



Power Rotary Switches

- Built to MIL-S-6807
- Life 10,000 Cycles
- Carry 15 Amp Continuous
- Make & Break 5-10 Amp Res. 115VAC/28VDC
- Screw Terminals Only
- Torque to 8 In. Lbs.

Index	Positions	Poles/Deck
22.5°	16	1
30°	11	1,3
36°	9	1
45°	7	1,2
90°	4	1,2

TYPICAL APPLICATIONS OF JANCO SWITCHES

- ❑ E.C.M. System Switch, Instrumentation Console
- ❑ Windscreen Wiper Switch
- ❑ Fire Control Unit
- ❑ Engine Fire Shut Off Switch
- ❑ Tank Turret Sight Control Switch
- ❑ NVIS Green Lighting (Night Vision Imaging System)
- ❑ Temperature Selector Switch
- ❑ Software Data Loader
- ❑ APU Fire Control Switch
- ❑ Heating System (Cabin Temperature Control Switch)
- ❑ Combat Systems Display Console
- ❑ Safety Critical Power Switch
- ❑ Radar Warning Control

Janco

Janco Corporation, Box 3038 • 3111 Winona Ave., Burbank, CA 91504
Phone: (818) 846-1800 • Fax: (818) 842-3396 • TWX: #910-498-2701

SWITCHING TECHNOLOGY

General Specifications

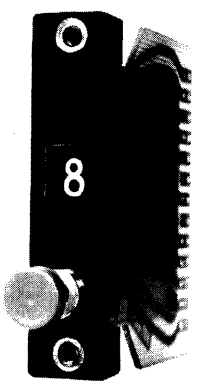
- All Switches Meet or Exceed Environmental Condition Requirements of MIL-S-3786 and MIL-S-22710.
  - Explosion Proof / MIL-STD-202 • Salt Spray / MIL-STD-202
  - Sand and Dust / MIL-STD-202 • Shock High Impact / MIL-STD-202
  - Shock Medium / MIL-STD-202 • Vibration / MIL-STD-202
  - Altitude to 70,000 Feet • Moisture Resistance / MIL-STD-202
  - Thermal Shock / MIL-STD-202 • Panel Seal
- All Switches Offer Maximum Protection Against RFI/EMI
- All Switches Are Totally Enclosed.

Options

- O-Ring Shaft and Panel Seal
- Combination of Decks
- Bridging Contacts
- Momentary Positions
- Adjustable Stops
- Solenoid Driven
- Solenoid Latched
- Keylock
- Gang Switches
- Concentric Shaft Switches
- Isolated / Guarded Positions

SERIES D

Pushbutton Rotary Switches

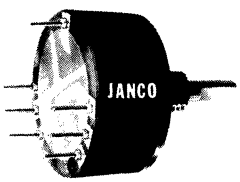


- Built to MIL-S-22710
- Life 50,000 Cycles
- Carry 3 Amp Cont.
- Make & Break. .125 Amp Res. 115VAC/28VDC
- Available with Standard or Coded Outputs, Special Codes Also Available
- M Series QPL to MIL-S-22710/18/23/30

	MIL-S-22710/23			MIL-S-22710/30	MIL-S-22710/18		
	30°	36°	45°	22.5°	30°	36°	45°
Max. Positions	**12**	**10**	**8**	**16**	**12**	**10**	**8**

SERIES E

Miniature/Micro-Miniature Printed Circuit Rotary Selector Switches



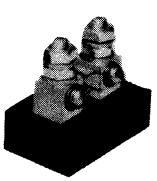
Index	Max. Positions
SERIES EA, EB, EC	
15°	24
18°	20
22°	16
30°	12
36°	10
45°	8
SERIES ED, EE	
30°	12
36°	10
45°	8

- Built to MIL-S-3786; MIL-S-22710
- Life 25,000 Cycles
- Carry 3 Amp Cont.
- Make & Break..125 Amp Res. 115VAC/28VDC
- Available with Standard or Coded Outputs, Special Codes Also Available
- Printed Circuit Construction

TYPICAL APPLICATIONS OF JANCO SWITCHES

- ❑ Flare Dispenser
- ❑ Missile Safe/Arm Switch
- ❑ Flap Control Switch
- ❑ Autobrake Switch
- ❑ Engine Start Switch
- ❑ Program Integrated Panel
- ❑ Throttle Friction Switch
- ❑ In Flight Refuelling Equipment
- ❑ YAW Trim Switch for Tactile Tests
- ❑ Master Ignition Switch (Helicopter)
- ❑ Propeller De-Icing
- ❑ Wing De-Icing
- ❑ Switch for Digital Flight Data Recorder System
- ❑ Rudder Trim Switch
- ❑ Engine Speed Control Switch
- ❑ Airborne Radar System Switch
- ❑ Automatic Pilot Transfer Switch

OTHER PRODUCTS



Electrical Hardware Products for Aircraft

- External Ammeter Shunts MIL-S-61-B
- Flexible Bus Assemblies
- Bus Bars ■ Bonding Jumpers

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Janco

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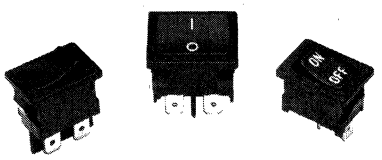
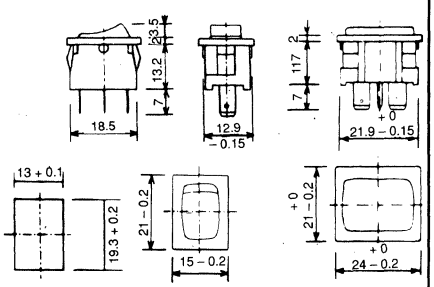
MOLVENO COMETTI

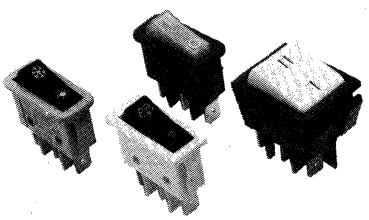
A1, A4, A8

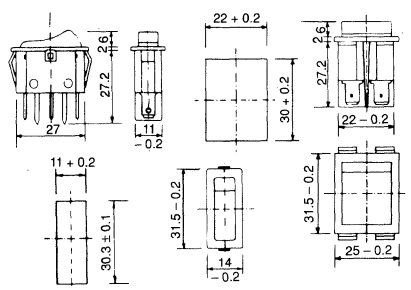




A1, A4, A8 SERIES
Rating: 3, 6, 10, 15 A/120VAC
Temp: 65C / UL & CSA
105 C / European
Colors: Standard: Red, Black, Brown and White
Others available on request
Functions: SPST, SPDT, DPST, DPDT, Momentaries, illuminated AC/DC

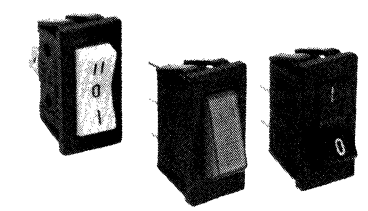
B1, B4

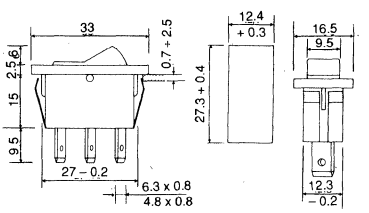




B1, B4 SERIES
Rating: 4, 10, 16, 20 A/120VAC
Temp: 65C / UL & CSA
105C / European
Colors: Standard: Red, Black, Brown and White.
Others available on request
Functions: SPST, SPDT, MOM.
DPST, DPDT IN B4, illuminated AC/DC

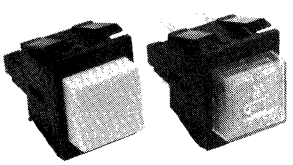
SCM

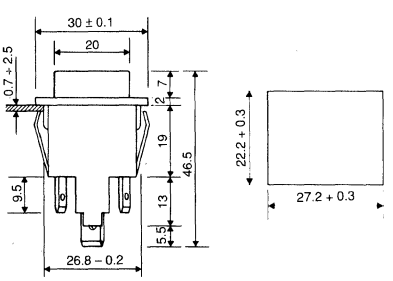




SCM SERIES
Rating: 3, 10, 16 A/120VAC
Temp: 65C / UL & CSA
105C / European
Colors: Standard: Red, Black, Brown and White.
Others available on request
Functions: SPST, SPDT, and Momentaries, illuminated AC/DC

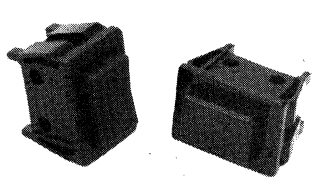
SPL63

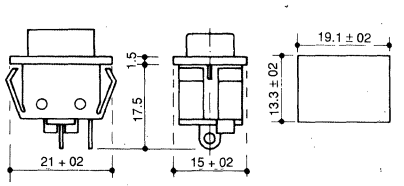




SPL63 SERIES
Rating: 1.5 or 16 A/250VAC
Temp: 65C UL/CSA
Colors: Standard: Black Body. Red, Green, Amber, White, Yellow lenses. Others available.
Functions: SPST, DPST, Momentaries, illuminated or non.

SCA





SCA SERIES
Rating: 2, 6, 10 A/250VAC
Temp: 65C UL/CSA
120C / European
Colors: Standard: Black, and White. Other colors available on request
Functions: SPST

ALL DIMENSIONS IN MILLIMETERS

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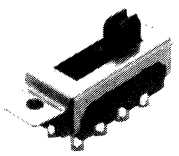
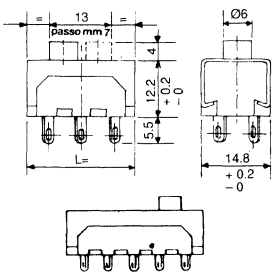
MOLVENO COMETTI

Switches, Switches/Indicator Lights, Indicator Lights, AC Receptacles

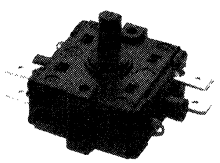
SCL

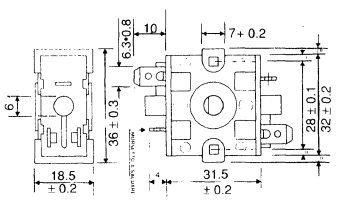




SCL SERIES
Rating: 6 AMPS / 250VAC
Temp: 65C UL/CSA
125C European
Thermoplastic or Thermosetting available.
Functions: DPDT up to 5 positions.

SCR

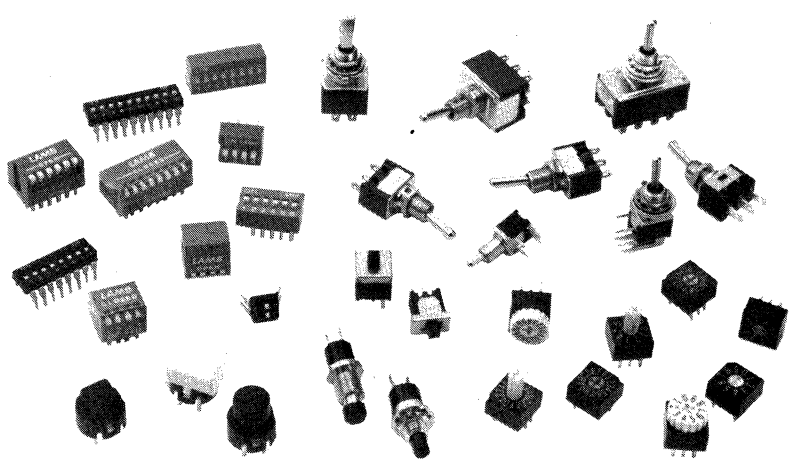




ALL DIMENSIONS IN MILLIMETERS

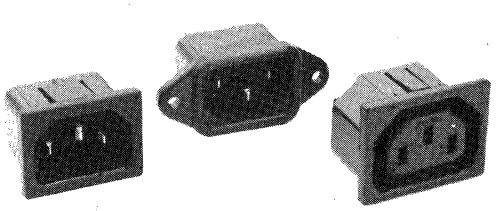
SCR SERIES
Rating: 2 or 10 A/250VAC
Temp: 125C European.
(UL/CSA Pending)
Shaft available.
Functions: DP up to 6 positions.

Additional Switches and AC Receptacles from LAMB INDUSTRIES, INC.



SWITCHES

- TOGGLES
- TINY TOGGLES
- TINY SLIDES
- DIPS
- PIANO DIPS
- INSERTABLE DIPS
- MINIATURE DIP ROTARIES
- KEY SWITCHES
- PUSH BUTTONS



PLEASE SEE SECTION 5100 FOR ADDITIONAL LAMB/MOLVENO COMETTI PRODUCTS.

AC RECEPTACLES

NC-174	6A	125V
NC-180	15A	125V
NC-176	10A	250V
NC-176	15A	250V
NC-186	15A	250V

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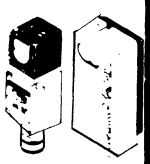
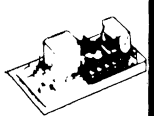
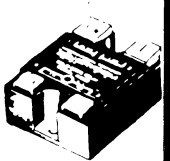

PHOTOELECTRICS


RELAYS


LIQUID LEVEL CONTROLS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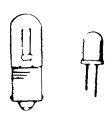
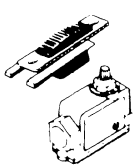
CIRCUIT BREAKERS FUSES & FUSEHOLDERS


KNOBS


LAMPS & LEDS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Lucas Ledex Switches

Rotary Manual Switches

• Economy with simplified circuitry • Eliminates auxiliary circuit components • Minimizes wiring

Model Series	Poles-Throws/Deck	Combinations	Contact Ratings	Make/Break	Carry	Dielectric
206	6P60°T	6	Brass/silver plated	0.5A/28 VDC (0.25/110 VAC)	5 A	750 V contact to contact
208	8P45°T	4				
210	10P36°T	5	Solid silver	1.0A/28 VDC (0.5A/110 VAC)		
212	12P30°T	6				
304	4P90°T	2				
306	6P60°T	6				
312	12P30°T	6				
404	4P90°T	2	Brass/silver plated	1.0A/28 VDC (0.5A/110 VAC)	5 A	1,000 V contact to contact 500 V when contacts are insulated back to back
406	6P60°T	6				
412	12P30°T	7	Solid silver	2.0A/28 VDC (1.0A/110 VAC)		
504	4P90°T	2				
506	6P60°T	6				
512	12P30°T	7				
524	24P15°T	8				

Stepping Switches (Stock Models)

• Dielectric clip-to-clip VRMS: 1,000 • Dielectric insulated back-to-back clips: 500 • Control deck: notched

Electrical Positions	Poles-Throws/Deck	Number of Load Cells	Additional Circuit on Control Deck	Total Circuitry	Carry Resistive Max.	Break Resistive Max.	Coil to Case Dielectric VRMS	Weight (lb)
4	3P4T	4	1P4T	13P4T	5 A	2.5A/28 VDC (0.5A/120 VDC)	1,200	0.375
6	2P6T	5	1P6T	11P6T			1,200	0.406
8	3P8T	2	1P8T	7P8T			1,200	1.250
10	1P10T	7	—	7P10T			1,200	1.313
10	2P10T	4	—	8P10T			1,200	1.281
12	1P12T	5	—	5P12T			1,000	0.438
12	1P12T	9	—	9P12T	10 A	5.0A/28 VDC (1.0A/120 VDC)	1,200	1.250

Packaged Switches (Stock Models)

• Handles high density transfer switching without relays in extreme environments

Poles-Throws/Deck	Operating Voltage VDC	Current @ Rated Coil Voltage	Coil Duty Cycle	Dielectric Strength (VRMS) Coil	Coil Resistance @ 20°C (Ohms ±5%)	Dielectric Strengths (VRMS) Decks	Carry Resistive Max.	Break Amps Resistive
13PT2	28	2.5	1/10	1,000	11.03	500	5 A	1.0A/28 VDC (0.5A/120 VAC)
18P2T	28	3.5	1/10	1,200	8.02	500	5 A	2.0A/28 VDC (1.0A/120 VAC)
22P2T	28	3.5	1/10	1,200	8.02			
35P2T	28	5.0	1/10	1,200	5.67			
39P2T	28	5.7	1/10	1,200	4.91			
40P2T	28	3.6	1/4	1,200	7.72			

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eem SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
«	much smaller than
$>$	larger than
$\geq$	larger than or equal to
»	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

eem SI UNITS

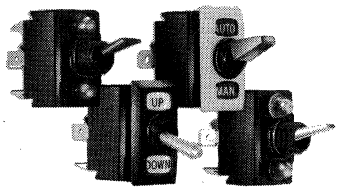
Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

engineered switches

McGILL®

McGILL MFG. CO., INC,, ELECTRICAL DIV.,
VALPARAISO, IN 46383 (800) 233-8828

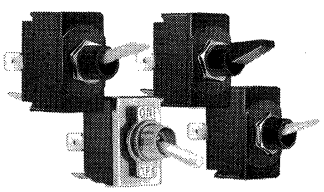
TOGLITE™ LIGHTED TOGGLE SWITCHES



- **Broad Selection** of bat styles, colors, indicating plates and legends to fit design and functional requirements.
- **Reliable, long-life mechanisms** for exceptional performances.
- **Variety of circuit arrangements.**
- **Environmental ratings**—150°F., 85% relative humidity.
- **Choice of terminals:** Screw, 1/4″ wide spade, or solder.
- **Choice of lights:** 6V, 14V, 28V or 250V AC, 125V AC Standard.

15 Amp 277V AC
3/4 HP 125-277V AC
Single Pole & Double Pole
Case Dimensions
1.35″ x .80″
15/32″-32 thd. bushing
UL Listed
CSA Approved

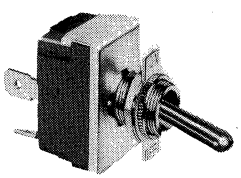
DESIGNER LINE TOGGLE SWITCHES



- **Choice of designer-style lighted or unlighted bats** in colors to your specifications.
- **Reliable, long-life mechanism** for exceptional performance.
- **Polycarbonate or die-cast zinc coverplates.**
- **25,000-hour 14V incandescent standard** (other incandescent and neon lamps available on special order).
- **Environmental ratings:** 150°F., 85% relative humidity.
- **Choice of terminals:** Screw, 1/4″ wide spade, or solder.

15 Amp 277V AC
3/4 HP 125-277V AC
Single Pole & Double Pole.
Case Dimensions: 1.35″ x .80″
15/32″ thd. bushing
UL Listed
CSA Approved

STANDARD TOGGLE SWITCHES



- **Wide selection of circuitry, ratings, terminals.**
- **Time-proven, reliable long-life mechanism.**
- **Variety of bat styles and colors.**
- **SP, DP, 3+4 pole models available.**

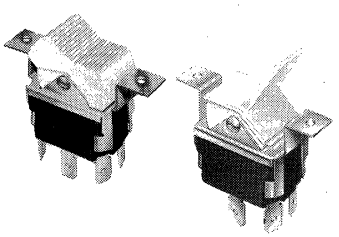
UL Listed
CSA Approved

20 A 125 V AC
10 A 250 V AC
1 HP 125-250 V AC
20 A 250 V AC Non-Inductive
Also available 25 A 125-250 V AC Non-Inductive

UL Listed
C.S.A. Approved

Silver cadmium oxide contacts
Brown general-purpose phenolic cases
Nickel plated bats

ROCKER AND PADDLE SWITCHES



- **Distinctive styling**—With your choice of standard or specially designed actuators to meet style requirements.
- **Reliability**—Mechanical excellence from one of the most experienced manufacturers of switches of this type.
- **Extra electrical capacity**—20 Amp models provide an extra margin of reliability.
- **Broad range of variations**—Terminals, circuitry, coverplates, actuators are available or can be engineered to fit your needs.

0801 SP and 0801 DP Series

UL Listed	CSA Approved
20 Amp 277V AC	16 Amp 277V AC
1 1/2HP 125-250V AC	1 1/2HP 125-250V AC

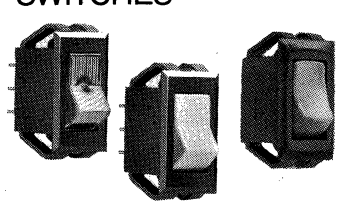
20 Amp 12V DC

1801 SP and 1801 DP Series

UL Listed	CSA Approved
6 Amp 125V AC	
3 Amp 250V AC	
1/4HP 125-250V AC	

6 Amp 12V DC
Case Dimensions: 1 15/64″ x 51/64″

MINIATURE ROCKER SWITCHES



- **Choice of Stylette™**—(new softer designer lines that enhance product styling) **or standard miniature rocker switches.**
- **Choice of illuminated or solid** two surface smooth colored rocker.
- **Rocker colors available**—
  Light-Clear-Amber-Red-*Green-*Blue
  Non-lighted-White-Black-Red
  (other colors, consult factory).
- **Plastic snap-in bezels**—for fast easy installation.
- **Available in black & white bezels** (other colors, consult factory).
- **Terminals**—1/4″ quick disconnect-standard. Also available 16-ga. wire.
- **Lamps**—115V AC neon standard. Also available 6V AC or DC, 14V AC or DC, 28V AC or DC & 250V AC neon.

McGILL MANUFACTURING COMPANY, INC., ELECTRICAL DIVISION, VALPARAISO, IN 46383

engineered switches **McGILL®**

McGILL MFG. CO., INC., ELECTRICAL DIV.,
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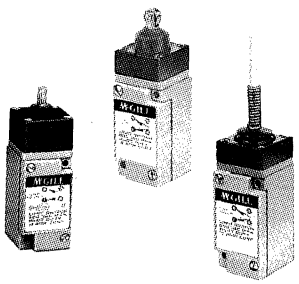
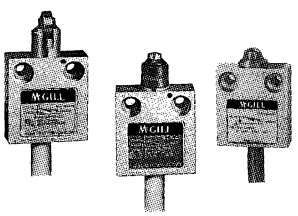
1506 SERIES ROTARY ACTUATED SWITCHES



- plug-in and non plug-in body styles with convenient on-the-spot adjusting
- wobble actuated switches have flexible levers that operate with any movement except direct pull
- rollers on side plungers in horizontal position
- head adjusts clockwise and counterclockwise
- light on indicator versions wire to N.O. circuit
- Meet NEMA 1,3,4, and 13 standards

Circuitry: SPDT, DPDT
Types: Side/Top Rotary, Maintained, Center Neutral, Plain Top, Roller, Roller-Side Plungers, Wobble, Coil Spring
Body Styles: Plug-in, Non-Plug-in 1/2″ or 3/4″ conduit
Make/Break Voltages: 120, 240, 480, 600 VAC; 120, 240 VDC
UL Listed
CSA certified

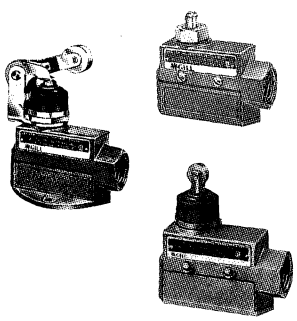
1505 SERIES MINIATURE PRE-WIRED ENCLOSED SWITCHES



- pre-wired at factory with industrial quality cable (SJTO)
- eliminate need to wire at switch, so they're ideal for use in limited access areas
- gang-mountable to build multi-plunger switch .63″ between plunger
- seals keep liquids from entering switch cavity
- complete range of actuators, including plain and roller plungers, and side rotary
- Meet NEMA 1, 3, 4, 12 and 13

Circuitry: SPDT
Types: Plain, Boot-Sealed, Roller and Cross-Roller Plunger, Side Rotary
Make/Break Voltages: 120, 240 VAC; 28 VDC
UL Listed
CSA certified

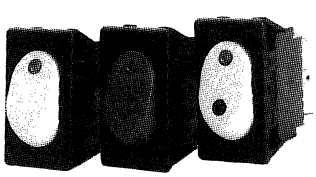
1502 SERIES COMPACT ENCLOSED SWITCHES



- side and flange mounted switches available with or without actuator seal boots
- combination insulator/seal cemented inside bottom enclosure
- lead washers seal mounting holes on side mount switches
- side mounts installed with #6 screwshead adjusted clockwise and counterclockwise operation
- removal of bottom enclosure exposes terminals for easy wiring
- NEMA 1 rated

Circuitry: SPDT, DPDT
Types: Straight, Roller Plunger, Roller Lever, One-Way Roller Lever, Manual, Coil Spring
Body Styles: Side or Flange mounted, with/without seal boot
Make/Break Voltages: 125, 250, 480, 600 VAC; 125, 250 VDC
UL Listed
CSA certified

0852 EURO-STYLED ROCKER SWITCHES



- patented sleek, rounded ultra-modern design
- rugged, reliable rocker mechanism proven in millions of applications
- fits standard cutouts
- available with moisture-resistant seals
- .187 spade, screw terminals, solder and wire leads optional

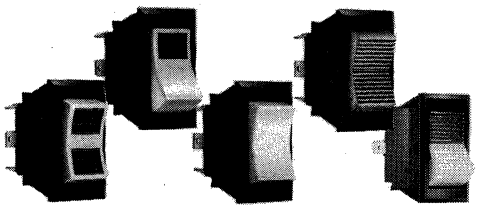
Circuitry: SPDT, DPDT
Types: one-light, two-lights, non-lighted with three different rocker colors: red, white, black
Electrical: 15A, 277V AC; 3/4 HP, 125-277V AC; 6-28V DC Incandescent; 115V Neon
Terminals: 1/4″ Spade
UL Listed
CSA certified

engineered switches

McGILL®

McGILL MFG. CO., INC., ELECTRICAL DIV.,
VALPARAISO, IN 46383 (800) 233-8828

LIGHTED ROCKER SWITCHES WITH SNAP-ON COLORED CAPS



0851, 1851, 1861, 0871, 1871, 0881 and 1881 switch series standard construction features:
These switches have black plastic bezels for snap-in-mounting, 1/4" quick-disconnect spade terminals, 115V neon lamps. Available with 6-28V DC incandescent lamp consult factory. Optional splash-resistant gasket model available—request new Sealtite™ switch.

Underwriters' Lab. Inc. Listed
CSA Approved
0851, 0861, 0871, 0881
15 Amp 277V AC
3/4 HP-125 277V AC

1851, 1861, 1871, 1881
6 Amp 125V AC
3 Amp 277V AC
1/4 HP-125 277V AC

SINGLE POLE (Black Bezel, White Rocker, Red Lens)

Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0851)	6 A (1851)
ON	—	OFF	SPST	1	0851-1301	1851-1301
ON	OFF	ON	SPDT	2	0851-2302	1851-2302
ON	—	ON	SPDT	2	0851-2303	1851-2303
(ON)	—	OFF	SPST	1	0851-1304	1851-1304
(ON)	OFF	(ON)	SPDT	2	0851-2305	1851-2305
(ON)	OFF	ON	SPDT	2	0851-2306	1851-2306
ON	—	(OFF)	SPST	1	0851-1307	1851-1307
(ON)	—	ON	SPDT	2	0851-2308	1851-2308

( ) = Momentary.

SINGLE POLE LIGHTED (Black Bezel)

Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0871)	6 A (1871)
ON	—	OFF	SPST	1	0871-1601	1871-1601
ON	OFF	ON	SPDT	2	0871-2602	1871-2602
ON	—	ON	SPDT	2	0871-2603	1871-2603
(ON)	—	OFF	SPST	1	0871-1604	1871-1604
(ON)	OFF	(ON)	SPDT	2	0871-2605	1871-2605
(ON)	OFF	ON	SPDT	2	0871-2606	1871-2606
ON	—	(OFF)	SPST	1	0871-1607	1871-1607

( ) Momentary. Above numbers do not include cap.

SEALTITE™ SWITCHES

Protects switch against liquids, dust, dirt and many other contaminants. Lighted or unlighted versions. Consult factory for part number.

DOUBLE POLE (Black Bezel, White Rocker, Red Lens)

Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0861)	6 A (1861)
ON	—	OFF	DPST	1	0861-1301	1861-1301
ON	OFF	ON	DPDT	2	0861-2302	1861-2302
ON	—	ON	DPDT	2	0861-2303	1861-2303
(ON)	—	OFF	DPST	1	0861-1304	1861-1304
(ON)	OFF	(ON)	DPDT	2	0861-2305	1861-2305
(ON)	OFF	ON	DPDT	2	0861-2306	1861-2306
ON	—	(OFF)	DPST	1	0861-1307	1861-1307
(ON)	—	ON	DPDT	2	0861-2308	1861-2308

( ) = Momentary.

DOUBLE POLE LIGHTED (Black Bezel)

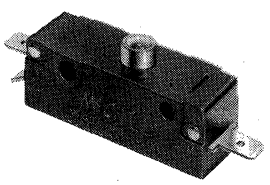
Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0881)	6 A (1881)
ON	—	OFF	DPST	1	0881-1601	1881-1601
ON	OFF	ON	DPDT	2	0881-2602	1881-2602
ON	—	ON	DPDT	2	0881-2603	1881-2603
(ON)	—	OFF	DPST	1	0881-1604	1881-1604
(ON)	OFF	(ON)	DPDT	2	0881-2605	1881-2605
(ON)	OFF	ON	DPDT	2	0881-2606	1881-2606
ON	—	(OFF)	DPST	1	0881-1607	1881-1607
(ON)	—	ON	DPDT	2	0881-2608	1881-2608

( ) Momentary. Above numbers do not include cap.

SNAP-ON COLORED CAPS

Color	Full Cap Serrated	½ Cap Serrated	Curved Full Satin Clear Cap	Curved Full Satin Opaque Cap
White	0871-0000	0871-0010	0871-0020	0871-0030
Clear	0871-0100	0871-0110	0871-0120	0871-0130
Amber	0871-0200	0871-0210	0871-0220	0871-0230
Red	0871-0300	0871-0310	0871-0320	0871-0330
Green	0871-0400	0871-0410	0871-0420	0871-0430
Blue	0871-0500	0871-0510	0871-0520	0871-0530
Chrome	—	—	—	0871-0730
Black	0871-0800	0871-0810	—	0871-0830

SNAP-ACTION SWITCHES

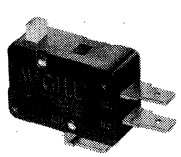


2600 Series
20 Amp 125-250V AC
1 HP 125-250V AC
2 HP 250V AC
SPDT & SPST, NO or NC
Less than .005" differential travel
Operating force 20 oz. max.
Underwriters' Laboratories, Inc. Listed
CSA Approved
Dimensions 1 13/16" x 41/64" x 41/64"
Standard Terminals
Spade Terminals .250" x .032"

2700 Series
20 Amp 125-250V AC
1 HP 125-250V AC
2 HP 250V AC
Underwriters' Laboratories, Inc. Listed
CSA Approved
Dimensions 1 21/64" x 1-13/16" x 43/64"
Spade Terminals .250" x .032"

MINIATURE SNAP-ACTION SWITCHES

McGill® 4775 Series Rolling Cam* SNAP-ACTION SWITCHES. An engineering breakthrough that provides 150,000,000 cycle reliability, less contact bounce (1.5 millsec), LIGHT OPERATING FORCE—75gm. Max.



4777 Series available rated:
15 Amp 125-250V AC, 1/2 HP 125-250V AC
25 Amp 125-250V AC, 1 HP 125V AC
2 HP 250V AC, 85°C. Max. Ambient Temp.

10 Amp
125-250V AC
1/2 HP 125-250V AC
4 Amp "L" 125V AC

Underwriters' Laboratories, Inc. Listed;
CSA Approved
Optional UL 100,000 cycle listing and 20.1 Amp
Case Dimensions: 1 3/32" x 5/8" x 13/32"

ACTUATOR	CATALOG NUMBERS SPADE TERMINALS SPDT	SPST NO	SPST NC	OPERATING CHARACTERISTICS Operating Force Max. gm.	Release Force Min. gm.	Movement Diff. Max. In.	Pre-travel Max. In.	Total Over-travel Min. In.	Actuator Length
Basic plunger	4775-1100	4775-1200	4775-1300	75	10	.016	.047	.050	
Short rigid lever	4775-1120	4775-1220	4775-1320	75	9	.018	.052	.050	27/32
Long rigid lever	4775-1130	4775-1230	4775-1330	37	4	.037	.108	.090	1 13/32
Short rigid lever w/roller	4775-1140	4775-1240	4775-1340	75	9	.018	.052	.050	25/32
Long rigid lever w/roller	4775-1150	4775-1250	4775-1350	37	4	.037	.108	.090	1 11/32
Simulated roller	4775-1160	4775-1260	4775-1360	37	5	.033	.096	.090	1 9/32

NOTE: Operating characteristics are given for levers mounted in the support farthest from the plunger. When the levers are mounted in the support closest to the plunger, multiply the given force values by .57 and the travel values by 1.76 to obtain the correct values.

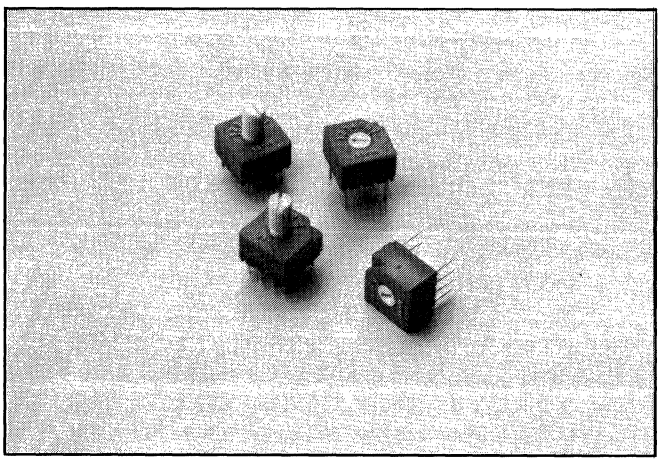
4600 Series 15 Amp switches with berylium copper mechanism also available.

SWITCH BUYER HOTLINE (800) 233-8828; FAX (219) 465-2456; PHONE (219) 465-2200

MEPCOPAL

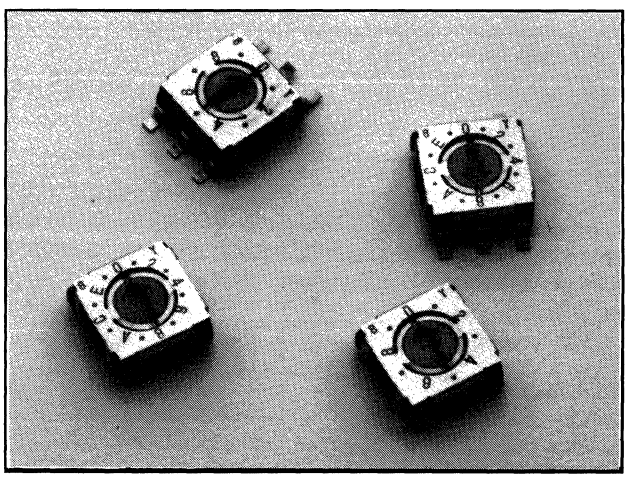
Trimmers & Switches Pure and Simple.

SELECTOR AND BINARY CODED DIP AND SMD ROTARY SWITCHES



SS-10 SWITCHES

S-7000 SWITCHES



Switch	Number of Positions	Type	Mounting	Size
CS-4	2 (Single Pole) 3 (Single Pole) 2 (Double Pole)	Selector Selector Selector	SMD SMD SMD	4 mm sq. 4 mm sq. 4 mm sq.
SS-10	6 (Single Pole) 3 (Double Pole)	Selector Selector	DIP DIP	10 mm sq. 10 mm sq.
S-1000	16 BCH	Digital	DIP	10 mm sq.
S-2000	10 BCD	Digital	DIP	10 mm sq.
S-5000	10 BCD*/16 BCH*	Digital	DIP	11 mm sq.
S-7000	10 BCD /16 BCH	Digital	SMD	7 mm sq.
S-8000	8 (3 bits)	Digital	DIP	7 mm sq.

*Built-in resistor and/or diode arrays.

MEPCOPAL Mepcopal Company, 11468 Sorrento Valley Road, San Diego, California 92121
619/453-0332, FAX: 619/481-1123

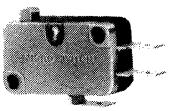
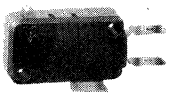
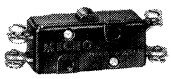
MICRO SWITCH
a Honeywell Division

SUBMINIATURE/MINIATURE BASIC SWITCHES

SM subminiature basic switches are a versatile collection of small size and ample electrical capacities. SX subminiature basic switches are the smallest snap-action switches available from MICRO SWITCH, yet are big in performance and selection. They provide up to 7 amp power load capacity. V3 miniature basic switches put a 25 amp power load capacity and a choice of 11 other electrical ratings into a relatively small package. V7 miniature basic switches have electrical ratings up to 15 amp power load capacity, and offer two versions—commercial and European designed to meet all leading European approval agency requirements. TB miniature basic switches are small double-break units which offer means of controlling 2, 3 or 4 isolated circuits.

MINIATURE AND SUBMINIATURE BASIC SWITCHES



Listing	11SX21-T	11SM1-T	V3-101-D8	V7-1B11E9	1TB1-1
PHYSICAL DESCRIPTION					
Package Size (inches)	.35H .20W .50L	.49H .25W .78L	.63H .40W 1.09L	.63H .40W 1.14L	.50H .50W 1.25L
Actuator	Pin plunger	Pin plunger	Pin plunger	Pin plunger	Pin plunger
Terminals	T solder	T solder	D8 QC	E9 QC	screw
Mounting Centers	.19	.38	.88	.88	.37
CHARACTERISTICS					
UL/CSA Rating	5a 250VAC	5a 250 VAC	11a 1/3HP 277 VAC	11a 1/3HP 277VAC	10a 250VAC 1/2HP 125 VAC
Circuitry	SPDT	SPDT	SPDT	SPDT	2 CKT DB
Operating Force	2.5 to 5 oz.	3 to 5 oz.	8 oz.	5.3 oz.	7 to 13 oz.
Differential Travel (inches)	.002	.004	.006-.016	.002-.010	.010-.025
ENVIRONMENT					
Temperature Range (°F) Upper	250°	180°	180°	185°	180°
Lower	−65°	−65°	−65°	−40	—
Sealing		Elastomer sealed plunger avail.			
Housing Material	General purpose phenolic	General purpose phenolic	General purpose phenolic	Polyester	General purpose phenolic
Other options Request Catalog 10	Pin, integral or auxiliary leaf and lever, overtravel plunger actuators. Many terminal variations. SPST NO or NC ctry.			Pin, integral or auxiliary leaf and lever actuators. Meets European and UK standards.	Pin, auxiliary leaf actuators. 4 CKT DB. Solder term.
	400° temp. 7a rating. Gold contacts. Low force/low DT versions. MIL-S-8805 listings.	400° temp. 11a rating. Gold contacts. Low force/low DT versions. MIL-S-8805 listings. BEAB, TV-2 listings.	600° temp. 25a rating. Gold alloy contacts. Low force/high force versions. MIL-S-8805 listings. TV-3,4,5 listings.		

MICRO SWITCH
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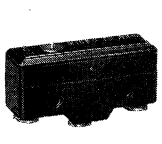
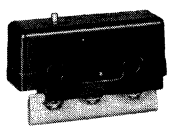
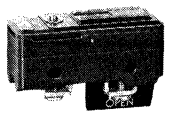
STANDARD BASIC SWITCHES

Power load switching and motor handling capacity are among the attractions of thumb-size BZ/BA standard basic switches. Double-pole double-throw switching is added by DT switches.

Where there's a need for reliable switching of high capacity systems involving DC motors and solenoids, MT magnetic blow-out switches do the job. The 3MN has double-break switching.




Listing	BZ-2R-A2	BA-2RV22-A2	DT-2R-A7	MT4R-A28	3MN1
PHYSICAL DESCRIPTION					
Package Size (inches)	.95H .69W 1.94L	.95H .69W 1.94L	1.28H .69W 1.94L	1.30H .69W 1.94L	1.20H .68W 2.50L
Actuator	Pin	Short roller lever	Pin	Pin	Plunger
Terminals	Screw	Screw	Screw	Screw	Screw
Mounting Centers (inches)	1	1	1	1	2.13
CHARACTERISTICS					
UL/CSA Rating	15A-480VAC	20A-480VAC	10A-250VAC	10A-125VAC or VDC	15A-600VAC 1 Hp at 240 VAC
Circuitry	SPDT	SPDT	DPDT	SPDT	2 CKT DB
Operating Force	9-13 oz.	14-22 oz.	20 oz.	12-18 oz.	12-20 oz.
Differential Travel (inches)	.0004-.002	.002-.0075	.005	.005	.015-.025
ENVIRONMENT					
Temperature Range (°F) Upper	180°	180°	180°	180°	180°
Lower	−65°	−65°	—	—	—
Sealing	Neoprene or Elastomer sealed plunger avail.				
Housing Material	General purpose phenolic	General purpose phenolic	General purpose phenolic	Arc resistant melamine	General purpose phenolic
Other options Request Catalog 10	Pin, integral or auxiliary leaf and lever, overtravel plunger actuators. Many terminal variations. Manual reset versions. Special ctry. available.		Pin, integral or auxiliary leaf actuators.	Pin, integral or auxiliary leaf or lever actuators SPST ctry.	
	22a rating. 250° and 400° temperature. Alloy contacts. Low force/low DT versions. MIL-S-8805 listings.	25a rating. 250° temp.			

SALES AND SERVICE

MICRO SWITCH serves its customers through a worldwide network of sales offices and distributors. For ordering, application assistance, pricing or name of nearest Authorized Distributor, contact a nearby MICRO SWITCH sales office. See the EEM Yellow Pages or contact:

MICRO SWITCH
11 W. Spring St.
Freeport, Illinois 61032
Tel. 815/235-6600

MICRO SWITCH
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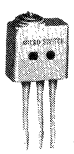
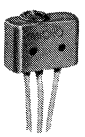
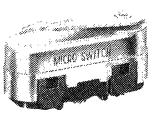
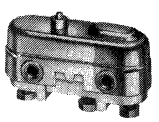
SEALED AND HIGH TEMPERATURE BASIC SWITCHES

Specially adapted basic switches include: SE/XE environment-proof switches which protect subminiature SM/SX basic switches within a sealed housing; HM hermetically sealed switches are interchangeable in operating point with the SM switches; HS hermetically sealed switches which parallel the size and mounting scheme of the standard basic switches; and HT high temperture switches for use up to +1000°F.

Listing	1XE1	1SE1	1HM1	1HS1	2HT1
PHYSICAL DESCRIPTION					
Package Size (inches)	.75H .32W .62L	.75H .34W .88L	.72H .25W .79L	1.18H .67W 1.96L	1.25H .70W 1.96L
Actuator	Pin	Pin	Integral lever	Integral lever	Pin
Terminals	Leadwire 1′	Leadwire 1′	Solder	Screw	Screw
Mounting Centers (inches)	.19	.38	.37	1	1
CHARACTERISTICS					
Electrical Data	7A-28 VDC, 115,250 VAC	5A-28 VDC, 125, 250 VAC	4A-28 VDC, 115, 400 Hz	25A-28 VDC	3A-125, 250 VAC
Circuitry	SPDT	SPDT	SPDT	SPDT	SPDT
Operating Force	5-17 oz.	5-17 oz.	7 oz.	10-22 oz.	10-20 oz.
Differential Travel (inches)	.005	.004	.006	.020	
ENVIRONMENT					
Temperature Range (°F) Upper	221°	221°	250°	180°	1000°
Lower	−65°	−65°	−85°	−67°	—
Sealing	Environment MIL-S-8805	Environment MIL-S-8805	Hermetic	Hermetic MIL-S-8805	NO
Housing Material	Aluminum	Aluminum	Stainless steel	Monel	Stainless steel
Other options Request Catalog 10	Aux. leaf actuators. SPST ctry. 300° temp. longer leads. Solder term. UL/CSA listing.	Aux. leaf or lever actuator, SPST ctry. 500° temp. UL/CSA listing.	Aux leaf or lever actuator. MIL-S-8805 listing. 300° & 500° temp. Leadwire termination.	Leadwire termination. Roller lever actuators. 250° & 300° temp. UL/CSA listing.	Overtravel plungers. Panel mount. UL Recognized.

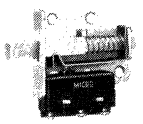
MICRO SWITCH
a Honeywell Division

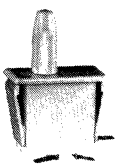
INTERLOCK SWITCHES

Interlock switches automatically cut power when a service door or drawer is opened helping protect personnel and equipment.

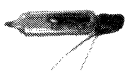
MERCURY SWITCHES

Mercury switches use electrodes and mercury pool in a hermetically sealed glass tube to satisfy needs in contaminated atmospheres or where available operating force is extremely low. Tilting operates the switch.









Listing	17AC18-T	1DM1	WW-1G03A-D7	AS412A1
PHYSICAL DESCRIPTION				
Package Size (inches)	1.53 × .34 × 1.18H	1.25H .68W 1.95L	1.93H .54W 1.58L	.35 dia. 1.75L.
Actuator	Rod	Plunger	Plunger	Tilt to operate
Terminals	Solder	Quick-connect	Quick-connect	Leadwire
Mounting Centers (inches)	.437 × .578	Snap-in mount	Snap-in mount	Not applicable
CHARACTERISTICS				
Electrical Data	5A 125, 250, VAC	10A, 125 250, 277 VAC UL/CSA	16A, 125 250 VAC UL/CSA	1A- 115 VAC
Circuitry	SPDT	SPDT	2-N.O.	SPST
Operating Force	—	15 oz.	15 oz.	Not applicable
Differential Travel (inches)	—	—	—	.3 to 1.2°
ENVIRONMENT				
Temperature Range (°F) Upper	185°	180°	185°	140°
Lower	−67°	−35°	−40°	−38°
Sealing	Depends on basic switch	—	—	Hermetic
Housing Material	Stainless steel bracket, stainless steel rod	Polyester	Polyester	Glass
Other options Request Catalog	Various plastic and steel plungers. Various termination. Many basic switch and ctry. options.	Alternate action. Push-pull action. Pull-to-cheat action. DPDT ctry. Various color and shaped plungers.	1, 2 or 3 circuit. Various term. Designed to comply with worldwide certification standards.	20 amp. versions. −65 to 500° temperature. SPDT, 2 CKT DB. Various sizes and tilt angles.

SALES AND SERVICE

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MICRO SWITCH
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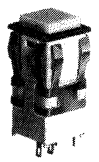
MANUAL SWITCHES

Many options in colors, legending, shapes, sizes, and mounting available as well as power, electronic or solid state switching. AML's comprehensive line blends with other panel components for total display harmony. MML provides a full line of manuals in an economical miniature package. Series 2 provides modular assembly with 1 to 4 section display. Many other pushbutton lines are available. Request Catalog 30 or Catalog 80 for military qualified products.



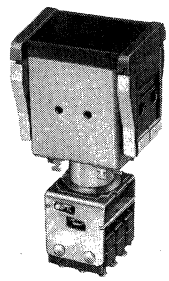


AML Series





MML Series



Series 2

Because of the many variations of these products a listing is not being given.

PHYSICAL DESCRIPTION Panel Area	Pushbuttons: .80" (20,5 mm) square. PB's, paddles, and rockers: .80 × 1.20" (20,5 × 30,5 mm).				PWB mount: .40" (10,2 mm) square and .60 × .40" (15,2 × 10,2mm), except 2-pole power duty paddles and rockers.				1.0 × 1.41" (2,5 × 35,8 mm) .86 × 1.35" (21,8 × 34,3 mm)
Display	Pushbuttons: .59" (15,0 mm) square and .59 × .99" (15,0 × 25,0 mm). Transmitted, projected, and dead front full and split color. Rockers: Full and split color rockers, with lens. Paddles: Full and split color covers, with lens.				Pushbuttons: .26" (6,6 mm) square and .46 × .26" (11,7 × 6,6 mm). Transmitted color. Rockers: Optional lenses for transmitted color.				.85 × 1.08" (21,6 × 27,4 mm) buttons. 1-4 section display Transmitted and projected color.
Illumination	Incandescent T-1-3/4 lamps—6, 14, 28 v LEDS—2.4, 5, 10, 15 V Neon lamps—125, 250 V				LEDs—1.7, 2.1, 2.2, 2.3 V Incandescent T-1 lamps—5 V (other voltage avail.) Neon lamps—125, 250 V				Incandescent T-1-3/4 lamps—6, 14, and 28 V.
Behind Panel Depth (max.)	1.7" (43,1 mm)				.67" (17,0 mm)				3.28" (83,3 mm)
Mounting	Snap-in individual, strip, matrix, sub-panel PC board mounting				Printed wiring board, snap-in strip, matrix.				Snap-in flange mount and units with mounting barriers for individual or strip mount.
Termination	Solder, quick-connect, PC board, push-on				Printed wiring board, solder, quick-connect.				Solder, quick-connect and screw terminals.
Sealing	Optional panel seal for pushbuttons.				—				Optional panel seal.
SPECIAL FEATURES	Keylock switches available for controlled access applications.				Mechanically interlocked switches provide latching functions.				Coil equipped units for remote operation (pull-in and hold-in)
CHARACTERISTICS Electrical Data	Solid State: 5 or 6-16 VDC	Electronic Control: Up to 3 a., 125 VAC	Power Duty Push buttons: Up to 10 a., 125/250 VAC	Power Duty Rockers, Paddles: Up to 15 a., 125/250 VAC	Solid State: 5-24 VDC	Electronic Control: Up to 1 a., 125 VAC res.	Power Duty Push buttons: Up to 6 a., 250 VAC res.	Power Duty Paddles: Up to 6 a., 250 VAC res.	1-20 a., 125, 250, 480 VAC, depending on switch module specified.
Circuitry	Current Sinking	1, 2, or 4 Form C	2 Form X	1 or 2 Form A	Current Sinking	1 or 2 Form C	1 or 2 Form X	1 or 2 Form C	1-4 Form C.
AGENCY LISTINGS	UL, CSA, CEE (European approvals being obtained as needed, from individual countries), MIL-S-22885				UL and CSA				UL, CSA. For MIL-S-22885 versions, refer to Catalog 80.

MICRO SWITCH
a Honeywell Division

TOGGLE SWITCHES

We offer a wide selection of size, circuitry, capacity sealing and toggle action. Plus a great array of levers, paddles and rockers that offer positive tactile feedback in a variety of colors.









Listing	11TS95-2	1TL1-7	1TP201-3	13AT1
PHYSICAL DESCRIPTION	1-pole 1.13×.62″ (28,7×15,7 mm)	1-pole 1.12×62″ (28,4×15,7 mm)	1-pole 2.17×.62″ (55,1×15,7 mm)	2-pole .84×.72″ (21,3×18,3 mm)
Display	Toggle lever.	Toggle lever.	Rocker actuator.	Toggle lever operator.
Illumination	Not applicable.	Not applicable.		Not applicable.
Behind Panel Depth (max.)	1.08″ (27,4 mm)	1.35″ (34,3 mm)	1.45″ (36,8 mm)	.98″ (24,8 mm)
Mounting	Threaded bushing. 15/32-32	Threaded bushing.	3-hole flush panel mtg.	Threaded bushing. 15/32-32
Termination	Quick connect	Screw	Screw	Solder
Sealing	Bushing seal.	Bushing and cover-to-case seals. Environment proof.		
CHARACTERISTICS **Electrical Data**	15 a., 125 or 250 VAC.	10 a. 125, 250 or 277 VAC.	15 a., 125, 250 or 277 VAC.	5 a., 125 or 250 VAC.
Circuitry	1-pole, 2 positions, maint. action	1-pole, 3 positions, mom. action	1-pole, 2 positions, maint. action	3 positions, mom. action.
AGENCY LISTINGS	UL, CSA.	UL, CSA. MIL-S-3950	UL, CSA.	UL, CSA.
Other options **Request Catalog 30**	1 or 2-pole, 2 or 3 positions, mom. and maint. action. Solder or screw terminals. Colored lever sleeves.	1, 2 or 4 pole, 2 or 3 positions. mom. and maint. action.		1-10 poles. 2 or 3 positions, mom. and maint. action. Some meet MIL-S-8805/26 and MIL-S-8805/98. Gold contacts. Colored lever sleeves. Screw or QC term. Bushing and panel seals, hermetically sealed switch units. Pull-to-unlock and tab lever options.
		Solder, IWTS termination. 15 a. 277 VAC. Pull-to-unlock toggle option.	Full color and transparent rockers. Above panel mounting.	

SALES AND SERVICE

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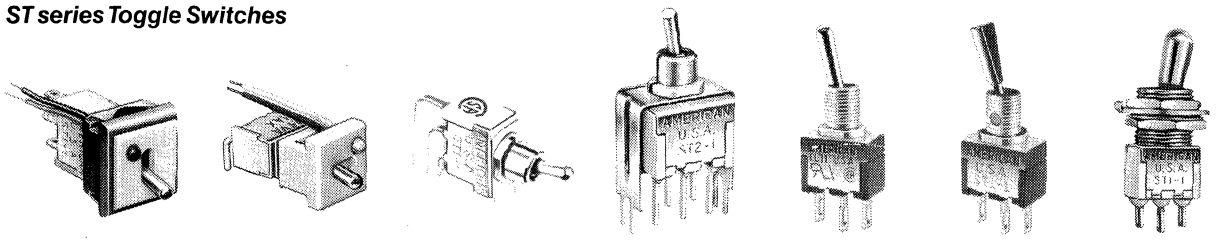
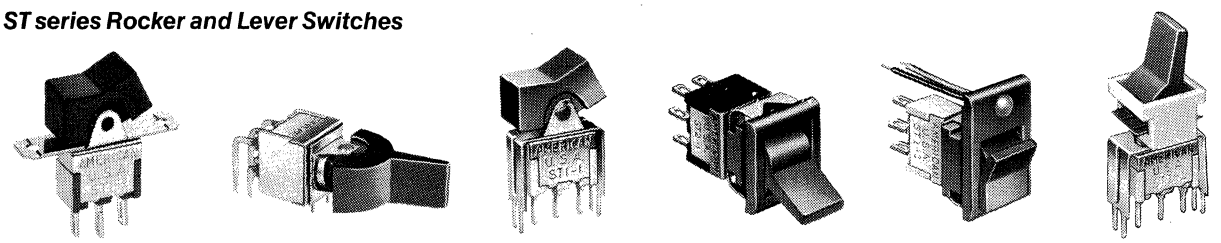
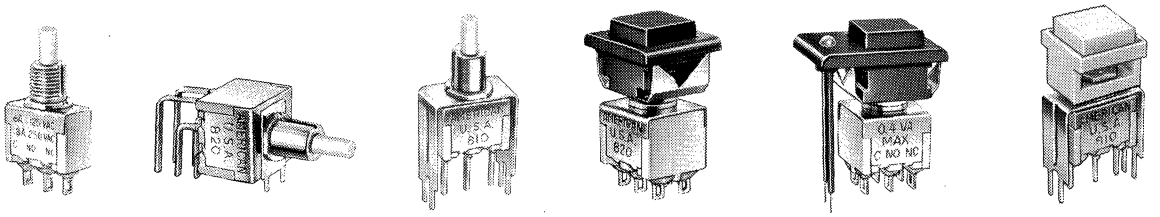
ST series Toggle Switches



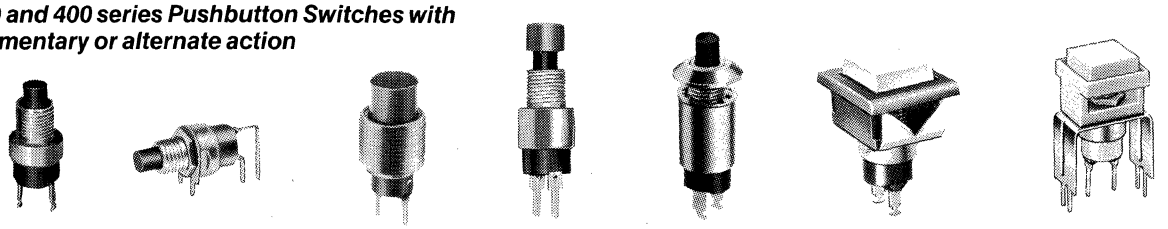
ST series Rocker and Lever Switches



800 series snap-action momentary Pushbutton Switches and PB series momentary Pushbutton Switches

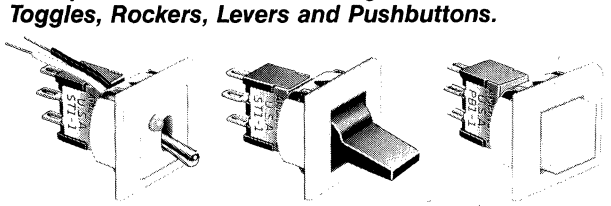


300 and 400 series Pushbutton Switches with momentary or alternate action

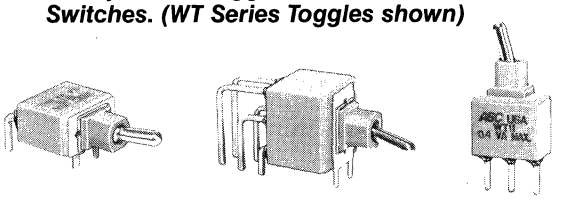


New Products

J96 option round-hole mounting bezels; Toggles, Rockers, Levers and Pushbuttons.



Totally sealed Toggle, Rocker and Pushbutton Switches. (WT Series Toggles shown)



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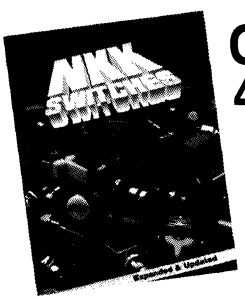

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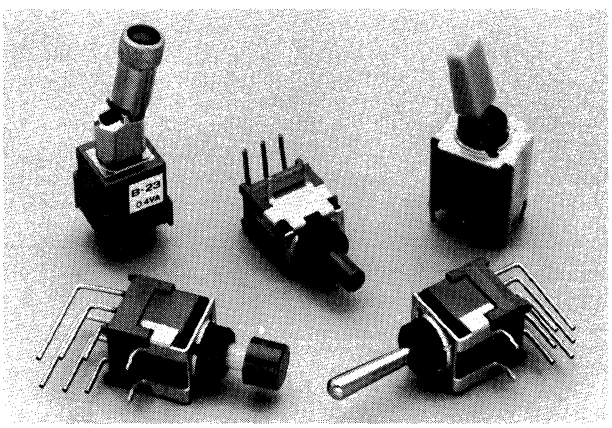
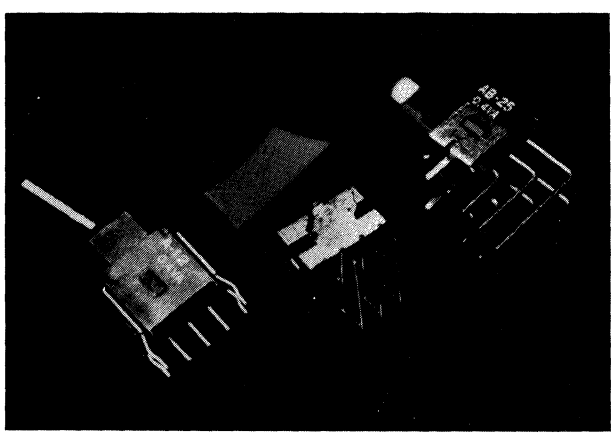


Series B. Antistatic super-subminiature PCB washables.
Antistatic-electricity toggles, rockers, pushbuttons. Rating: 0.4VA max. @28V AC/DC max. SPDT, DPDT & SP3T in 6 circuits. Standard and long-length bracketed or unbracketed straight, right angle & vertical terminations with .100" x .100" spacing. Patented STC contacts.
Call 602/991-0942. Ask for EEM Extension.



Series A. Super-subminiature PCB washables.
Toggles, rockers, pushbuttons, slides & indicator lights. Patented STC contacts. Rating: 0.4VA max. @28V AC/DC max. SPST, SPDT, DPDT & SP3T in all circuits. Bracketed & unbracketed straight, right angle & vertical terminations with .100" x .100" spacing.
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Series DR. Washable binary coded DIP rotaries.
Screwdriver, shaft or dial actuated with high-visibility legends for PCB. Shaft actuated for panel mounting. Real or complement code. Decimal or hexadecimal. Self-cleaning contacts. Switching rating: 100mA/5V DC, non-switching: 100mA/50V DC.
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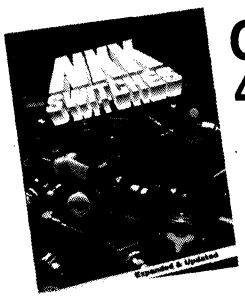

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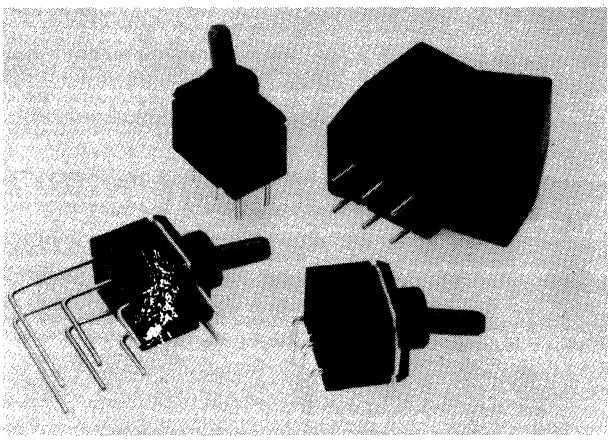
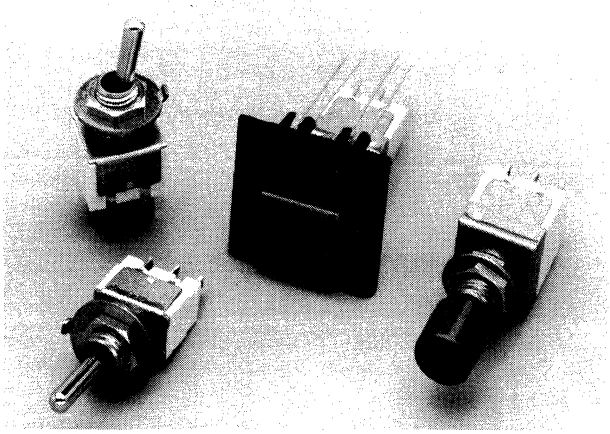
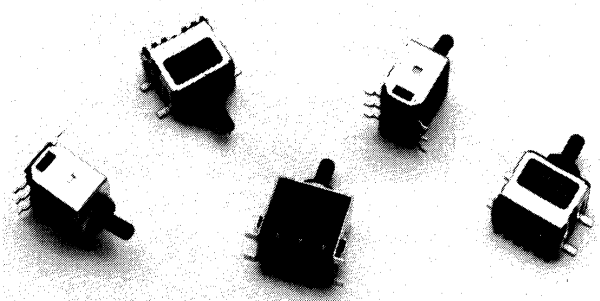


Series G. World's smallest washable toggles & pushbuttons.
Toggles, rockers, pushbuttons & indicator lights one-third size of super-subminiatures, 0.25 gram weight. Patented hi-rel logic level STC contacts. Straight, right angle & vertical terminals for standard 100" x .100" spacing. SPDT & DPDT.
Call 602/991-0942. Ask for EEM Extension.



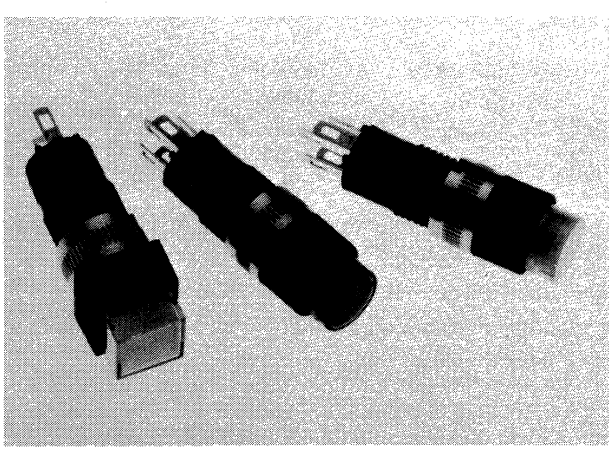
Series E. Cost & space saving 3 amp toggles & pushbuttons.
Subminiature. Rated 3A @125V AC (silver contacts), 0.4VA max. @28V AC/DC (gold contacts). 1500V dielectric. UL & CSA recognized. SPST, SPDT, DPST & DPDT. Slow-make, slow-break contact for AC and low-volt DC operations. Snap-in or bushing mounted.
Call 602/991-0942. Ask for EEM Extension.



Series G3. Micro-subminiature washable surface mount.
World's smallest, most reliable surface mount toggles & pushbuttons. Patented STC contacts. Straight (bracketed or unbracketed) or right angle terminations. Vapor phase reflow solderable. SPDT & DPDT in numerous circuits. 500-device tape or 50-piece stick tube.
Call 602/991-0942. Ask for EEM Extension.

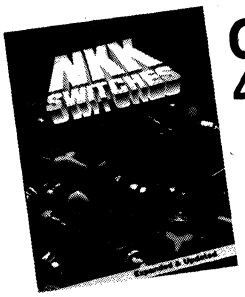


Series FB/SB pushbuttons, 0.4VA TO 3 amp.
Rugged, economical panel-mounting SB models to 3 amps. Anti-jamming device protects contacts. UL & CSA recognized. Optional slip-on caps in 7 colors. Tiny logic level FB models with .197" dia. bushing, .819" overall length are UL recognized.
Call 602/991-0942. Ask for EEM Extension.



Series HB. Ultra-small LED panel mount pushbuttons.
One-fourth size of std. lighted devices. Tiny .315" dia. body takes up less than 1" behind panel. Hi-visibility full-face or spot-illuminated caps relamp from front panel. Self-cleaning contacts. SPDT with 0.1A max. @30V AC/DC max. rating. UL recognized.
Call 602/991-0942. Ask for EEM Extension.

NKK switches



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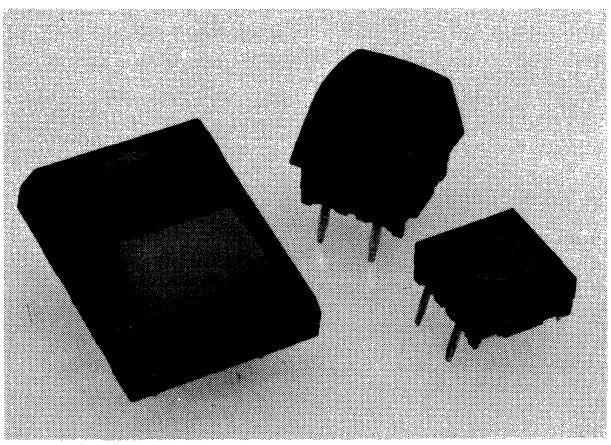

Series JF/JB. 5 million actuations from keypad switches.
Attractive, hi-rel JF keypads with or without illumination. Numerous colors. Light touch. 50mA/24V DC rated. JB models feature low profile, short stroke with guaranteed 5 million operations. Copper alloy dome for crisp tactile feedback.
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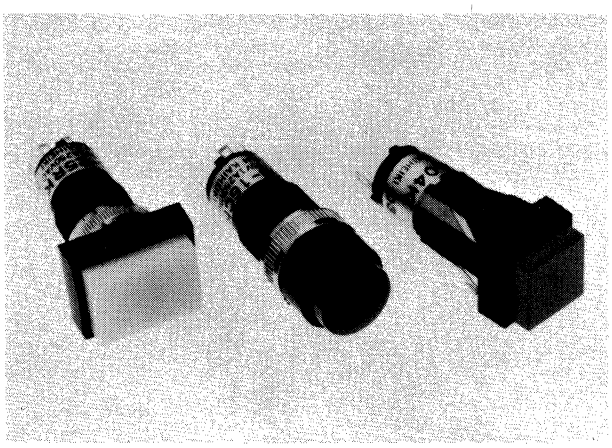
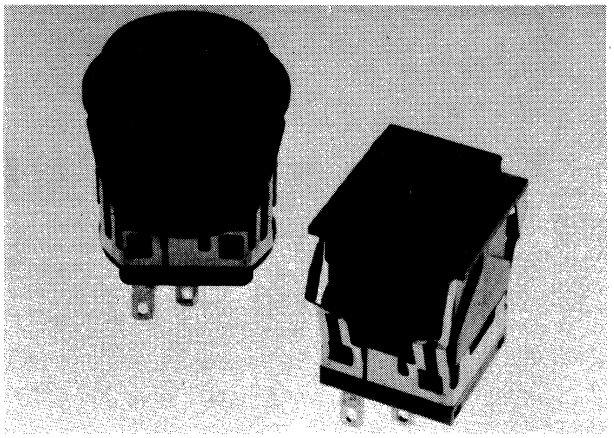
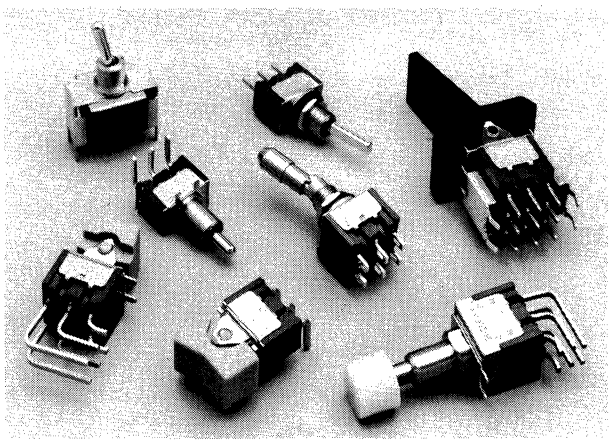


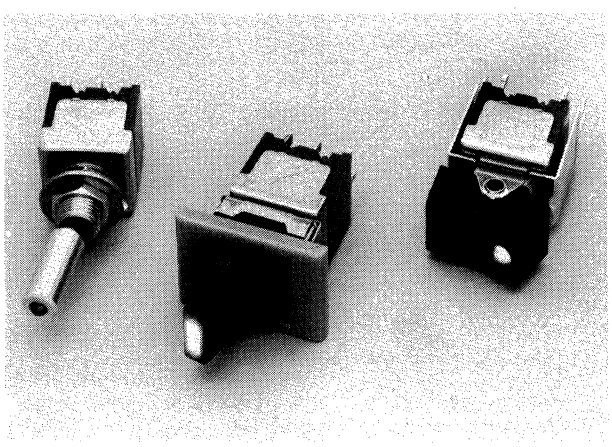
Series KB. 1 amp & logic level lighted pushbuttons.
Miniature KBs allow front panel, bushing or snap-in mounting, plus optional adapters for straight or right angle PCB mounting. High visibility. Several lamp choices, all relampable from front panel. SPDT, DPDT in maintained or momentary circuits. Hi-rel snap-action contacts.
Call 602/991-0942. Ask for EEM Extension.



Series LB. 3 amp Lighted pushbuttons with panel seal option.
SPDT, DPDT 3 amp with UL & CSA recognized, or logic level., maintained or momentary circuits. Oil, dust and watertight panel-sealed model meets IP65 of IEC 529 standard. Single or bicolor LEDs. Min. 1 million operations. Optional PC adaptor, splash/dust covers, barriers & more. **Call 602/991-0942. Ask for EEM Extension.**

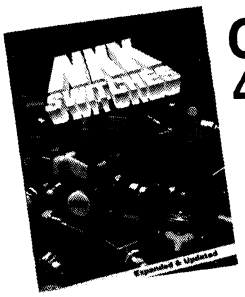


Series M. 6 amp subminiature toggles, rockers & pushbuttons.
World's largest selection. 6A/125V AC, 3A/250V AC & 0.4VA/28V max. ratings. 1 to 4 poles. 9 circuits. Numerous toggle, rocker, paddle types. Mom. and alt. action pushbuttons. All terminal types. Threaded, smooth and splashproof bushings. Most UL & CSA recognized.
Call 602/991-0942. Ask for EEM Extension.



Series M2100. Unique! Tip changes color with actuation.
Toggles, rockers/paddles with high-visibility LED that changes color with position of actuator. 6A/125V AC, 3A/30V DC & logic level ratings. 1500V dielectric strength. Anti-jamming device protects contacts. Bushing, snap-in or flat frame mounting.
Call 602/991-0942. Ask for EEM Extension.

NKK switches



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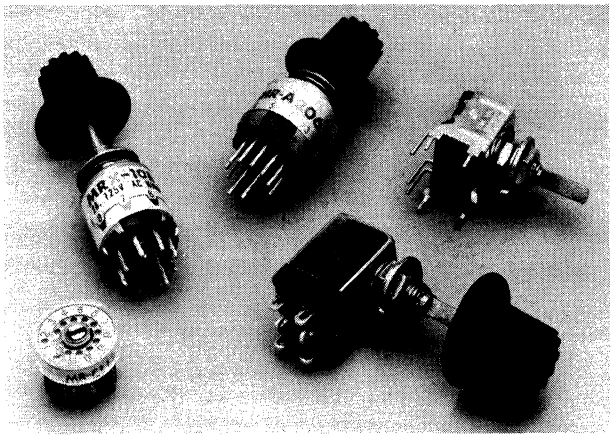
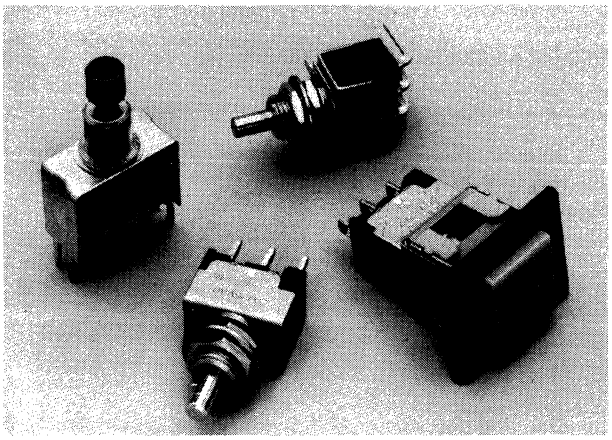
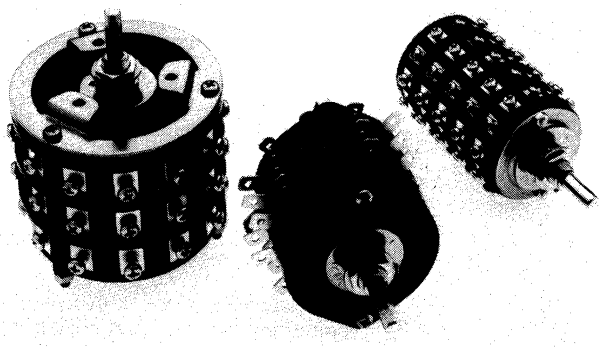


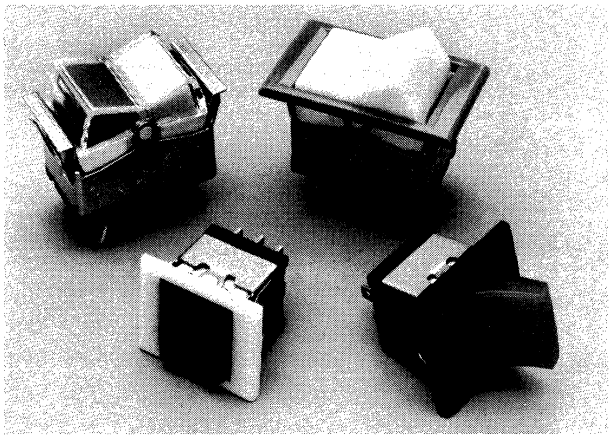
Series MR. Half-inch dia. logic level to 10 amp UL rotaries. Miniature shaft actuated (knob supplied) rotaries. PCB or panel mounting. Panel depths from .323" to .681". Single, double & four poles. 30°, 45°, 60°, 120° indexing and adjustable stop settings or continuous rotation. Washable and splash-proof models available.
Call 602/991-0942. Ask for EEM Extension.



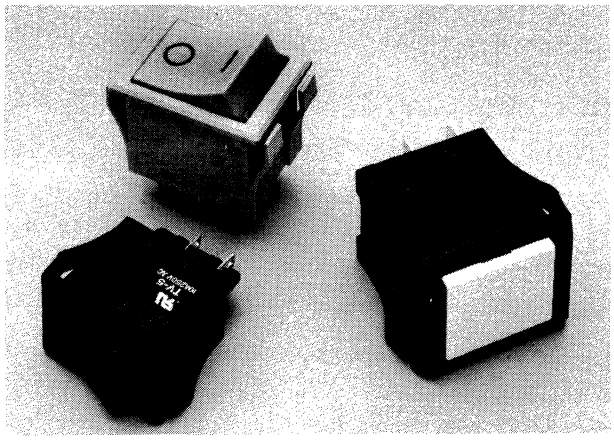
Series MB2400. Subminiature 3 amp momentary pushbuttons. Hi-rel, light-touch, snap acting contacts with high torque bushings, external insulating barriers, 1500V dielectric strength. SPDT, DPDT. 3A or logic level. 7 bushing types. Solder lug, straight PC with various bracket lengths & types. UL & CSA recognized.
Call 602/991-0942. Ask for EEM Extension.



Series HS/PS/TS. Standard size to hi-cap 30 amp rotaries. Nonshorting TS: 1 through 5 poles, 2 through 11 positions, 6A (res. load) rating. Shorting or nonshorting HS: 1 through 6 poles, 2 through 11 pos., 6A & 12A ratings. Nonshorting PS: 1 through 5 poles, 2 through 11 pos., 30A (res. load), 10A (inductive load).
Call 602/991-0942. Ask for EEM Extension.



Series MLW/LW. High visibility 5 to 20 amp lighted rockers. MLWs: industry's first snap-in lighted rockers. Rockers/paddles in 8 colors. SPDT, DPDT, SP3T in 6 circuits. Neon, LED or 5 incandescent voltages. Design, spot illuminated and solid caps. Std. size 10A LW model have partitioned rocker. Dual incandescent lamps.
Call 602/991-0942. Ask for EEM Extension.



Series JW/JP. Snap-in mount 16A rockers & pushbuttons. JW rockers & JP pushbuttons provide high inrush current capability to prevent contact welding. SP & DP maintained circuits. Model "L" has UL & CSA TV-8 rating; 16A125/250VAC (res. load). Model "M" has UL & CSA TV-5 rating; 10A125/250VAC (res. load).
Call 602/991-0942. Ask for EEM Extension.

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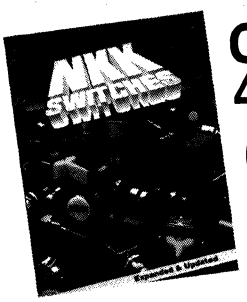

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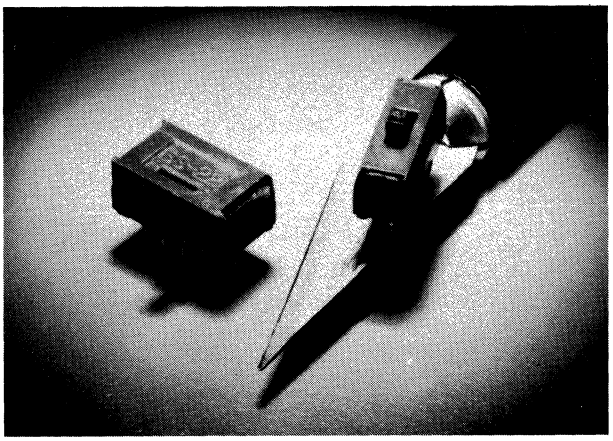
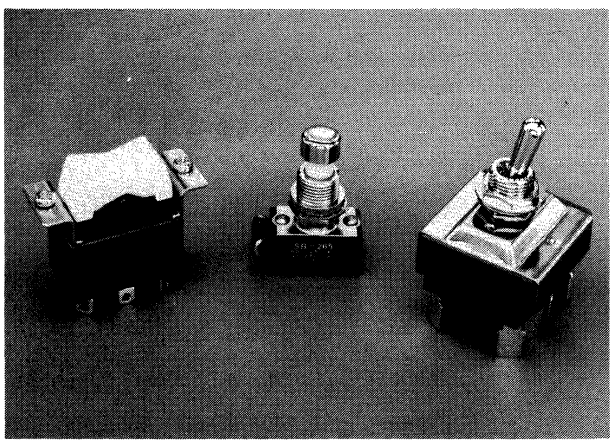


Series SS. Unique! Micro-subminiature PCB slides.
Tiny (.257"x.402") slide-actuated switch. SPDT, SP3T & DPDT with 0.1A@30V DC rating. Top or side-actuated types for max. flexibility. All fit standard 100" x .100" PCB spacing. Lighted models also offered.
Call 602/991-0942. Ask for EEM Extension.



Series S/SB/SW std. size. Toggles, rockers & pushbuttons.
S Series: bushing mounted toggles with 1 through 4 poles, 6 circuits and 3A-20A rating (res. load). Optional splashproof bushing. SB: 3A to 15A, 1&2 pole, momentary or alt. action, bushing mounted pushbuttons. SW: 3A to 20A (with res. load rockers). Flush panel mount.
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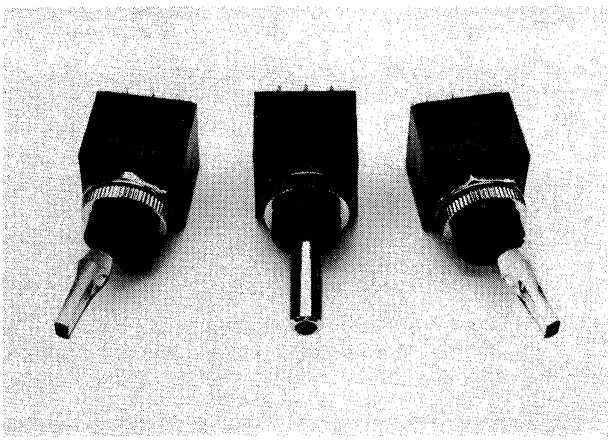

Series TL. Fully illuminated or LED tipped 6A toggles.
Entire polycarbonate toggle lights up in red, green or yellow. Or choose toggle with LED light at tip only. Both provide hi-visibility in low light. 6A/125V AC. Splashproof! Sealed to meet IP65 or IEC529 stds. Single or double pole. UL & CSA recognized.
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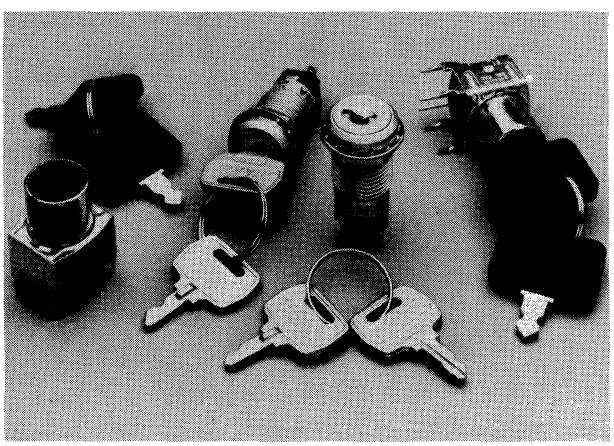

Series SK. Compact bushing & panel mount keylocks.
Crisp detent, self-cleaning contacts, dust resistant interior. UL/CSA recognized bushing mounted 3A rated SPDT with 1500V dielectric strength. Short .945" length behind panel. Plus, washable logic level PCB types available in 3 poles. Straight or right angle terminals.
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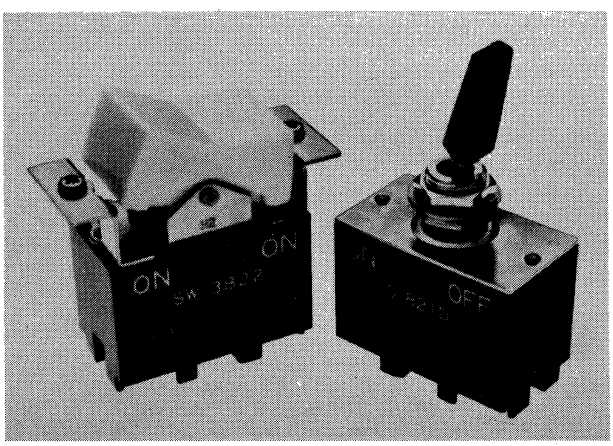
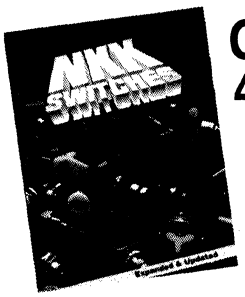


Series S/SW. High capacity AC/DC toggles & rockers to 50 amps.
Series S toggles rated 30A/125V AC (res. load) & 50A/125V AC. 2 & 3 poles with up to 3 maintained circuits. Bushing mounted, screw terminals. SW rockers rated at 30A/125V AC. Plus, 15A/125V DC (res. load) & 5A/125V (inductive load) models for hi-capacity DC applications.
Call 602/991-0942. Ask for EEM Extension.

NKK switches



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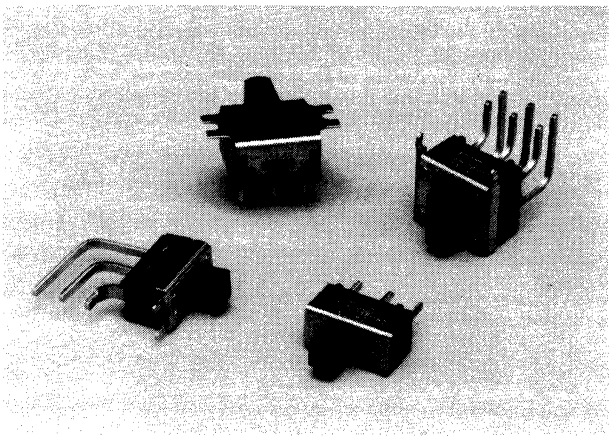
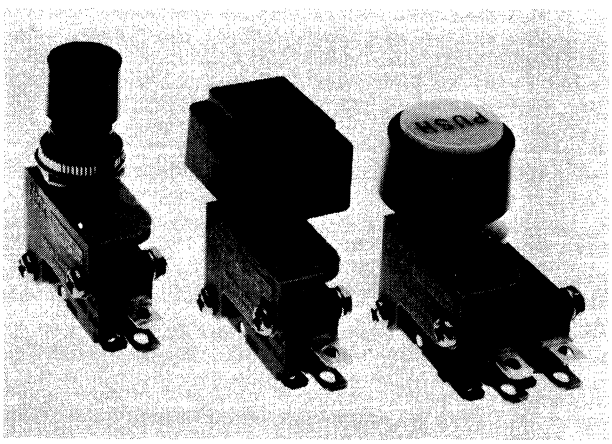
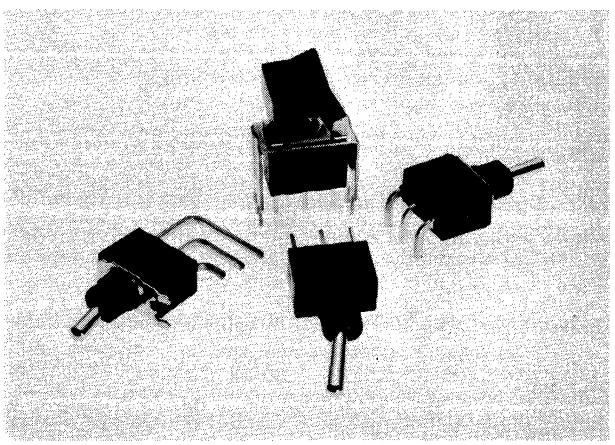


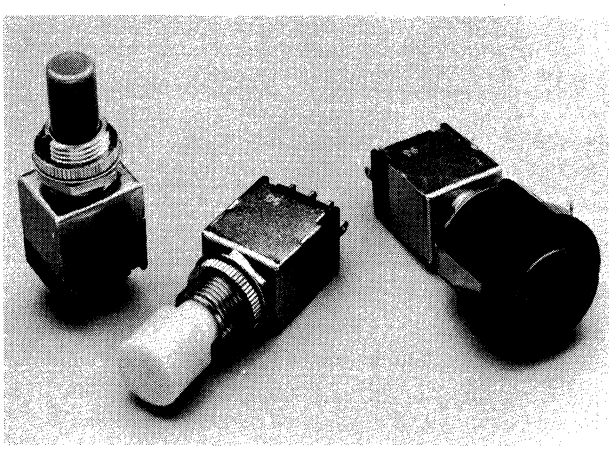
Series MS. Unique! 6A subminiature slides.
Hi-rel contact & compact .500" x .469" dimensions for high-density, side-by-side mounting. SPDT & DPDT with 6A/125V to logic level. Solder lug, straight, right angle & vertical epoxy sealed terminals. Lighted models.
Call 602/991-0942. Ask for EEM Extension.



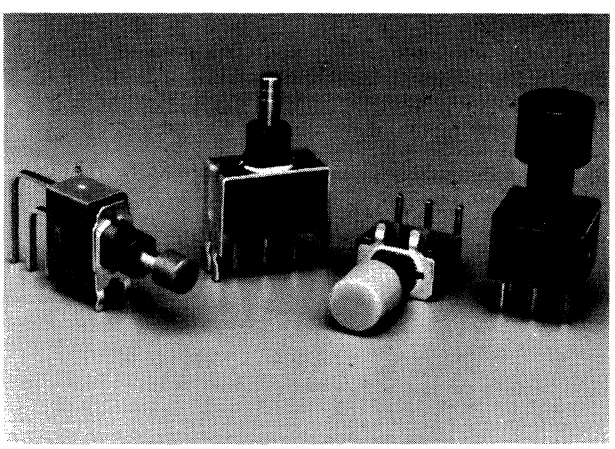
Series SCB. 5,000,000-operation panel mount pushbuttons.
Snap acting contact provides unrivalled lifespan. Rated at 15A@125V AC (res. load). High-capacity version rated at 15A@1/2HP@125V AC (res. load) provides min. 1 million operations. UL/CSA recognized. Rectangular & round shrouds & caps in several colors.
Call 602/991-0942. Ask for EEM Extension.



Series M2T. Washable 6A subminiature toggles/rockers.
Large selection of 6A/125V AC to logic level models, many with UL & CSA recognized. All feature built-in O-ring for washability. SPDT & DPDT. Numerous PCB terminal types. Choice of toggle & rocker/paddle actuators. Anti-jamming protects contacts, extends switch life.
Call 602/991-0942. Ask for EEM Extension.

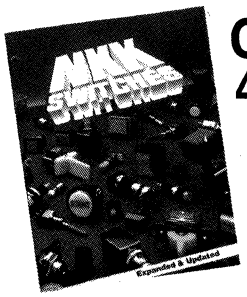


Series DLB. Lighted power rated panel mount pushbuttons.
Std. size, exceptionally durable. Bushing & snap-in mounted DPDT models with 5A/125V AC to logic level ratings. 1500V dielectric strength. Solder lug & PC terminals. Patented detent. 6V, 14V, 28V incandescent or 110V neon or LED. Numerous cap styles & colors.
Call 602/991-0942. Ask for EEM Extension.



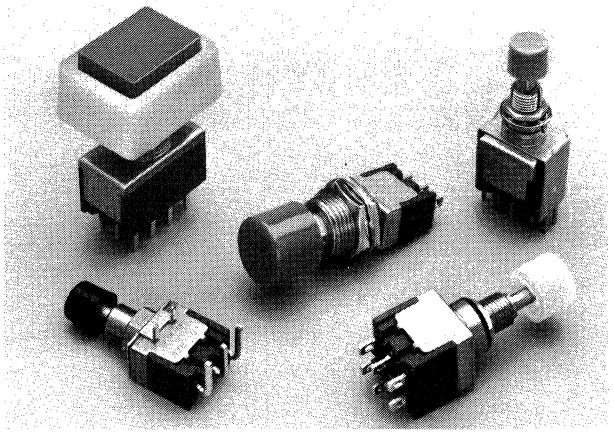
Series M2B. Washable 1A subminiature pushbuttons.
Hi-rel, light-touch, snap acting contacts feature built-in O-ring for washability. Anti-jamming design to protect contacts, extend switch life. 6A/125V to logic level. SPDT & DPDT with UL & CSA recognized. Numerous PCB terminal types. Snap-on pushbutton in several colors & sizes. **Call 602/991-0942. Ask for EEM Extension.**

NKK switches

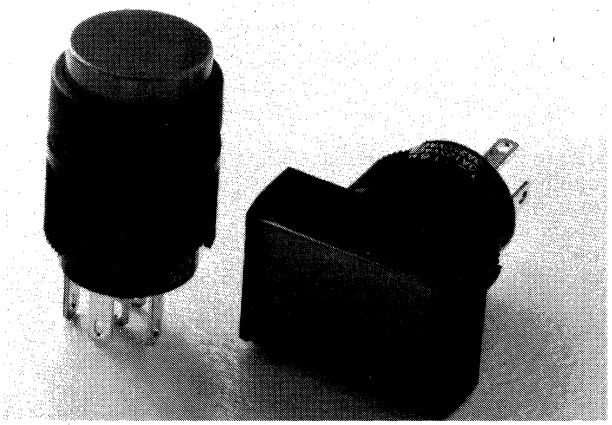


Call for free 1992 456-page catalog. (602) 991-0942

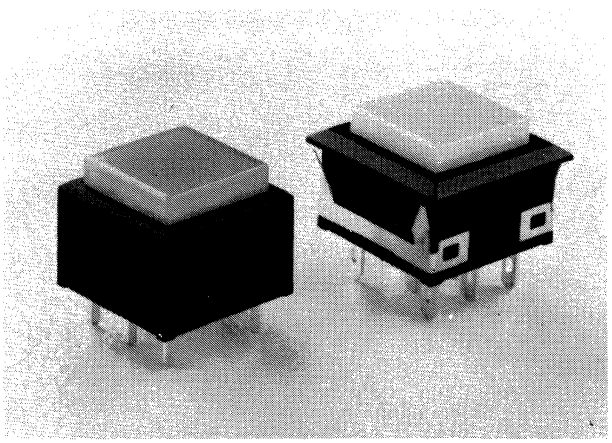
NKK SWITCHES
7850 E. Gelding Drive
Scottsdale, AZ 85260
FAX (602) 998-1435



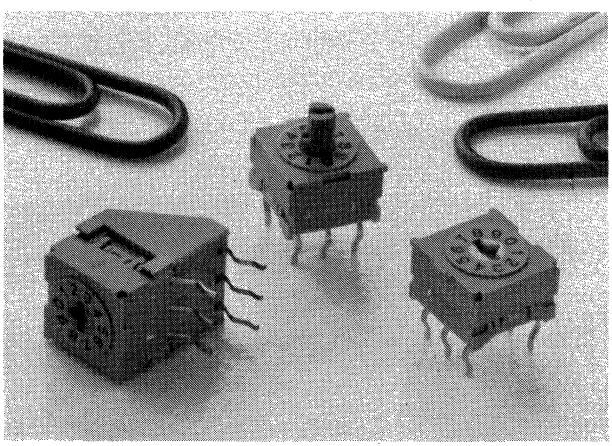
Series MB2000. Versatile 6 amp subminiature pushbuttons. Tremendous selection. SP to 4P in momentary or alt. action. 6A to logic level, plus dual rating. Bushing mount, bracketed & angle PC & large bushing mount. Screw-on or snap-on caps in several colors. Accessories include splashproof boots, colored shrouds & mounters. **Call 602/991-0942. Ask for EEM Extension.**



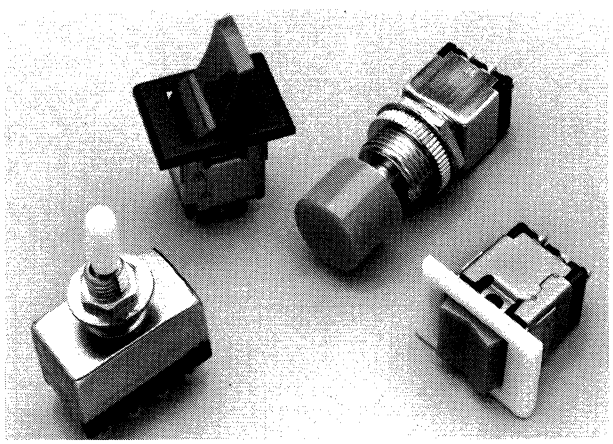
Series YB. Lighted panel mount pushbuttons with twin seal. 1 million mechanical actuations. Exceptional reliability ensured by double-seal design that protects contacts from dust, water and other contaminants. Meets IP65 of IEC529 standards. Snap-in or bushing mount. 3A 125/250V AC, 3A 30V DC & logic level. Wide choice of lamps. **Call 602/991-0942. Ask for EEM Extension.**



Series UB. Space-saving lighted panel mount/PCB pushbuttons. Half-inch body saves space behind panel or on PC board. Momentary or alt. action. Quick-make, quick-break contacts limit arcing, prolong life. 5A, 125/250V AC, 5A, 30V DC or logic level. SPDT & DPDT. Special latchdown mechanism.
Call 602/991-0942. Ask for EEM Extension.

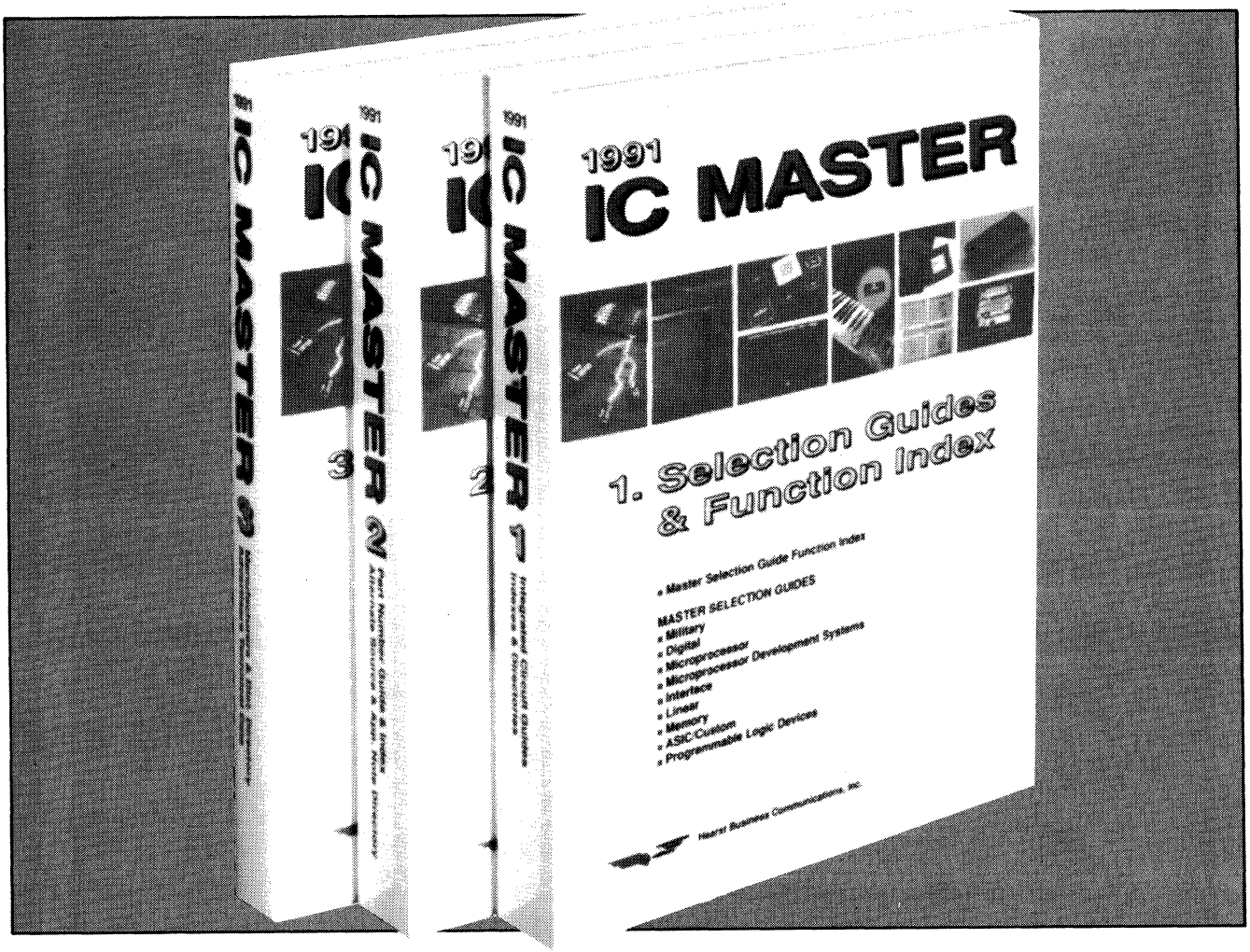


Series ND. World's smallest binary coded DIP rotaries. Washable thru hole PCB or surface mountable types. Straight or right angle mount. Real or complement-coded with 10-pos. decimal or 16-pos. hexadecimal. Screwdriver or shaft-actuated with hi-visibility legends for easy code setting. 100mA/50V DC switching rating.
Call 602/991-0942. Ask for EEM Extension.



Series S/SB/PW miniatures. Toggles, rockers & pushbuttons. Heavy duty miniatures include 1 through 4 poles, 10A S Series toggles & 5A SB Series pushbuttons. High torque collar prevents rotation or separation from case during mounting. Built to endure severe environments. 5A PW SPDT & DPDT rockers feature positive detent actuation.
Call 602/991-0942. Ask for EEM Extension.

SUPER TIME SAVER!



Do you work with ICs? Do you have trouble finding the IC you need? Are you sick and tired of sifting through dozens of manufacturers' data books? Do you have trouble comparing one set of specs to another? Are you sick and tired of wasting time?

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There's more! The Master has a section on microprocessor development tools with complete performance parameters. There's another section on programmable logic devices giving you everything from output configuration to PLD development systems.

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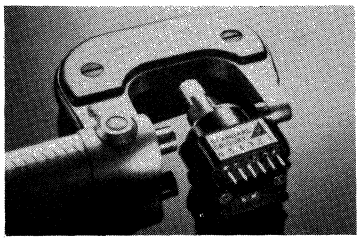


Engineered, manufactured and tested for superior performance Standard Grigsby's Series SG-OE1 optical encoder offers unmatched reliability and long life. Advanced optical switching technology eliminates metal contacts and related metal fatigue. The result: superior accuracy and extended life. Standard Grigsby's unique vibration-resistant interlock design assures perfect alignment of manufactured components throughout the life of the switch, for positive switching every time. No improper output code problems!

Rotary Encoder Switch

Electrical Characteristics

Operating Voltage	5Vdc + .25Vdc
Switching Current	30 mA max.
Power Consumption	@5Vdc; 150 MW max.
Logic Low Minimum	0.5V
Logic High Minimum	3.8V
Life Rating	5,000,000+ cycles
Operating Temperature	−40°C to 125°C
Storage Temperature	−55°C to 150°C
Humidity	85% R.H. @ 40°C, 240 hours

Mechanical Characteristics

Shaft Rotation	Continuous in either direction
Operating Speed	100 RPM max.
Axial Force	15 lb. min. push/pull force applied to end of shaft

Materials and Finishes

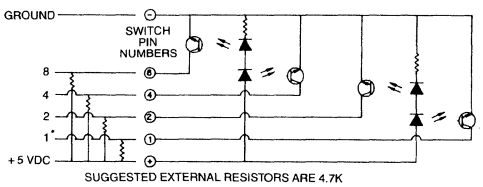
Housing	Thermoplastic
Bushing	Brass, nickel plate
Shaft	Thermoplastic
PC Boards	NEMA Grade FR-4
Board Terminals	Brass tinned
Mounting Hardware	One cadmium plated nut and lockwasher supplied with each

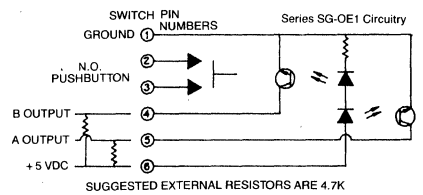
Options

- 16, 24, 32, 64, 128, 152 positions
- Shaft Length/Shaft diameter
- Panel Seal
- Binary/Gray Code
- Cable

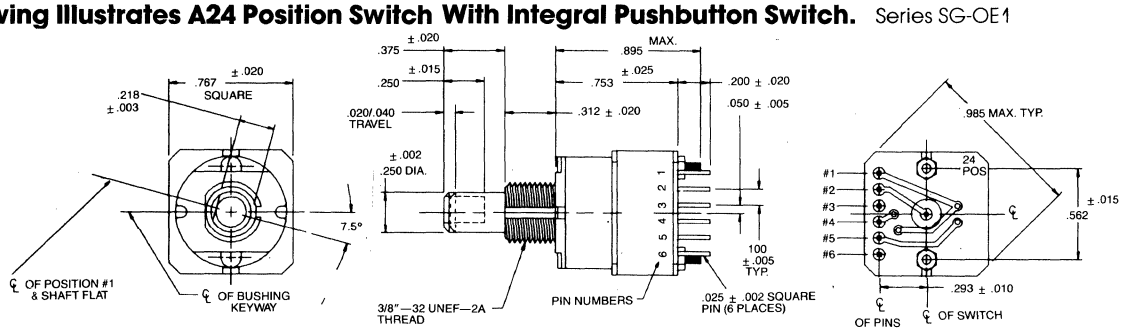
Pushbutton Encoder Switch

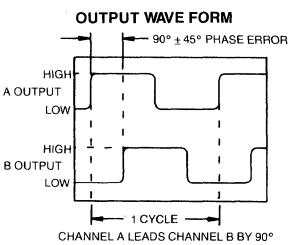
Rating at 24 Vdc:	10mA resistive
Contact Resistance:	End of life—100 milliohms
Voltage Breakdown:	250 Vac between mutually insulated parts
Life Rating:	3,000,000 cycles
Contact Bounce:	less than 4 milliseconds at make, 10 miliseconds at break
Operating Force:	300 grams standard





Drawing Illustrates A24 Position Switch With Integral Pushbutton Switch. Series SG-OE1





Standard Grigsby Optical Encoder Part Numbers:

SG-OE1-16 (16-position)
SG-OE1-16pb (16-position w/pushbutton)
SG-OE1-24 (24-position)
SG-OE1-24pb (24-position w/pushbutton)
SG-OE1-32 (32-position)
SG-OE1-32pb (32-position w/pushbutton)

Options

Shaft Length
Shaft Diameter
Ribbon Cable and/or Connectors

Part Numbers

SG-OE1-16b (16 position, binary coded)
SG-OE1-16g (16 position, gray coded)
SG-OE1-64 (64 position)
SG-OE1-128 (128 position)
SG-OE1-152 (152 position)
SG-OE2-64
SG-OE2-128
SG-OE2-256

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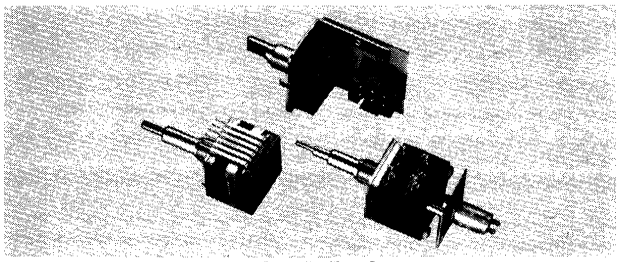
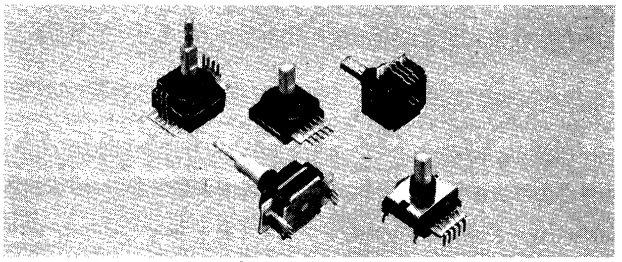
Rotary Encoder Switches

OAKGRIGSBY



MMP-Rel



LCE Encoder

Electrical Characteristics

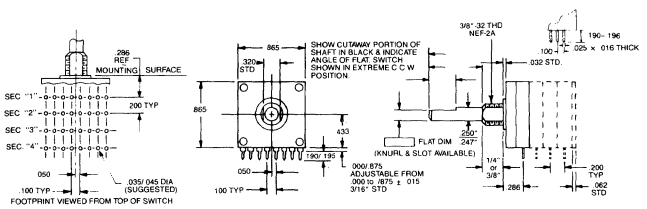
Current Carrying	Resistive load.
Capacity	250 MA at 28 VDC.
Shock Humidity	MIL-STD 202E.
Code Program	Shorting or non-shorting (non-shorting versions, up to 16 positions only).
Dielectric Strength	From pole to shaft 1,000 volts min.
Contact Resistance	75 milliohms max, over lifetime.

Contacts	Phosphor-bronze with silver inlay at interface with program disc. Gold inlays available upon request. External terminals are solder (60-40) plate except on die cut edges.
Codes	Hexidecimal, B,C,D, Gray and others on special order.
Switching Loads	1.5 MA at 115 VAC. 150 MA at 14 VDC.

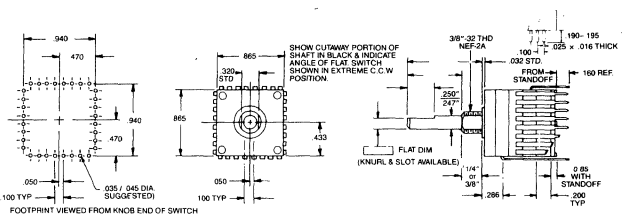
Mechanical Specifications

Operating Forces	(torque over detents): 7 to 20 in./oz. ±25%.
Life	50,000 minimum cycles at rated load (250,000 cycles available)
Rotational position Stops	Per requirement.
Stop Strength	15 in./lb. min.
Operating Temperature Range	−55°C to +85°C (105°C optional).
Sealing	Terminals are insert molded into housing. Front and rear molded sections of module are interlock construction. Ideally suited for wave soldering.
Shafts and Hardware	Shafts and hardware are steel, cadmium plated and chromate treated, detent parts, including stops, are stainless steel.
Anti-Rotation Device	Flatted mounting bushing. .375" dia. × .320," double "D."
Concentric Shafts	Available.
Detent Angles	90°, 60°, 45°, 36°, 30°, 22.5°, 20°, 18°, 15°, 12.8°, 11.25°, 10°.
Molded Construction	Molded parts are Ryton R4 and Polyester PBT, chosen for heat resistance and electrical characteristics. Rated 94 V-O or better.
Disc. Construction	Program disc. is glass epoxy, copper clad with silver plating standard. Gold upon request.

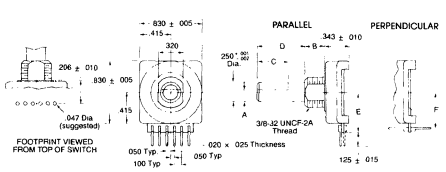
Parallel Shaft Mounting (relative to PC Board)



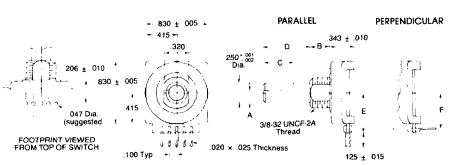
Perpendicular Shaft Mounting (relative to PC Board)



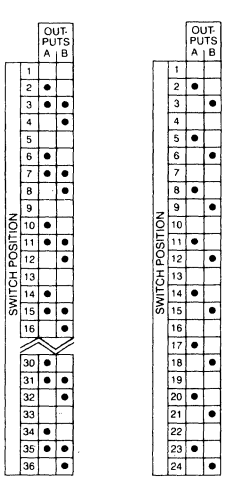
LCE-1 PARALLEL OR PERPENDICULAR MOUNTING (relative to PC Board)



LCE-2 PARALLEL OR PERPENDICULAR MOUNTING (relative to PC Board)



Unused Terminals Omitted



Unless otherwise specified, standard dimensions are:

A. Thickness of flat—.218 ± .003 standard
B. Length of bushing—.250 ± .010 standard. Also available in .000 ± .010 and .375 ± .010.
C. Length of flat—.375 ± .010 standard. Others upon request.
D. Length of shaft—.500 ± .015 standard. Others upon request.
E. Centerline of switch to standoff—.615 ± .005.
F. Centerline of switch to centerline of terminal—.470 ± .007, or .625 ± .007 extending to rear, .500 ± .007 extending to front.

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Rotary Switches

1/2" Single Deck (Sealed and Unsealed)

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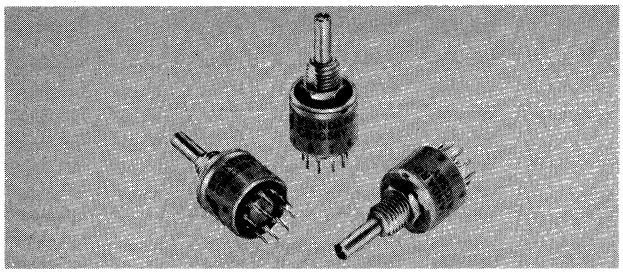
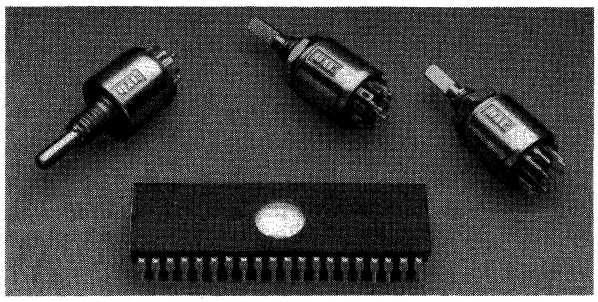
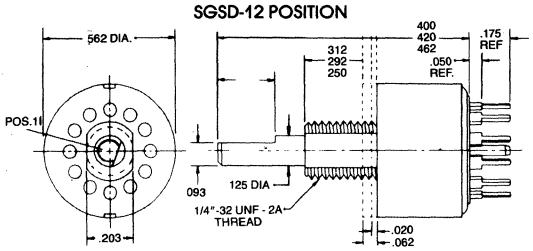


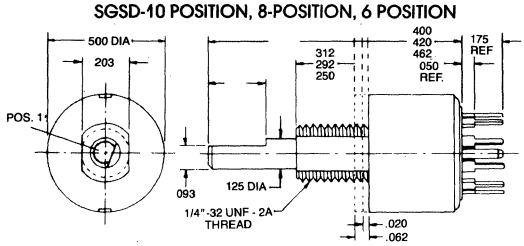


Series SD/SDS
(unsealed)

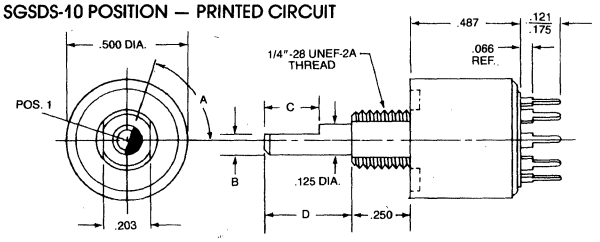
SGSD-12 POSITION



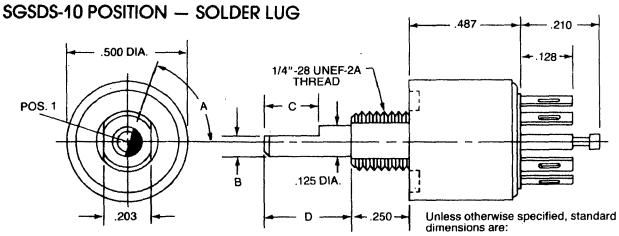
SGSD-10 POSITION, 8-POSITION, 6 POSITION



SGSDS-10 POSITION — PRINTED CIRCUIT



SGSDS-10 POSITION — SOLDER LUG



Unless otherwise specified, standard dimensions are:
A. Angle of flat – 72° ±3°.
B. Thickness of flat – .093" ±.003".
C. Length of flat – .250" ±.015".
D. Length of shaft – .375" ±.020".

Series 500
(sealed)

Electrical Characteristics

Current and Voltage Ratings	200 MA at 28 VDC resistive. 150 MA at 115 VAC resistive.
Current Carrying Capacity	6 amps
Dielectric Strength	600 VAC min.
Insulation Resistance	10,000 megohms min., 50,000 megohms initial
Contact Resistance	Typical: 25 milliohms

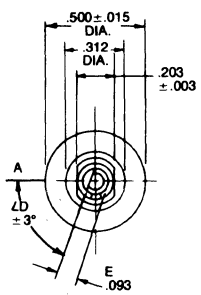
Mechanical Specifications

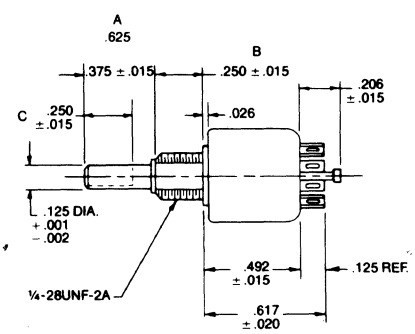
Life	25,000 cycles
Rotational Torque	8 to 24 oz./in. at ambient conditions
Stop Strength	7.5 lb./in. min.
Shaft Orientation	Flat is opposite pole number one contacting position-standard
Detent Angles	30°, 36°, 45°, 60° and 90°

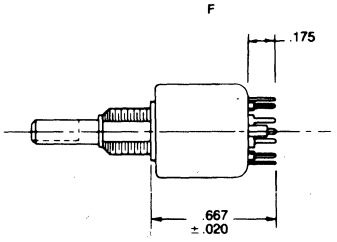
Material and Finishes

Switch Base	Diallyl Phthalate per MIL-M-14
Shaft	Stainless steel passivated
Index Housing	Zamak with chromate finish
Shaft & Panel Seals	Available
Terminals and Contacts	Gold plated
Mounting Hardware	Mounting nut and lockwasher supplied unassembled

Fixed Stops







Military Type Switches

The Type 500 switches are provided in sealed or unsealed versions, with fixed stops and solder lug or PC terminals, to meet the requirements of MIL-S-3786/20.

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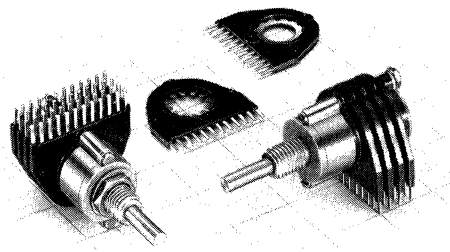
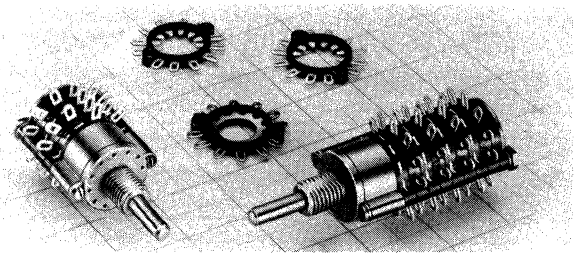
Rotary Switches
1/2" Multi Deck

OAKGRIGSBY



Series MD (PC)



Series MD SL

Electrical Characteristics

Current and Voltage Ratings	150 MA. at 28 VDC resistive. 100 MA. at 115 VAC resistive.
Current Carrying Capacity	3 amps.
Dielectric Strength	600 VAC min.
Insulation Resistance	50,000 megohms.
Contact Resistance	25 milliohms max. at initial contact.

Mechanical Specifications

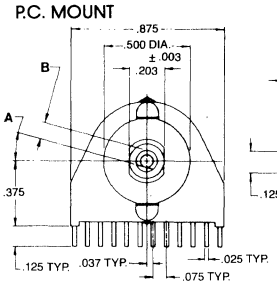
Life	25,000 cycles.
Rotational Torque	6 to 32 oz./in. depending on number of poles.
Stop Strength	10.0 pound-inches min.
Stops	Fixed or adjustable available.
Shaft Orientation	Flat is opposite pole number one contacting position.

Material and Finishes

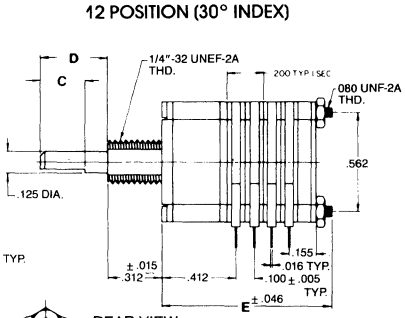
Decks	Ryton R-4 for PC mount/thermoset for SL.
Shaft	Stainless steel passivated.
Index Housing	Zamak with chromate finish.
Rotor Contacts	Silver alloy. Gold plate optional.
Stationary Contacts and Terminals	Brass silver plate. Gold plate optional.
Mounting Hardware	Mounting nut and lockwasher supplied unassembled.

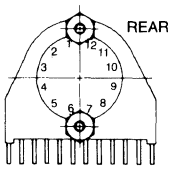
250 diameter shafts available upon request.

P.C. MOUNT

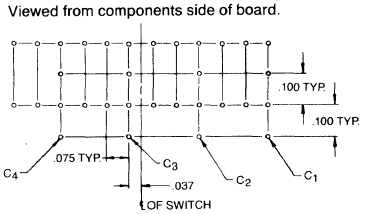


12 POSITION (30° INDEX)



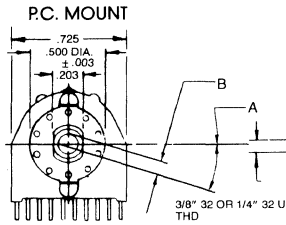


P.C. BOARD MOUNTING PATTERN
Viewed from components side of board.

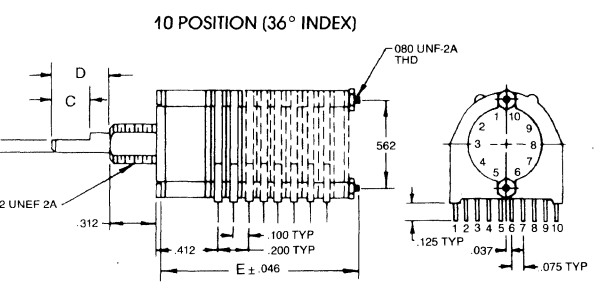


SHAFT END OF SWITCH

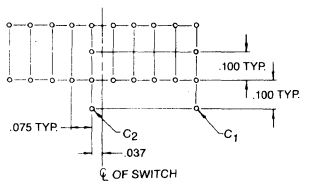
P.C. MOUNT



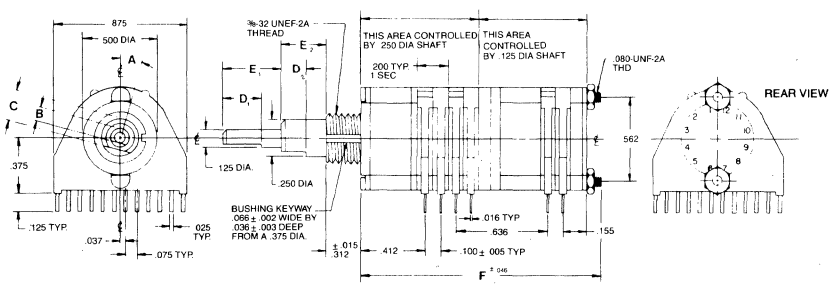
10 POSITION (36° INDEX)



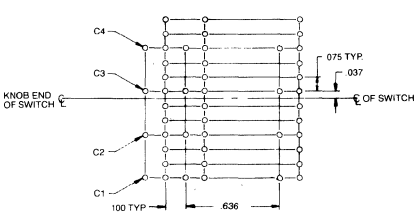
P.C. BOARD MOUNTING PATTERN
Viewed from components side of board.



Unless otherwise specified, standard dimensions are:
A. Angle of flat—15° ±3°.
B. Thickness of flat—.093" ± .003".
C. Length of flat—.250" ± .015".
D. Length of shaft—.375" ± .020".
E. .780" for one section. Add .200" ± for each additional section.



P.C. BOARD MOUNTING PATTERN
Viewed from components side of board.

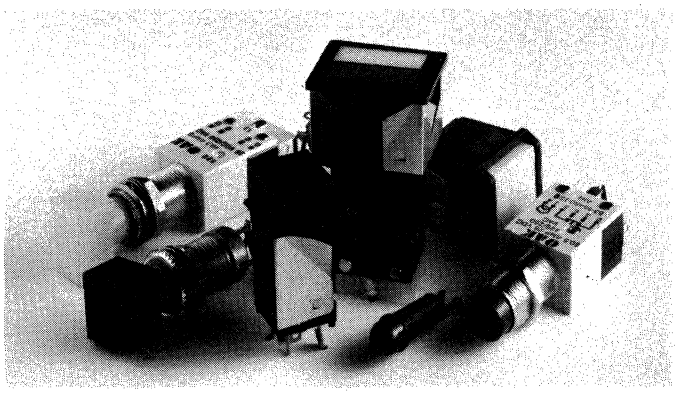


Unless otherwise specified, standard dimensions are:
A. Angle of flat–15° ±3°
B. Thickness of flat–.093" ±.003"
C. Thickness of flat–.219" ±.003".
D. Length of flat–.250" ±.015".
E. Length of shaft–.375" ±.020".
F. 1.416" for one section. Add .200" for each additional section.

OAKGRIGSBY INC. 88 N. Dugan Rd., Sugar Grove, IL 60554 • Phone 708/556-4200 • FAX 708/556-4216

Lighted Pushbutton Switches And Indicators

OAKGRIGSBY



Oak Optolite™ lighted pushbutton switches and indicators come in a choice of eleven styles and nine custom colors with custom legends and various mounting options. A wide range of electrical ratings and contact configurations is available in both alternate (push-on-push-off) and momentary operation with up to 10 million duty cycles. These switches meet the military specifications for MIL-L-3661 and MIL-L-7961.

	Contact Rating	Circuits	Switch Action	Termination	Panel Cut Out	Panel Thickness	Space Req'd. Behind Panel	Switch Body Dimensions	Low Level Switching	UL Approved
	.5A@30VDC	SPST Form A	Momentary	Solder	.512 dia.	.02 to .50	1.312	.563 dia.		
	3A@30 VDC	SPST Form Z	Momentary	Solder or PC	.512 dia.	.02 to .50	1.093	.625 dia.	X	X
	5A@28VDC	SPST Form Z SPDT Form C	Momentary & Alternate	Solder	.512 dia.	.02 to .50	1.187	.750 dia.		X
	10.5A@28VDC	SPST Form X DPST Form X SPST Form Z DPST Form Z	Momentary & Alternate	Solder	.512 dia.	.02 to .50	1.312	.656 x .781		X
	15A@28VDC	SPDT Form C	Momentary & Alternate	Solder	.512 dia.	.02 to .50	1.250	.750 dia.		
	.5A@28VDC	SPDT Form C	Momentary & Alternate	Solder	.512 dia.	.02 to .28	1.540	.563 dia.		X
	10.5A@28VDC	SPST Form X SPDT Form Z DPST Form X DPDT Form Z	Momentary & Alternate	Solder	.512 dia.	.02 to .38	1.450	.65 x .78		X
	.5@30VDC	SPDT Form X	Momentary	Solder or PC	.687 dia.	.06 to .18	.843	.688 dia.		
	10.5A@28VDC	SPDT Form Z DPDT Form Z	Momentary & Alternate	Solder	.870 x 1.110	.06 to .25	2.125	.93 x 1.17		
	3A@30VDC	SPST Form Z	Momentary	Solder	.512 dia.	.02 to .25	1.312	.62 dia.		
	Varies	SPDT	Momentary	Solder	.890 x .890	.02 to .125	1.150	.874 x .874		

NOTES: 1) Pushbuttons are available in Round, Square and Rectangular shapes and a variety of styles and colors.

2) Matching indicator bases are available for Friction Cap Presslites

3) A broad selection of mounting hardware is available including Knurled Nut and Safety Collar for surface or sub panel mounting, and 6 different recess mounting configurations including low cost Snap-in type

Indicators

- Many indicator-lens combinations available.
- A wide variety of military approved lamps available.

Size	General Purpose	Watertight	EMI Suppressed	Push to Test	Incandescent	Neon	MIL Approved
T1	X	X	X		X		X
T1 3/4	X	X	X	X	X		X
T2	X	X	X			X	X
T3 1/4	X	X	X	X	X	X	X
Panel Light	X						X

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Keylocks

OAKGRIGSBY

Electrical Characteristics

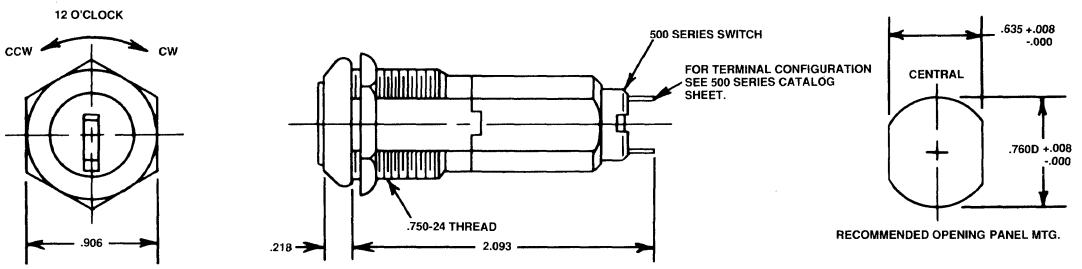
	KL Series	KL (UL/CSA) Series
Current and Voltage Ratings	200 MA at 28 VDC resistive, 150 MA at 115 VAC resistive	4 amps at 120 VAC, 2 amps at 240 VAC (UL/CSA listed)
Current Carrying Capacity	6 amps	6 amps, continuous, with max. temperature rise of 20°C
Contact Resistance	25 milliohms initially, 100 milliohms max. after life	10 milliohms
Dielectric Resistance	200 VAC min. (36° indexing, 1000 VAC min. (45° & 90° indexing)	600 VAC min.
Insulation Resistance	50,000 megohms initially, 10,000 megohms after life	
Static Protection	20,000 VDC min.	

Mechanical Specifications

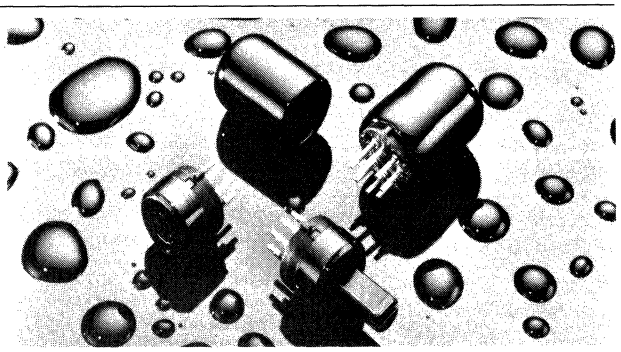
	KL Series	KL (UL/CSA) Series
Life	25,000 cycles	10,000 cycles
Rotational Torque	6 to 24 oz./in. at ambient conditions	7 to 24 oz./in. at ambient conditions
Stops	Fixed	Fixed
Indexing Angles	90°, 45° and 36°	90° and 45° std.

Material and Finishes

	KL Series	KL (UL/CSA) Series
Locks	Barrel: Zinc alloy. Key: Brass	
Finishes	Bright nickel, satin nickel, bright chrome, satin chrome and black. KL (UL/CSA) Series bezel: polished stainless steel	
Switch Housing	Molded Zytel 94 V-2	
Terminal and Contacts	Gold plated	Copper alloy, silver-plated



TO-5 Rotary Switch



Electrical Characteristics

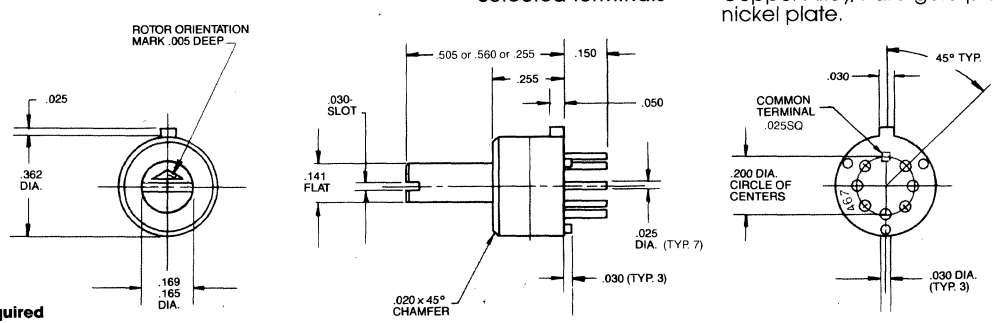
Current and Voltage Ratings	10 MA 1 volt. 500 MA 125VAC resistive load.
Current Carrying Capacity	.5 amps.
Contact Resistance	50 milliohms max. initial. 100 milliohms max. after operating life.
Breakdown Voltage	500 V 60 Hz. 850-1900 VAC.
Temperature Range (Operating)	−30°C to +65° C.
Insulation Resistance	50,000 megohms min. at 100 Volts.

Mechanical Specifications

Life	2500 cycles.
Rotational Torque	2 in./oz. to 4 in./oz. initial room ambient.
Stops	Available as required from 2 to 8 positions.
Angle of Throw	45°/position−8 position max.

Material and Finishes

Switch Base/Index	Polyester, Glass Filled.
Shaft	Acetal, Homopolymer.
Shaft Seal	Ethylene Propylene.
Rotor Contact	Brass, hard gold plate over nickel plate.
Common Ring Terminal	Phosphor Bronze, hard gold plate over nickel plate.
Selected Terminals	Copper Alloy, hard gold plate over nickel plate.



Part #91002
***Indicate if stops are required**

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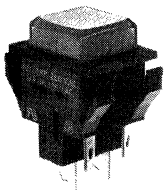
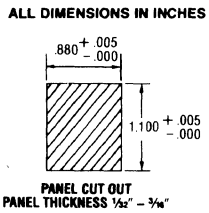
OSLO CONTROLS

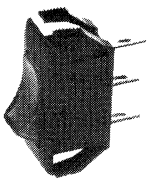
TYPE S Lighted & Non-lighted Pushbutton Switches



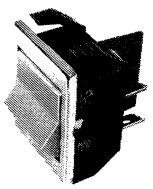


FEATURES
- Snap-in panel mounting with options in:
- Lighted or non-lighted styles
- LED, incandescent or neon lamps
- Single pole and double pole circuit arrangements
- Momentary or alternating actions
- 10 amps 125/250VAC 1/4 HP, UL, CSA, VDE
- Mechanical life 100,000 operations

TYPE R and CR Lighted & Non-lighted Rocker Switches



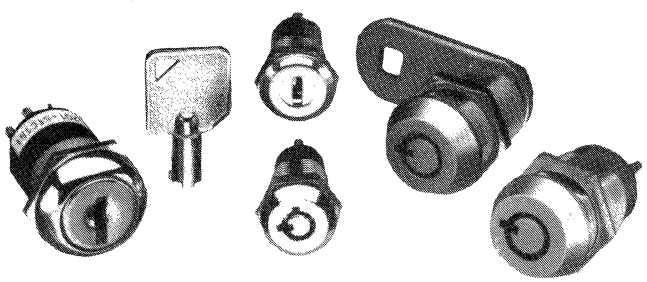
TYPE CRS
SINGLE-POLE



TYPE RT
DOUBLE-POLE

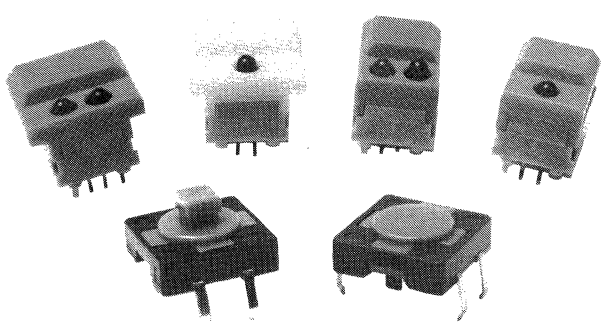
FEATURES
- Snap-in panel mounting with options in:
- Lighted or non-lighted styles
- LED, incandescent or neon lamps
- Single pole and double pole circuit arrangements
- Maintained or momentary actions, 2 or 3 position
- 20 amps 125/250VAC 3/4 HP, 125/250VAC UL, CSA
- High inrush capability
- Mechanical life: 100,000 operations

TYPE K and TYPE J Keylock Switches



FEATURES
- Flat keys or tubular keys
- Single pole and double pole
- Various key operate and removal positions
- PC mount, solder or quick connect terminals
- Maintained or momentary contacts
- 4 amp 125 VAC or 28 VDC UL, CSA
- Miniature to full size available (12mm diameter to 19mm diameter)

TYPE T Board Mounting Switches



FEATURES
- Crisp tactile feel
- Long life, 5 million operations
- Wave solderable types
- Momentary and maintained contacts
- Available LED illumination
- Wide selection of colors
- Competitively priced
- Standard Pin Configuration

OSLO CONTROLS
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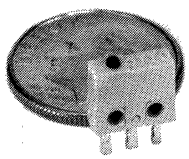
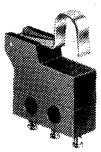
OTTO CONTROLS® More than just the Switch! Because

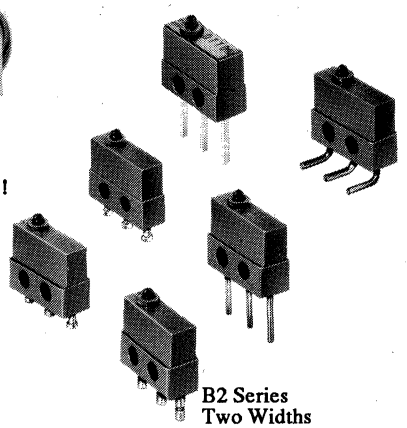
Sub-Miniature Basic Switches



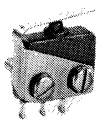
B1 Series
Ultra-Small
1 Million Cycles!



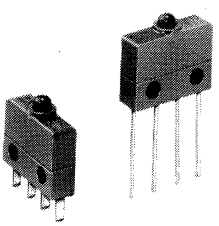
B2-5 Series
Integral Levers

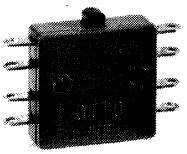


B2 Series
Two Widths

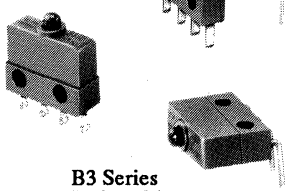


A1-101

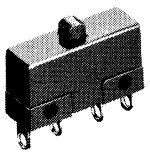




B5-7 Series
10 Amps
Double-Pole



B3 Series
TTL to 8Amps

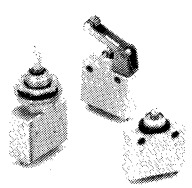


B5 Series
10 Amps

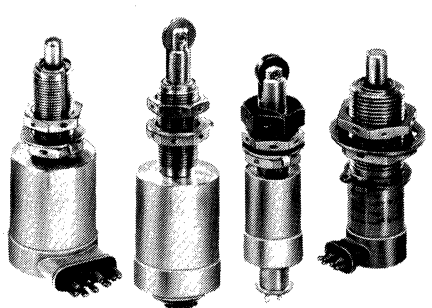
Series		B1 Sub-Subminiature	B2 Subminiature	B2-5 Integral Lever	B3 Subminiature	B5 Miniature	B5-7 Two Pole
Circuitry		SPDT	SPDT	SPDT	SPDT-DB	SPDT-DB	DPDT-DB
Rating①	Resistive	1A	7A	7A	8A	10A	10A
	Inductive	.5A	4A	4A	5A	7.5A	7.5
Actuation		Cam	Cam	Lever	Cam	Cam	Cam
Operating Force		4 oz. max	3-8 ounces	1.76 oz. max	3-8 ounces	3-8 ounces	3-8 ounces
Size:	Length	.300	.510	.580	.510	.790	.790
	Height	.280	.350	.450	.445	.530	.868
	Depth	.100	.156/.200	.200	.200	..260	.260
Mounting Centers		.150	.188	.188	.281	.500	.500
Terminal Styles②		1, 2	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6	1,3,6,7	1,3,6,7
Approvals			M8805/4,/106,/109	---	M8805/101	M8805/7	---
		---	UL/CSA	UL/CSA	UL/CSA	UL/CSA	---

①120/250VAC, 28VDC, silver contacts . ② 1. PC pins, 2. Turret, 1/8", 3. Turret 3/16", 4. Wire Wrap, 5. Right Angle PC, 6. Solder, 7. QC Tabs

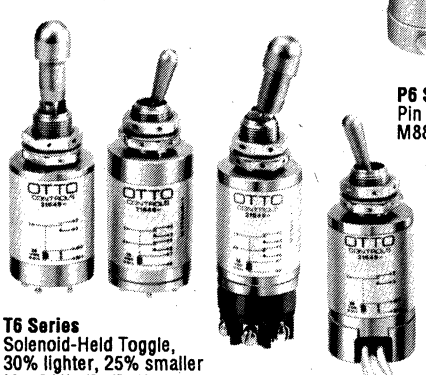
Environment-free Sealed



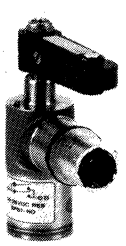
P6-3 Series
Sub-Miniature
Up to 10 Amps!



P6 Series
Pin & Roller Plunger, 2 & 4 pole
M8805/39, /40, /43, /100, /104



T6 Series
Solenoid-Held Toggle,
30% lighter, 25% smaller
M5594/1, /2, /3, /6

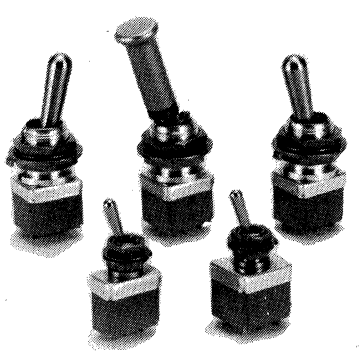


R6 Series
Rotary Roller
Actuation

Miniature Toggles

New!

T3 Series



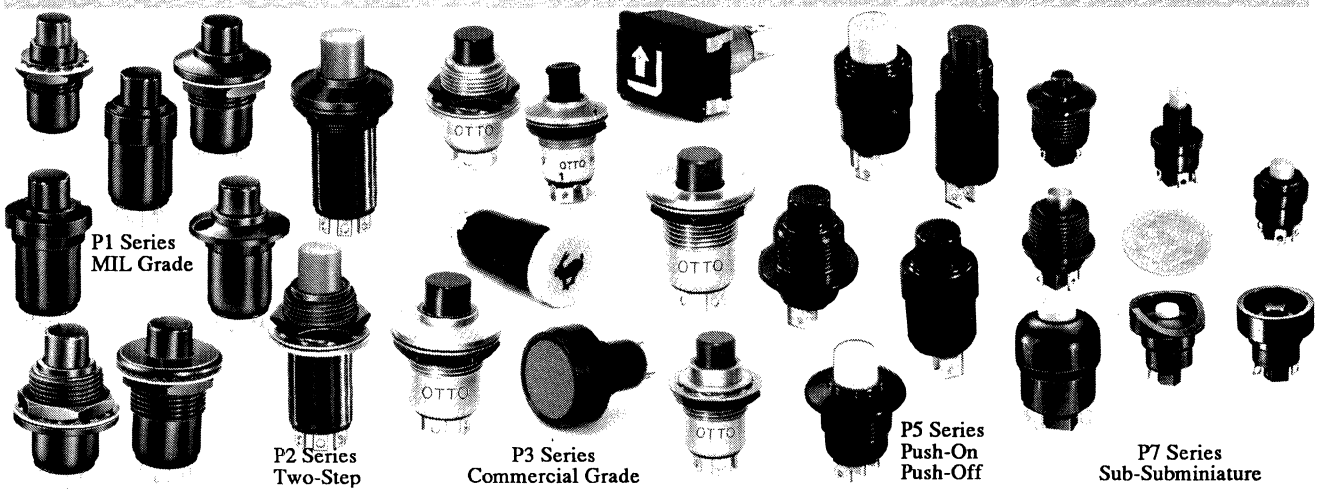
- Non-Teasible
- Shorter behind panel
- Weighs 25% less
- More plating choices
- More reliable. . . less parts
- Commercial
- MIL-S-83731
- 5 Amp., resistive
- 1 & 2 pole
- 15/32" bushing, sealed
- 1/4-40 bushing, unsealed
- Lever-Lock 15/32" bushing, sealed

OTTO Controls 2 East Main Street • Carpentersville, Illinois 60110 Phone: 708/428-7171 • Fax: 708/428-1956

we add value to your switch solution

OTTO CONTROLS

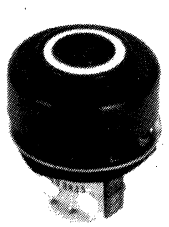
Sealed Push Button Switches-Standard Designs



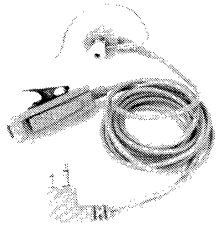
Series. . .		P1 MIL Grade	P2 3-Position	P3 Commercial Grade	P5 Alternate Action	P7 Sub-Miniature
Circuitry		SPDT-DB	2-SPDT	SPDT-DB	SPDT	SPDT-DB
Actuation		Mom./Push-Pull	2 Levels	Mom./Push-Pull	Push-On/Push-Off	Momentary
Rating①	Resistive	10A	5A	10A	5A	5A
	Inductive	5A	3A	5A	3A	3A
Mechanical Life		Up to 1 million	Up to 50,000	Up to 1 million	Up to 1 million	Up to 1 million
Operating Force		3-5 lbs.	3.5/6.0 lbs.	3-5 lbs.	3-5 lbs.	1.2-2.2 lbs.
Typical Behind Panel		.865	1.25	.865	.720	.510
Terminal Styles②		1, 2	1	1, 2	1, 2	1, 2, 3
Approvals		M8805/3	- - -	- - -	- - -	M8805/110
		- - -	- - -	- - -	- - -	- - -
Materials	Case	Black Anodized	Black Anodized	Clear Anodized	Black Anodized	Black Anodized
	Button	Nylon in 9 colors	Nylon in 9 colors	Nylon in 9 colors	Nylon in 9 colors	Nylon in 9 colors

① Ratings based on 120/250VAC, 28VDC, silver contacts. ② Terminal Style Code: 1. Solder, 2. Screw, 3. PC Pin

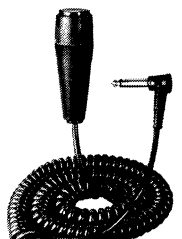
Some Examples of Special Purpose Designs



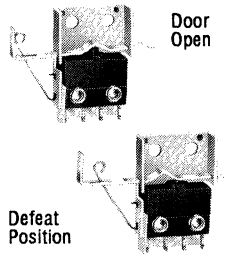
Vandal-Proof
Sealed, Survives abuse



Custom Assembly
Switch, cable, connector



Pendent Switch
Remote Switch with cable



Door Interlock
Safety with service defeat



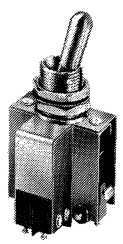
Sealed, Toggle
3-Position, 8 Poles



4-Way Toggle
Miniature Joy Stick



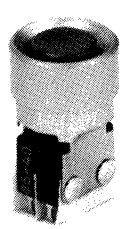
Offset Push Button
Clears back-of-panel interference



Open Frame Toggle
4-Position, 4 Pole



Trigger Switch
Two level control U2-016



Shrouded Button
Guards against accidental operation

OTTO Controls 2 East Main Street • Carpentersville, Illinois 60110 Phone: 708/428-7171 • Fax: 708/428-1956

PDI® Power Dynamics, Inc.

KEYLOCK SWITCHES

P.O. Box 539 • 59 Lakeside Avenue, West Orange, NJ 07052 (201) 736-5722 • Fax (201) 736-8930

IG-051Z (Low Cost Zinc Die Cast)
IG-051 (Brass, Chrome-Plated)

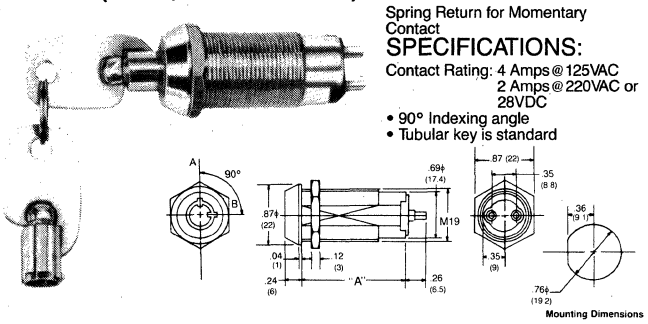
HIGH CURRENT SERIES

Spring Return for Momentary Contact

SPECIFICATIONS:

Contact Rating: 4 Amps@125VAC
2 Amps@220VAC or 28VDC

- 90° Indexing angle
- Tubular key is standard



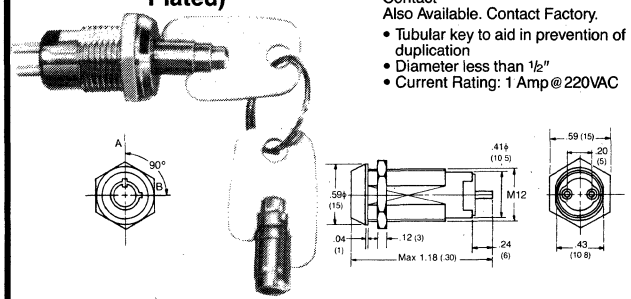
Mounting Dimensions

IG-300Z (Zinc Die Cast)
IG-300 (Brass, Chrome-Plated)

ULTRA-MINIATURE SERIES

Spring Return for Momentary Contact
Also Available. Contact Factory.

- Tubular key to aid in prevention of duplication
- Diameter less than ½"
- Current Rating: 1 Amp@220VAC

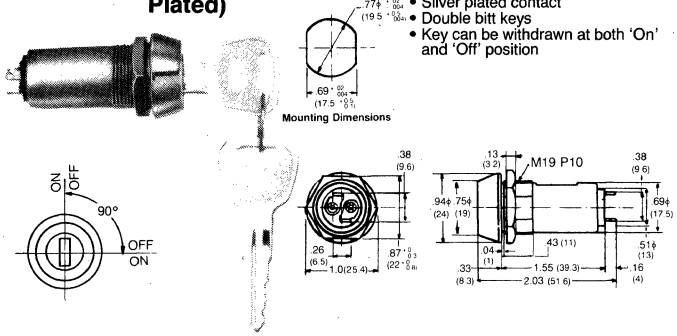


IG-260 (Zinc Die Cast)
IG-260CH (Brass, Chrome-Plated)

LOW COST SERIES

2 Pin 90° 2 Position On/Off

- 5 Amps@125VAC
- Silver plated contact
- Double bitt keys
- Key can be withdrawn at both 'On' and 'Off' position



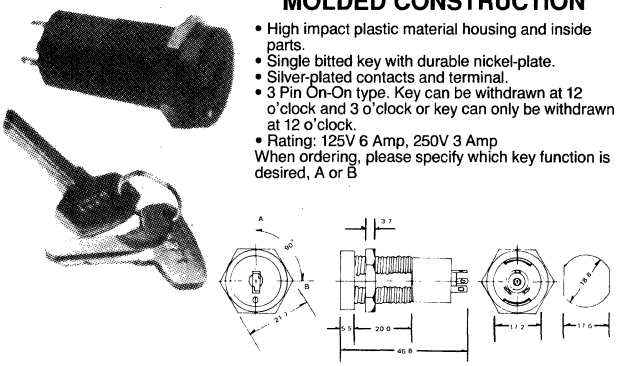
Mounting Dimensions

IG-305

SINGLE BITTED FLAT; MOLDED CONSTRUCTION

- High impact plastic material housing and inside parts.
- Single bitted key with durable nickel-plate.
- Silver-plated contacts and terminal.
- 3 Pin On-On type. Key can be withdrawn at 12 o'clock and 3 o'clock or key can only be withdrawn at 12 o'clock.
- Rating: 125V 6 Amp, 250V 3 Amp

When ordering, please specify which key function is desired, A or B

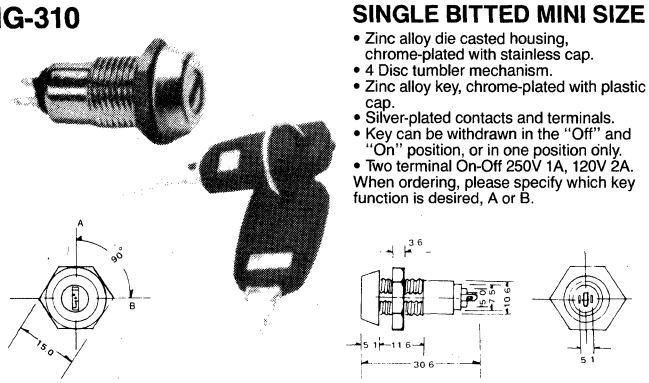


IG-310

SINGLE BITTED MINI SIZE

- Zinc alloy die casted housing, chrome-plated with stainless cap.
- 4 Disc tumbler mechanism.
- Zinc alloy key, chrome-plated with plastic cap.
- Silver-plated contacts and terminals.
- Key can be withdrawn in the "Off" and "On" position, or in one position only.
- Two terminal On-Off 250V 1A, 120V 2A.

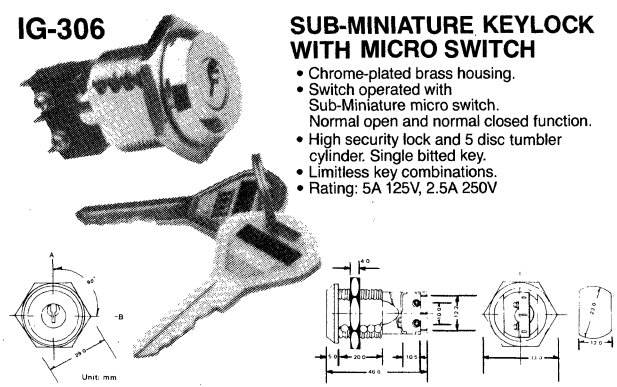
When ordering, please specify which key function is desired, A or B.



IG-306

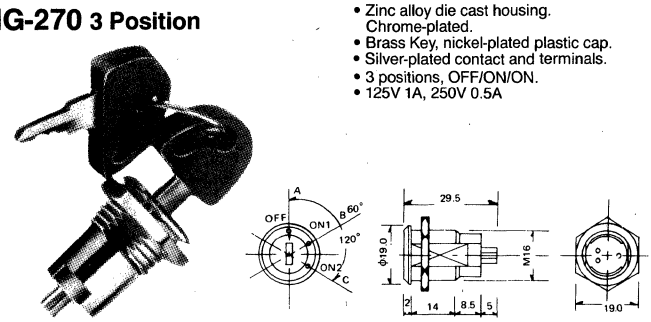
SUB-MINIATURE KEYLOCK WITH MICRO SWITCH

- Chrome-plated brass housing.
- Switch operated with Sub-Miniature micro switch. Normal open and normal closed function.
- High security lock and 5 disc tumbler cylinder. Single bitted key.
- Limitless key combinations.
- Rating: 5A 125V, 2.5A 250V



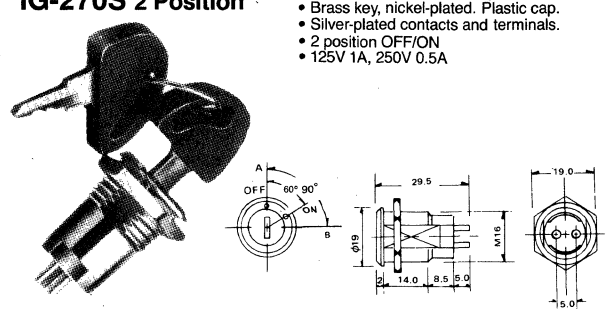
IG-270 3 Position

- Zinc alloy die cast housing. Chrome-plated.
- Brass Key, nickel-plated plastic cap.
- Silver-plated contact and terminals.
- 3 positions, OFF/ON/ON.
- 125V 1A, 250V 0.5A



IG-270S 2 Position

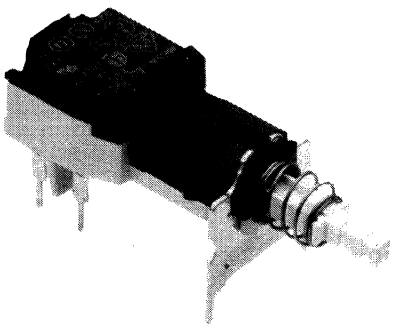
- Zinc alloy, die cast housing, chrome-plated.
- Brass key, nickel-plated. Plastic cap.
- Silver-plated contacts and terminals.
- 2 position OFF/ON
- 125V 1A, 250V 0.5A



CALL OR WRITE POWER DYNAMICS, INC. FOR MORE INFORMATION • FSC60046 • UNIT: mm

Preh Electronic Industries, Inc.
470 East Main Street, Lake Zurich, IL 60047-2578 U.S.A.
Phone (708) 438-4000 • FAX 708-438-5522

POWER/MINIATURE SWITCHES



ME-5 SERIES POWER SWITCHES
"SOFT TOUCH", PUSH-PUSH
70060-003/70060-200
The ME-5 Series of power switches (DPST) is available in 3 or 5 amp versions with printed circuit or solder terminals. Optional SPDT auxiliary switches (IA/24V, AC/DC), and accessories, ie- dust covers and fuse holders are also available on request.

Preh ME-5 Power Switches and Minature Pushbutton Switches have been designed for rugged operation and long life in today's sophisticated electronic equipment.

All Preh switches offer short stroke, audible "click", positive tactile feel, PC mount, low resistance, long life and precious metal, self-cleaning contact surfaces .

Preh switches with custom pushbuttons, legends and contact materials are available on special request.



70052-006
PUSH BUTTON
"P" Miniature DPDT push-push for PC mounting. Red push button supplied,



75120-100
KEY SWITCH "P", SP with 2 parallel contacts, contact surface silver. Snap-in mount.



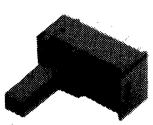
75120-050
KEY SWITCH "S" with 2 parallel contacts, contact surface silver.Black push-button with red LED indicator (green LED available).



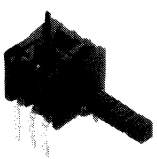
75120-102
KEY SWITCH "S" with 2 parallel contacts, contact surface silver. Snap-in mount. Black pushbutton with red LED indicator (green LED available).



75120-108
KEY SWITCH "S" with 2 parallel contacts, contact surface silver Transparent red pushbutton with LED indicator . Snap- in mount .



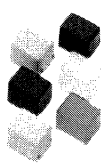
74650-013
SLIDE SWITCH
Miniature 4-position (SP4T) PC mount switch with knob. Contact surface gold, different color and additional printing of letters and symbols available on request.



70052-014
PUSH SWITCH
"P" Miniature DPDT push-push for PC mounting. Keycap available.



70052-022
PUSH BUTTON
"P" Miniature DPDT push-push for PC mounting. Red push button supplied,



10081-XXX
KEY CAPS
Accessory, keycaps for 75120 Series Switches. Available in transparent red, green or clear. Opaque white, grey and black.

	70060 Series	75120 Series	74650 Series	70052 Series
Switch Rating	-003: 2.5/100 A 250 VAC -200: 4/100 A 250 VAC	0.025 A, 30 VAC or DC	100mA 30 VACor DC	0.5 A, 12 VAC or DC 0.05 A, 250 VAC
Dielectric Strength	4000 V contact/conductive parts 2000 V contact/contact	—	500 VAC	500 VAC
Insulation Resistance	Dry: less than 10G ohms	—	more than 100m ohms	—
Contact Resistance	less than 50m ohms, typical 30m ohms	less than 150m ohms	less than 100m ohms	less than 20m ohms
Life	25,000 cycles	400,000 cycles	1,000 cycles	10,000 cycles
Operating Force	less than 6N	1.5 ± 0.3N	1N to 5N	less than 6N
Flammability	UL 94 VO	UL 94 V-1	—	—
Approvals	SEV, CSA, S, VDE, UL, D, N	—	—	—

"S" - Switch key movement is perpendicular to the mounting surface
"P" - Switch key movement is parallel to the mounting surface

PRES:AIR:TROL®
PRES:AIR:TROL CORPORATION
1009 W. Boston Post Road, Mamaroneck, NY 10543
914•698-2026 FAX: 914•698-9456 Telex: 5106000212
800•431-2625 (OUTSIDE NY)

PRESSURE AND VACUUM SWITCHES
• AND •
SHOCK-PROOF SWITCHES
(Shock-Proof • Water-Proof • Explosion-Proof)

PRESSURE & VACUUM SWITCHES

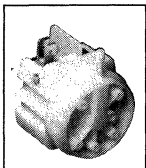


FIGURE R
RADIAL SPOUT
SIZE: 2¼" × 2¼"
MOUNT: USE #4 SELF TAP SCREWS

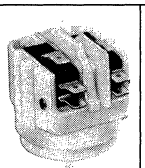


FIGURE C
CENTER SPOUT
SIZE: 2¼" × 2¼"
MOUNT: USE #4 SELF TAP SCREWS

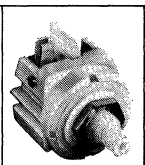


FIGURE M
1/8 NPT
SIZE: 2¼" × 2¼"
MOUNT: USE 9/16-18 NUT

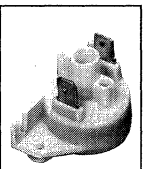


FIGURE D
DIFF. SWITCH
SIZE: 1⅝" × 1⅛" × 1"
MOUNT: USE (2) 1/8 SCREWS

NOTE:
1. Above sizes Do Not Include Inlet.
2. Special Micros available on request.
3. Fig. R, C & D Connect to 1/8" ID Tube.
4. Other Spout and Mounting Configurations Available.
5. Micro Switches Accept STD .250" Slide On Terminal.
6. Approx. Repeat Accuracy ±3% At Constant Temp.
7. Consult Factory For Special Requirements.

P.C. MOUNT



PRESSURE OR VACUUM

LOW COST PRESSURE SWITCHES

SPDT	DPDT	ADJUSTABLE RANGE	MAX 250VAC RATING	APPROVAL	FIG # STD	FIG # SPECIAL
PR10103A	—	1.5-7 INCH H_2O	3A	UL, CSA	R	M,C
PR10306A	—	5-35 INCH H_2O	5A	UL, CSA	R	M,C
PR10510A	PR20510A	20-50 INCH H_2O	10A	UL, CSA	R	M,C
PM11120A	PM21120A	1-5 PSI	21A	UL, CSA	M	R,C
PM11130A	PM21130A	2.5-6 PSI	21A	UL, CSA	M	R,C
PM11140A	PM21140A	4-11 PSI	21A	UL, CSA	M	R,C
PM11150A	PM21150A	9-18 PSI	21A	UL, CSA	M	R,C
PM11160A	PM21160A	15-28 PSI	21A	UL, CSA	M	R,C
PM11170A	PM21170A	25-40 PSI	21A	UL, CSA	M	R,C
PM11180A	PM21180A	35-65 PSI	21A	UL, CSA	M	R,C
PM11190A	PM21190A	50-100 PSI	21A	UL, CSA	M	R,C
PM11195A	PM21195A	75-125 PSI	21A	UL, CSA	M	R,C

LOW COST VACUUM SWITCHES

VR10103A	—	2.5-7 INCH H_2O	5A	UL, CSA	R	M,C
VR10306A	—	6-16 INCH H_2O	21A	UL, CSA	R	M,C
VR10510A	VR20510A	13-25 INCH H_2O	21A	UL, CSA	R	M,C
VR10515A	VR20515A	20-40 INCH H_2O	21A	UL, CSA	R	M,C
VR11120A	VR21120A	35-80 INCH H_2O	21A	UL, CSA	R	M,C
VR11130A	VR21130A	75-150 INCH H_2O	21A	UL, CSA	R	M,C
VR11140A	VR21140A	135-250 INCH H_2O	21A	UL, CSA	R	M,C

DIFFERENTIAL PRESSURE SWITCH (Pressure or Vacuum)

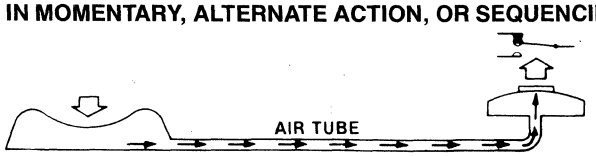
D1000A	—	.5-15 INCH H_2O	.5A	—	D
D1001A	—	5-30 INCH H_2O	.5A	—	D

NOTE: Differential switch may be set for normally open or closed contacts for pressure or vacuum operation.

SHOCK PROOF, WATER PROOF, EXPLOSION PROOF SWITCH

INSTEAD OF A SWITCH CONNECTED BY CABLE TO THE EQUIPMENT OR APPLIANCE, AN AIR BELLOWS IS JOINED BY TUBING TO AN AIR SWITCH CONTAINED WITHIN THE EQUIPMENT OR APPLIANCE. **AIR SWITCHES ARE AVAILABLE IN MOMENTARY, ALTERNATE ACTION, OR SEQUENCING ACTIONS.**

BELLOWS (AIR ACTUATOR)



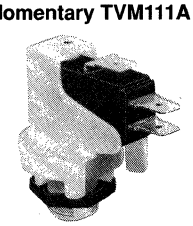
AIR SWITCH
MOMENTARY OR ON/OFF
(ALTERNATE ACTION)

Air Switches

1. 2HP @ 240VAC
   1HP @ 120VAC
   21 AMP @ 240VAC
2. Other mounting choices.
3. Acetel plastic body and mechanism ensures high mechanical stability and minimum moisture absorption.
4. Other switch ratings available.

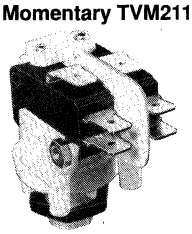
FILE #E80254 FILE #LR69099-1

ON/OFF TVA111A
Momentary TVM111A



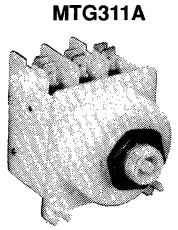
"Tinytrol™ Single"
SPDT

ON/OFF TVA211A
Momentary TVM211A



"Tinytrol Double"
DPDT
US PATENT 4,783,580

4-Function
MTG311A



"Magictrol™"
Sequencing

P.C. Mount "C" Series Momentary



- Printed Circuit Board Mount Air Switch
- SPST or DPST 1 Amp (typical)

Air Actuators (Bellows)

The air actuators in any of the various forms, are not affected by water, dirt, dust or flammable gases. Only a few of the many actuators available are shown here. Standard electrical footswitches are also available.



B225A



B513A



B318A



B225F



B643A



B621A



PRESS BOX
(AIR SWITCH IN A JUNCTION BOX)

RDI ELECTRONICS INCORPORATED

The following information is excerpted from our catalog. Please contact us for your complete guide to the components available from RDI Electronics.

SWITCHES

RDI Electronics offers pushbutton and miniature pushbutton versions, as well as tact, rocker, and slide switches to suit most applications.

PUSHBUTTON TYPES



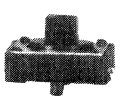
PUSH BUTTON SWITCH SPECIFICATIONS	
ELECTRICAL SPECIFICATIONS	
Rating Resistance	DC 30V, 0.3A Max.
Contact Resistance	20mΩ Max. under the DC 5V, 1A
Insulation Resistance	100MΩ Min. at DC 500V.
Withstanding Voltage	1 min. at AC 500V
Contact Timing	Non-shorting, Shorting.
MECHANICAL SPECIFICATIONS	
Terminal Strength	500g for 1 Min.
Operating Force	300 ± 200g
Control Strength	3 kg static force.
Function	Self-Lock, Inter-Lock, Non-Lock (Momentary)
DURABILITY SPECIFICATIONS	
Test Conditions	10,000 cycles at a rate of 15 ~ 20 cycles for 1 minute without load.
Operating Force	Within $^{+40}_{-40}$% of initial value.
Contact Resistance	40mΩ Min.

MINIATURE PUSHBUTTON TYPES

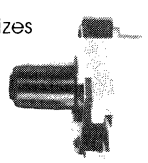


TACT TYPE

- Horizontal and vertical PC Mount
- Positive tactile feel
- 6.2mm and 12mm sizes



JTM-1101B



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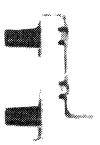


JTM-1102C



JTM-1105B

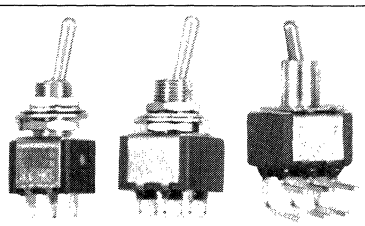


JTM-1108C

TACT SWITCH COMMON SPECIFICATION			
Specification	Model	JTM-1101, 1102 Type	JTM-1105,1108 Type
ELECTRICAL SPECIFICATIONS			
Power Rating		DC 12V, 50 mA Max.	
Contact Resistance		100 mΩ Max. under DC 5V, 1A.	
Insulation Resistance		100 MΩ Min. at DC 100 V	
Withstanding Voltage		1 min. at AC 250 V	
Bounce		10 msec. Max.	
MECHANICAL SPECIFICATIONS			
Switch Action		S.P.S.T. momentary push on switch	
Operating Force		100 ± 30 gf	200 ± 50 gf | 120 ± 50 gf
Control Strength		1 Kgf static force	
DURABILITY SPECIFICATIONS			
Test Conditions		100,000 ~ 500,000 cycles at a rate of 15 ~ 20 cycles for 1 minute with a resistive load DC 12 V, 50 m A.	
Contact Resistance		200 mΩ Max.	
Bounce		20 msec. Max.	
Operating Force		Within + 10% of initial value −40	

TOGGLE SWITCH TYPE

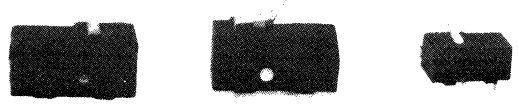
- PC and Solder Terminals
- Right angle and vertical mount



ELECTRICAL SPECIFICATIONS	
Contact Rating	3 amps with resistive load @ 120VAC or 28 VDC
Contact Resistance	20 milliohms max. initial @ 2-4VDC. 100 milliamps for both coin silver and gold plated contacts
Insulation Resistance	100 megohms minimum
Dielectric Strength	1,000 volts RMS @ sea level
DURABILITY SPECIFICATIONS	
Electrical Life	30,000 make-and-break cycles at full load
Operating Temperature	20°C to 65°C
MATERIALS	
Case	Diallyl Phthalate (DAP)
Toggle Handle	Brass, chrome palted
Bushing	Brass, nickel plated
Housing	Stainless Steel
Terminal/Switch Support	Brass electrotin plated
Contacts	Coin silver, silver plated
Center Contact & Terminal	Brass, silver plated

BASIC SUB-MINIATURE TYPE

- Solder, Faston or PC Terminals
- With or without Actuators
- UL Approved



PUSH BUTTON SWITCH SPECIFICATIONS	
ELECTRICAL SPECIFICATIONS	
Rating Resistance	DC 30V, 0.3A Max.
Contact Resistance	20mΩ Max. under the DC 5V, 1A
Insulation Resistance	100MΩ Min. at DC 500V.
Withstanding Voltage	1 min. at AC 500V
Contact Timing	Non-shorting, Shorting.
Service Life	Mechanically: 300,000 operations min. Electrically: 50,000 operations min. (full load)

FROM PROTOTYPE TO PRODUCTION, SPECIFY RDI ELECTRONICS FOR QUALITY, SERVICE AND COMPETITIVE PRICING.

RDI Electronics, Inc.,/ Dept. E, 56 Harrison St., New Rochelle, NY 10801 Tel: 914-632-7274/ Fax: 914-632-7464

ALLIED CONTROLS/RUNDEL PRODUCTS

562 Captain Neville Drive, Waterbury, CT 06705
(203) 757-4200 FAX (203) 757-4202

H33 Pushbuttons, Pilot Lights, and Selector Switches

H33 1 13/64" Pushbuttons
Round Momentary Operators[1]

Type of Unit	Cap Color	Operator & Cap Cat. No.	Operator & Cap List Price	Operator with NO Contact Cat. No.	Operator with NO Contact List Price	Operator with NC Contact Cat. No.	Operator with NC Contact List Price	Operator with 1NO-1NC Contacts Cat. No.	Operator with 1NO-1NC Contacts List Price	Operator with 2NO Contacts Cat. No.	Operator with 2NO Contacts List Price	Operator with 2NC Contacts Cat. No.	Operator with 2NC Contacts List Price
	Green	H33FSG0	$10.80	H33FSG1	$16.80	H33FSG2	$16.80	H33FSG3	$22.80	H33FSG4	$22.80	H33FSG5	$22.80
	Black	H33FSK0	10.80	H33FSK1	16.80	H33FSK2	16.80	H33FSK3	22.80	H33FSK4	22.80	H33FSK5	22.80
	Red	H33FSR0	10.80	H33FSR1	16.80	H33FSR2	16.80	H33FSR3	22.80	H33FSR4	22.80	H33FSR5	22.80
	Green	H33FHG0	10.80	H33FHG1	16.80	H33FHG2	16.80	H33FHG3	22.80	H33FHG4	22.80	H33FHG5	22.80
	Black	H33FHK0	10.80	H33FHK1	16.80	H33FHK2	16.80	H33FHK3	22.80	H33FHK4	22.80	H33FHK5	22.80
	Red	H33FHR0	10.80	H33FHR1	16.80	H33FHR2	16.80	H33FHR3	22.80	H33FHR4	22.80	H33FHR5	22.80
	Green	H33FFG0	10.80	H33FFG1	16.80	H33FFG2	16.80	H33FFG3	22.80	H33FFG4	22.80	H33FFG5	22.80
	Black	H33FFK0	10.80	H33FFK1	16.80	H33FFK2	16.80	H33FFK3	22.80	H33FFK4	22.80	H33FFK5	22.80
	Red	H33FFR0	10.80	H33FFR1	16.80	H33FFR2	16.80	H33FFR3	22.80	H33FFR4	22.80	H33FFR5	22.80
	Green	H33ESG0	10.80	H33ESG1	16.80	H33ESG2	16.80	H33ESG3	22.80	H33ESG4	22.80	H33ESG5	22.80
	Black	H33ESK0	10.80	H33ESK1	16.80	H33ESK2	16.80	H33ESK3	22.80	H33ESK4	22.80	H33ESK5	22.80
	Red	H33ESR0	10.80	H33ESR1	16.80	H33ESR2	16.80	H33ESR3	22.80	H33ESR4	22.80	H33ESR5	22.80
	Green	H33EHG0	10.80	H33EHG1	16.80	H33EHG2	16.80	H33EHG3	22.80	H33EHG4	22.80	H33EHG5	22.80
	Black	H33EHK0	10.80	H33EHK1	16.80	H33EHK2	16.80	H33EHK3	22.80	H33EHK4	22.80	H33EHK5	22.80
	Red	H33EKR0	10.80	H33EHR1	16.80	H33EHR2	16.80	H33EHR3	22.80	H33EHR4	22.80	H33EHR5	22.80
	Green	H33EFG0	10.80	H33EFG1	16.80	H33EFG2	16.80	H33EFG3	22.80	H33EFG4	22.80	H33EFG5	22.80
	Black	H33EFK0	10.80	H33EFK1	16.80	H33EFK2	16.80	H33EFK3	22.80	H33EFK4	22.80	H33EFK5	22.80
	Red	H33EFR0	10.80	H33EKR1	16.80	H33EKR2	16.80	H33EFR3	22.80	H33EFR4	22.80	H33EFR5	22.80

Momentary Operators with Mushroom Caps[1,2]

	Red	H33MSR0	$28.80	H33MSR1	$28.80	H33MSR2	$28.80	H33MSR3	$34.80	H33MSR4	$34.80	H33MSR5	$34.80
	Red	H33MFR0	38.80	H33MFR1	44.80	H33MFR2	44.80	H33MFR3	50.80	H33MFR4	50.80	H33MFR5	50.80
	Red	H33JSR0	22.80	H33JSR1	28.80	H33JSR2	28.80	H33JSR3	34.80	H33JSR4	34.80	H33JSR5	34.80
	Red	H33JFR0	44.80	H33JFR1	50.80	H33JFR2	50.80	H33JFR3	56.80	H33JFR4	56.80	H33JFR5	56.80
	Red	H33JDR0	46.80	H33JDR1	52.80	H33JDR2	52.80	H33JDR3	58.80	H33JDR4	58.80	H33JDR5	58.80

Maintained Pushbutton Operators[1]

	Green	H33MP1G0	$27.20	H33MP1G1	$33.20	H33MP1G2	$33.20	H33MP1G3	$39.20	H33MP1G4	$39.20	H33MP1G5	$39.20
	Black	H33MP1K0	27.20	H33MP1K1	33.20	H33MP1K2	33.20	H33MP1K3	39.20	H33MP1K4	39.20	H33MP1K5	39.20
	Red	H33MP1R0	27.20	H33MP1R1	33.20	H33MP1R2	33.20	H33MP1R3	39.20	H33MP1R4	39.20	H33MP1R5	39.20
	Red	H33MP3R0	38.80	H33MP3R1	44.80	H33MP3R2	44.80	H33MP3R3	50.80	H33MP3R4	50.80	H33MP3R5	50.80
	Red	H33MP2R0	38.80	H33MP2R1	44.80	H33MP2R2	44.80	H33MP2R3	50.80	H33MP2R4	50.80	H33MP2R5	50.80
	Red	H33PP3R0	34.80	H33PP3R1	40.80	H33PP3R2	40.80	H33PP3R3	46.80	H33PP3R4	46.80	H33PP3R5	46.80

Illuminated Momentary Pushbuttons[1]

Type Of Unit	Illumination	Operator with Lens, Lamp and Transformer (If indicated) Cat. No.	Operator with Lens, Lamp and Transformer (If indicated) List Price	Operator with NO Contact Cat. No.	Operator with NO Contact List Price	Operator with NC Contact Cat. No.	Operator with NC Contact List Price	Operator with 1NO-1NC Contacts Cat. No.	Operator with 1NO-1NC Contacts List Price	Operator with 2NO Contacts Cat. No.	Operator with 2NO Contacts List Price	Operator with 2NC Contacts Cat. No.	Operator with 2NC Contacts List Price
	6 Volt Lamp	H33PM1A0	$21.00	H33PM1A1	$27.00	H33PM1A2	$27.00	H33PM1A3	$33.00	H33PM1A4	$33.00	H33PM1A5	$33.00
	12 Volt Lamp	H33PM2A0	21.00	H33PM2A1	27.00	H33PM2A2	27.00	H33PM2A3	33.00	H33PM2A4	33.00	H33PM2A5	33.00
	24 Volt Lamp	H33PM3A0	22.60	H33PM3A1	28.60	H33PM3A2	28.60	H33PM3A3	34.60	H33PM3A4	34.60	H33PM3A5	34.60
	48 Volt Lamp	H33PM4A0	23.80	H33PM4A1	29.80	H33PM4A2	29.80	H33PM4A3	35.80	H33PM4A4	35.80	H33PM4A5	35.80
	60 Volt Lamp	H33PM5A0	23.80	H33PM5A1	29.80	H33PM5A2	29.80	H33PM5A3	35.80	H33PM5A4	35.80	H33PM5A5	35.80
	120 Volt Lamp	H33PM6A0	23.80	H33PM6A1	29.80	H33PM6A2	29.80	H33PM6A3	35.80	H33PM6A4	35.80	H33PM6A5	35.80
	120 Volt Trans. with 6 Volt Lamp	—	—	H33PM7A1	48.80	H33PM7A2	48.80	H33PM7A3	54.80	H33PM7A4	54.80	H33PM7A5	54.80
	240 Volt Trans. with 6 Volt Lamp			H33PM8A1	48.80	H33PM8A2	48.80	H33PM8A3	54.80	H33PM8A4	54.80	H33PM8A5	54.80
	480 Volt Trans. with 6 Volt Lamp	—	—	H33PM9A1	48.80	H33PM9A2	48.80	H33PM9A3	54.80	H33PM9A4	54.80	H33PM9A5	54.80

1 Legend plate is not included.
2 Mushroom caps can be ordered with two set screws, add suffix SSX to the Cat. No.
Example: H33MSRDSSX.
3 Recommended use of AEM contact block when specifying NO block, and BLB contact block when specifying NC block.

H33 1 13/64" Illuminated Pushbuttons
Illuminated Momentary Pushbutton (Push-Pull, Spring Return to Center)[1]

Type Of Unit	Illumination	Operator only Cat. No.	Operator only List Price	Operator with NO Contact Cat. No.	Operator with NO Contact List Price	Operator with NC Contact Cat. No.	Operator with NC Contact List Price	Operator with 1NO-1NC Contacts Cat. No.	Operator with 1NO-1NC Contacts List Price	Operator with 2NO Contacts Cat. No.	Operator with 2NO Contacts List Price	Operator with 2NC Contacts Cat. No.	Operator with 2NC Contacts List Price
	6 Volt Lamp	H33LP1A0	$33.20	H33LP1A1	$39.20	H33LP1A2	$39.20	H33LP1A3	$45.20	H33LP1A4	$45.20	H33LP1A5	$45.20
	12 Volt Lamp	H33L2A0	33.20	H33LP2A1	39.20	H33LP2A2	39.20	H33LP2A3	45.20	H33LP2A4	45.20	H33LP2A5	45.20
	24 Volt Lamp	H33LP3A0	34.80	H33LP3A1	40.80	H33LP3A2	40.80	H33LP3A3	46.80	H33LP3A4	46.80	H33LP3A5	46.80
	48 Volt Lamp	H33LP4A0	36.00	H33LP4A1	42.00	H33LP4A2	42.00	H33LP4A3	48.00	H33LP4A4	48.00	H33LP4A5	48.00
	60 Volt Lamp	H33L5A0	36.00	H33LP5A1	42.00	H33LP5A2	42.00	H33LP5A3	48.00	H33LP5A4	48.00	H33LP5A5	48.00
	120 Volt Lamp	H33L6A0	36.00	H33LP6A1	42.00	H33LP6A2	42.00	H33LP6A3	48.00	H33LP6A4	48.00	H33LP6A5	48.00
	120 Volt Trans. with 6 Volt Lamp	—	—	H33LP7A1	61.00	H33LP7A2	61.00	H33LP7A3	67.00	H33LP7A4	67.00	H33LP7A5	67.00
	240 Volt Trans. with 6 Volt Lamp			H33LP8A1	61.00	H33LP8A2	61.00	H33LP8A3	67.00	H33LP8A4	67.00	H33LP8A5	67.00
	480 Volt Trans. with 6 Volt Lamp	—	—	H33LP9A1	61.00	H33LP9A2	61.00	H33LP9A3	67.00	H33LP9A4	67.00	H33LP9A5	67.00

Illuminated Maintained Pushbuttons (Push-Pull)[1]

	6 Volt Lamp	H33PL1A0	$33.20	H33PL1A1	$39.20	H33PL1A2	$39.20	H33PL1A3	$45.20	H33PL1A4	$45.20	H33PL1A5	$45.20
	12 Volt Lamp	H33PL2A0	33.20	H33PL2A1	39.20	H33PL2A2	39.20	H33PL2A3	45.20	H33PL2A4	45.20	H33PL2A5	45.20
	24 Volt Lamp	H33PL3A0	34.80	H33PL3A1	40.80	H33PL3A2	40.80	H33PL3A3	46.80	H33PL3A4	46.80	H33PL3A5	46.80
	48 Volt Lamp	H33PL4A0	36.00	H33PL4A1	42.00	H33PL4A2	42.00	H33PL4A3	48.00	H33PL4A4	48.00	H33PL4A5	48.00
	60 Volt Lamp	H33PL5A0	36.00	H33PL5A1	42.00	H33PL5A2	42.00	H33PL5A3	48.00	H33PL5A4	48.00	H33PL5A5	48.00
	120 Volt Lamp	H33PL6A0	36.00	H33PL6A1	42.00	H33PL6A2	42.00	H33PL6A3	48.00	H33PL6A4	48.00	H33PL6A5	48.00
	120 Volt Trans. with 6 Volt Lamp	—	—	H33PL7A1	61.00	H33PL7A2	61.00	H33PL7A3	67.00	H33PL7A4	67.00	H33PL7A5	67.00
	240 Volt Trans. with 6 Volt Lamp			H33PL8A1	61.00	H33PL8A2	61.00	H33PL8A3	67.00	H33PL8A4	67.00	H33PL8A5	67.00
	480 Volt Trans. with 6 Volt Lamp	—	—	H33PL9A1	61.00	H33PL9A2	61.00	H33PL9A3	67.00	H33PL9A4	67.00	H33PL9A5	67.00

Illuminated Maintained Pushbuttons (Push-On; Push-Off)[1]

	6 Volt Lamp	H33ML1A0	$37.00	H33ML1A1	$43.00	H33ML1A2	$43.00	H33ML1A3	$49.00	H33ML1A4	$49.00	H33ML1A5	$49.00
	12 Volt Lamp	H33ML2A0	37.00	H33ML2A1	43.00	H33ML2A2	43.00	H33ML2A3	49.00	H33ML2A4	49.00	H33ML2A5	49.00
	24 Volt Lamp	H33ML3A0	38.60	H33ML3A1	44.60	H33ML3A2	44.60	H33ML3A3	50.60	H33ML3A4	50.60	H33ML3A5	50.60
	48 Volt Lamp	H33ML4A0	39.80	H33ML4A1	45.80	H33ML4A2	45.80	H33ML4A3	51.80	H33ML4A4	51.80	H33ML4A5	51.80
	60 Volt Lamp	H33ML5A0	39.80	H33ML5A1	45.80	H33ML5A2	45.80	H33ML5A3	51.80	H33ML5A4	51.80	H33ML5A5	51.80
	120 Volt Lamp	H33ML6A0	39.80	H33ML6A1	45.80	H33ML6A2	45.80	H33ML6A3	51.80	H33ML6A4	51.80	H33ML6A5	51.80
	120 Volt Trans. with 6 Volt Lamp	—	—	H33ML7A1	64.80	H33ML7A2	64.80	H33ML7A3	70.80	H33ML7A4	70.80	H33ML7A5	70.80
	240 Volt Trans. with 6 Volt Lamp			H33ML8A1	64.80	H33ML8A2	64.80	H33ML8A3	70.80	H33ML8A4	70.80	H33ML8A5	70.80
	480 Volt Trans. with 6 Volt Lamp	—	—	H33ML9A1	64.80	H33ML9A2	64.80	H33ML9A3	70.80	H33ML9A4	70.80	H33ML9A5	70.80

H33 1 13/64" Pilot Lights
Full Voltage and Transformer Pilot Lights

Type of Unit	Illumination	Pilot Light with Amber Lens Cat. No.	Pilot Light with Amber Lens List Price
	6 Volt Lamp	H33P1A	$22.00
	12 Volt Lamp	H33P2A	22.00
	24 Volt Lamp	H33P3A	23.60
	48 Volt Lamp	H33P4A	24.80
	60 Volt Lamp	H33P5A	24.80
	120 Volt Lamp	H33P6A	24.80
	120 Volt Transformer with 6 Volt Lamp	H33P7A	42.80
	240 Volt Transformer with 6 Volt Lamp	H33P8A	42.80
	480 Volt Transformer with 6 Volt Lamp	H33P9A	42.80

1 Legend plate is not included.
1A Price includes 1 N/O and 1 N/C contact and preformed jumpers necessary for operation.

Consult factory for Catalog Number Development ordering information.

ALLIED CONTROLS/RUNDEL PRODUCTS
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(203) 757-4200 FAX (203) 757-4202

H33/H36 Pushbuttons, Pilot Lights, and Selector Switches

H33 1 13/64" Pilot Lights
Push-to-Test Pilot Lights[1]

Type of Unit	Illumination	Pilot Light with Amber Lens Cat. No.	List Price
	6 Volt Lamp	H33PT1A3	$34.20
	12 Volt Lamp	H33PT2A3	34.20
	24 Volt Lamp	H33PT3A3	35.80
	48 Volt Lamp	H33PT4A3	37.00
	60 Volt Lamp	H33PT5A3	37.00
	120 Volt Lamp	H33PT6A3	37.00
	120 Volt Transformer with 6 Volt Lamp	H33PT7A3	54.80
	240 Volt Transformer with 6 Volt Lamp	H33PT8A3	54.80
	480 Volt Transformer with 6 Volt Lamp	H33PT9A3	54.80

Resistor Pilot Lights,

	120 Volt Lamp and Diode Block for Remote Test	H33PR0A	$44.80
	RB 120A with 120 Volt Lamp	H33PR1A	31.80
	RB 120B with 120 Volt Lamp	H33PR2A	31.80
	RB120/24A with 24 Volt Lamp	H33PR3A	34.60
	RB120/24B with 24 Volt Lamp	H33PR4A	34.60
	RB240/120A with 120 Volt Lamp	H33PR5A	35.80
	RB240/120B with 120 Volt Lamp	H33PR6A	35.80
	NRB120 with 120 Volt Neon Lamp	H33PR7A	29.80
	NRB240 with 120 Volt Neon Lamp	H33PR8A	29.80
	NRB480 with 120 Volt Neon Lamp	H33PR9A	29.80

H33 1 13/64" Selector Switches
Two Position Lever Operated Switches*[1]

Type of Unit	Operation	Cap Color	Operator Only Cat. No.	Operator Only List Price	Operator with Contact Blocks XO OX Cat. No.	Operator with Contact Blocks XO OX List Price	Operator with Contact Blocks XO OX XO OX Cat. No.	Operator with Contact Blocks XO OX XO OX List Price
	Manual	Green	H33SW12MGL0	$14.80	H33SW12MGL3	$26.80	H33SW12MGL6	$38.80
		Black	H33SW12MKL0	14.80	H33SW21MKL3	26.80	H33SW12MKL6	38.80
		Red	H33SW12MRL0	22.80	H33SW12MRL3	34.80	H33SW12MRL6	46.80
	Spring Return Right to Left	Green	H33SW12SRGL0	22.80	H33SW12SRGL3	34.80	H33SW12SRGL6	46.80
		Black	H33SW12SRKL0	22.80	H33SW12SRKL3	34.80	H33SW12SRKL6	46.80
		Red	H33SW12SRRL0	22.80	H33SW12SRRL3	34.80	H33SW12SRRL6	46.80

Three Position Lever Operated Selector Switches*[1]

Type of Unit	Operation	Cap Color	Operator Only Cat. No.	Operator Only List Price	Operator with Contact Blocks XOO OOX Cat. No.	Operator with Contact Blocks XOO OOX List Price	Operator with Contact Blocks XOO OXO OOX Cat. No.	Operator with Contact Blocks XOO OXO OOX List Price
	Manual, Single Rod Action	Green	H33SW13MGL0	$14.80	H33SW13MGL3	$26.80	H33SW13MGL7	$38.80
		Black	H33SW13MKL0	14.80	H33SW13MKL3	26.80	H33SW13MKL7	38.80
		Red	H33SW13MRL0	14.80	H33SW13MRL3	26.80	H33SW13MRL7	38.80
	Manual, Twin Rod Independent Action	Green	H33SW23MGL0	14.80	H33SW23MGL3	26.80	H33SW23MGI7	36.80
		Black	H33SW23MKL0	14.80	H33SW23MKL3	26.80	H33SW23MKL7	36.80
		Red	H33SW23MRL0	14.80	H33SW23MRL3	26.80	H33SW23MRL7	36.80
	Spring Return Left to Center,	Green	H33SW13SLGL0	22.80	H33SW13SLGL3	34.80	H33SW13SLGL7	46.80
		Black	H33SW13SLKL0	22.80	H33SW13SLKL3	34.80	H33SW13SLKL7	46.80
		Red	H33SW13SLRL0	22.80	H33SW13SLRL3	34.80	H33SW13SLRL7	46.80
	Spring Return Right to Center	Green	H33SW13SRGL0	22.80	H33SW13SRGL3	34.80	H33SW13SRGL7	46.80
		Black	H33SW13SRKL0	22.80	H33SW13SRKL3	34.80	H33SW13SRKL7	46.80
		Red	H33SW13SRRL0	22.80	H33SW13SRRL3	34.80	H33SW13SRRL7	46.80
	Spring Return Both Sides to Center	Green	H33SW23SCGL0	22.80	H33SW23SCGL3	34.80	H33SW23SCGL7	46.80
		Black	H33SW23SCKL0	22.80	H33SW23SCKL3	34.80	H33SW23SCKL7	46.80
		Red	H33SW23SCRL0	22.80	H33SW23SCRL3	34.80	H33SW23SCRL7	46.80

1. Legend plate is not included
2. Price includes 1 N/O & 1 N/C contact and preformed jumpers necessary for operation

H33 1 13/64" Selector Switches
Four Position Lever Operated Switches*[1]

Type of Unit	Operation	Cap Color	Operator Only Cat. No.	Operator Only List Price	Operator with Contacts XOOO OXOO OOXO OOOX Cat. No.	Operator with Contacts XOOO OXOO OOXO OOOX List Price
	Manual	Black	H33SW24MKL0	$14.80	H33SW24MLK6	$38.80
		Green	H33SW24MGL0	14.80	H33SW24MGL6	38.80
		Red	H33SW24MRL0	14.80	H33SW24MRL6	38.80

H33 1 13/64" Cam Switches


H33GB6


H33GB2


H33GC3


H33GB5


H33GB7


H33GB1

HOW TO ORDER

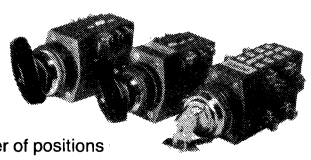
1. Unit Operator

Quantity	Class	(Operator)
_____	H _ _ _ SS3	Maintained
_____	H _ _ _ SS3	Spring Return to Center
_____	H _ _ _ KSS3	Key Lock Maintained
_____	H _ _ _ KSS3	Key Lock Spring Return


H33GC4

2. Select position angle.

Cam Angle	Maximum Positions
30° _____	up to 12 positions
45° _____	up to 8 positions
60° _____	up to 6 positions
90° _____	up to 4 positions



3. Specify Cam Angle / Specify number of positions
_____ (write in number) _____ (write in number)
4. Handles: Choose from seven handles and levers
Indicate handle number _____
5. Indicate nameplate legend and associated switch position. See legend plate section.

Pricing Information		
Cat. No.	Description	List Price 2
H33SS3	Standard maintained operator	$60.00
H33SS3-3SR	Standard operator 3 position spring return to center	$60.00
H33KSS3	Key lock maintained operator (includes 2 keys)	$80.00
H33KSS3-3SR	Key lock operator 3 position spring return to center	$80.00
–	Price per contact	$10.00
–	Engraved nameplate (show marking required)	$8.50
–	600V applications require spacers. Refer to local sales office.	–

H36 Monolever, Reset Operator
Monolever Operator Oiltight & Watertight

Available in 2, 3 or 4 position (plus center) either maintained, spring returned or a combination of both. The monolever uses a special DPDT contact block with 10 Amp 600 V rating.

	Operators	Center Position Plus	List Price 3
	H36M1-2M	2 Position Manual Return	$71.00
	H36M1-3M	3 Position Manual Return	79.00
	H36M1-4M	4 Position Manual Return	87.00
	H36M1-2SR	2 Position Spring Return	71.00
	H36M1-3SR	3 Position Spring Return	79.00
	H36M1-4SR	4 Position Spring Return	87.00
	Contact Blocks–for use with Monolever Operator		**List Price**
	H36MO1A1D	1 N/O Contact & Dummy	$ 8.00
	H36MO2A	2 N/O Contacts	12.00
	H36MO1B1D	1 N/C Contacts & Dummy	8.00
	H36MO2B	2 N/C Contacts	12.00
	H36MOC	1 N/O & N/C Contact	12.00

NEMA 1 Reset Operator

Standard length 4", measured from front of panel. Adjustable ± 1/4 inch. To make oiltight and watertight use H33SA1 boot. Other lengths available on special order. 3

	Color	Assembled Cat. No.	List Price 5	As Components
	Red	H36RS-11-AR21-15 4	$7.00	
	Green	-AG21	7.00	
	Black	-AB21	7.00	Reset without color cap order H36RS-11 @ $6.80 list
	Yellow	-AY21	7.00	
	Blue	-ABL21	7.00	Replacement color caps, see H33 components section for extended color caps.
	Brown	-ABR21	7.00	
	Orange	-AO21	7.00	
	White	-AW21	7.00	
	Grey	-AGR21	7.00	

1 Legend plate is not included.
2 Price includes handle
3 Includes operator only. Contact blocks not included.
4 Red & black reset buttons furnished with engraved "reset" legend.
5 For lengths longer than 4", add 20¢ list per inch.

***Illuminated Switches Available Upon Request**

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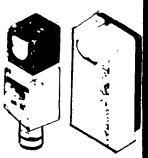
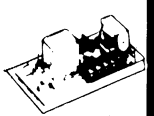
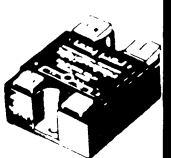

PHOTOELECTRICS


RELAYS


LIQUID LEVEL CONTROLS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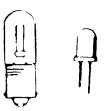
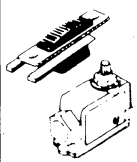

LAMPS & LEDS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SWITCHES

PUSHBUTTONS



MTG ½"
Base switch designed for use under custom membrane overlay.



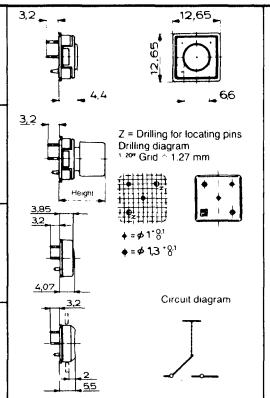
MTG ½"
Base switch with button.



MCS ½"
Base switch with sealing foil and facing ring.



MTP ½"
Base switch with keycap.

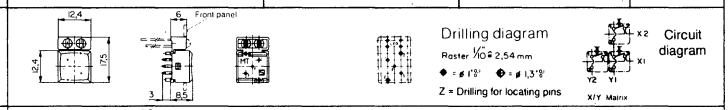


The snap dome is gold plated steel guaranteed for 10^6 operations.

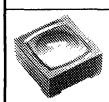
The actuating style, color and legend inscription can be selected from a number of basic components.



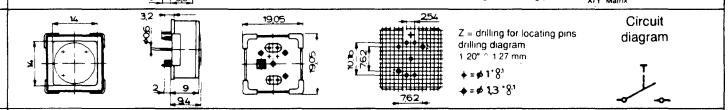
MT
Key switch with or without LED's.



The switches can be supplied with an IEC rating of sealing protection class IP40 or IP65.



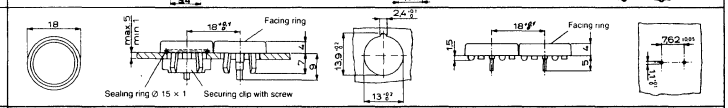
MTG, MCS, MTL ¾"
Key switch unlighted or backlighted with two LED's. MTL is indicator only.



The contacts are short travel and available with gold or silver plating.

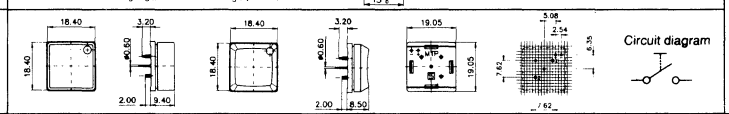


MCS ¾"
Key switch unlighted with extreme low profile for panel or pcb mounting.

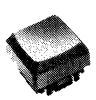




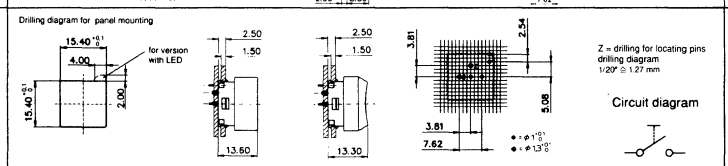
MTP ¾"
Key switch with or without LED



Adhesive sealing pads for wave-soldering and washing are available for most models.



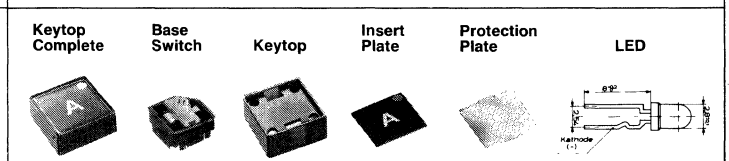
MMT/MMS ¾"
Key switch with momentary or alternate action for pcb or panel mounting. With or without LED



Medium stroke, low profile switches in momentary (MMT) or alternate (MMS) action for panel or pcb mounting. Self-cleaning contacts are silver, with a smooth gliding spring action. The MMT is guaranteed for 5 million operations. Available sealed or unsealed. Keytop assembly can be ordered separately for interchanging legends.

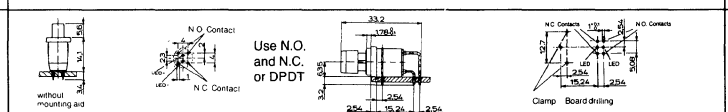


MMT/MMS ¾"
Optional keytop assembly

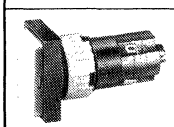




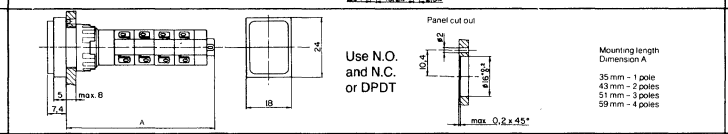
LDS/LDT



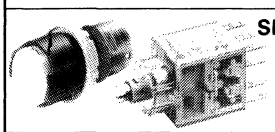
Miniature pushbutton with or without TI LED or mechanical indicator for panel or pcb mounting. Available with solder terminals and various button shapes and colors.



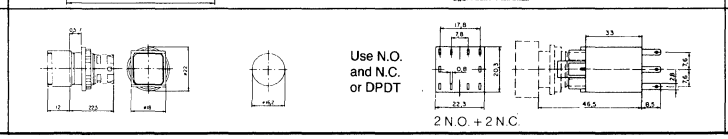
EMF



Pushbutton accepts TI¾ LED neon or incandescent lamps. Available in round, square or rectangular. Also with gold contacts, various lense colors and legend inscriptions. AF is matching indicator.



SBE

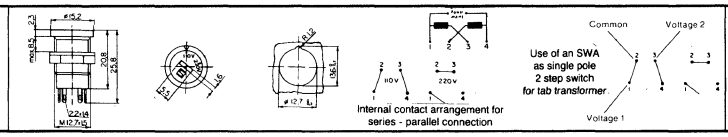


Heavy-duty push button with mechanical contact black accepts T5 LED, neon or incandescent lamps. Available in round, square, or rectangular. Various lense colors and legend inscriptions. AF is matching indicator.

ROTARY - Voltage Selector



SWA



Selector switch for international voltages. Part number 033.4501 for panel mounting and 033.4601 for pcb mounting. Reference full-line catalog for 3 and 6 position models.

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1/2 INCH SUBMINIATURE ROTARY "C" SWITCH

The Shallco subminiature ½ in. diameter "C" Series combines time proven (over 30 years) internal construction i.e., rotor, stator, wiper, with a cost effective die cast operating shaft and housing.
The Shallco "C" Series switches are designed to satisfy the most demanding industrial and commercial instrumentation requirements.
Shallco offers a unique ½ inch, 3 pole, 4 position, 30° switch and a greater selection of 36° and 60° switches than any other manufacturer.
The most cost effective switch combines the die cast shaft and housing. However, brass and stainless steel shafts are available and provide the flexibility needed to meet your exact requirements without over specifying. No other manufacturer offers this service.

SPECIFICATIONS

ELECTRICAL:

Contact Resistance: 20 milliohms max. thru life; 10 milliohms max. initial; see life curve
Insulation Resistance: 10,000 megohms minimum thru life; 50,000 megohms initial (as measured between mutually insulated parts)
Voltage breakdown (DWV): 600 Vac between mutually insulated parts
Life: 25,000 cycles minimum at .200 amp, 28 Vdc (resistive load) at +85°C

ENVIRONMENTAL:

Shock: MIL-STD-202 type "M" and "H" (medium and high shock)
Vibration: MIL-STD-202, method 204, test condition 3, grade 3 and also MIL-STD-810, method 514 procedure II, part 3, curve AF for X, Y and Z axis
Operating temperature range: −65°C to +85°C
Storage temperature range: (Non-operating exposure) −65°C to +125°C
General: Switches will meet or exceed the requirements of MIL-S-3786/20, thermal shock (−65°C to +125°C), salt spray, explosion, construction "E" and "F", stop strength, bushing strength (15 lb.), terminal strength, shaft and panel seals, sand and dust.

MATERIALS:

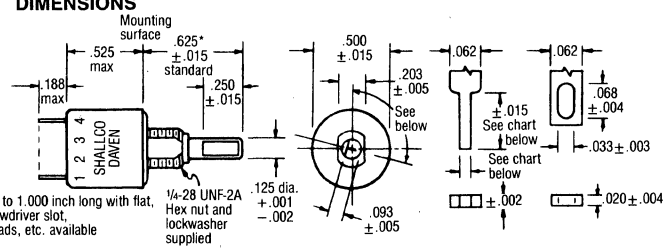
Bushing and housing (1 pc.): Chromate coated zinc die cast
Operating shaft: Chromate coated zinc die cast; optional brass or stainless steel
Contacts/Terminals: Gold-plated
Contact panel: Molded Thermoset plastic
Detent: Balanced system with two balls and spring
Wiper: Floating (rosebud) beryllium copper, gold plated
Seals: Shaft and bushing; double lubricated "O" ring. Panel: flat gasket, standard "O" ring -optional. Rear terminal seal: optional (see above)
Rotational torque: 10 inch ounces min.
Stop torque: 7.5 inch lb. min.

HOW TO SPECIFY

*Poles	Terminals	Indexing	Series	Contacts	†Positions	Stops	Shaft Length, fms	Flat Length	Shaft Material
1	P=PC	30°	"C"	"M"	02	"F" Fixed	16ths of inch	16ths of inch	Z=Zinc
2	S=Solder Lug	36°	Zinc		to	10=.625 Standard	04=.250 Standard		B=Brass
3				"B"		"R"			
4		60°	Housing		12	Continuous Rotation	16=1.000 max.		S=Steel

Example: 1P36CB10R1004Z
1 pole, PC, 36°, C Series, Non-shorting, 10 positions, continuous rotation, .625 long shaft (includes bushing), .250 long flat opposite position #1, chromate coated zinc operating shaft
fms=from mounting surface
1004 is standard. Shaft lengths up to 1.00" max. and various flat locations are optional.
*Shaft Flat Angle determined by Indexing Angle
†Std. .020×.020

DIMENSIONS



1/2 INCH BINARY CODED ROTARY SWITCHES

SPECIFICATIONS:

MATERIALS:

Bushings and housing (1 pc.): Stainless steel, nickel plated brass or chromate coated zinc die cast
Operating shaft: Stainless steel, brass or chromate coated zinc die cast
Contacts: Copper alloy with plated gold over nickel
Detent: Balance double balls of brass. Spring is steel
Shaft & panel seals: Double "O" ring shaft seal is standard. Flat gasket panel seal is standard. "O" ring panel seal is optional.
Contact panel: Diallyl phthalate per MIL-M-14

ELECTRICAL:

Life: Up to 25,000 cycles with a resistive load of .200 Amps, 28 volts DC max.
Contact Resistance: 20 milliohms initial; 100 millohms after life
Insulation Resistance: 50,000 megohms initial; 10,000 megohms after life
Voltage breakdown (DMV): 500 VAC between mutually insulated parts

MECHANICAL:

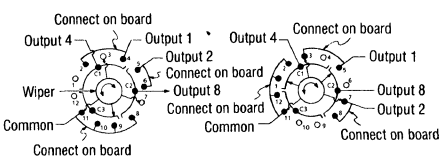
Stop torque: 7.5 pound inches minimum
Rotation torque: 8 to 24 ounce inches at room temperature
Optional seal: Can be sealed to withstand total immersion in FC 40/43 for 30 seconds @ +85°C
Long Life: To insure prolonged use or storage life, the contacts of the ½" binary coded switch are constructed with gold plating over silver. Shafts are available in lengths up to 1.00 inch (fms) in brass, stainless steel or zinc die cast to meet your specific requirements. Dougle "O" ring shaft seals are standard.
Compatible: Series 126 is available with up to 12 positions fixed stop, or continuous rotation, binary coded decimal (BCD) with 30° indexing. Its complement, the Series 126, is also furnished with up to 12 positions BCD. Both P/C and standard solder terminals are available.

BCD **COMPLEMENT BCD**

Switch Position	Common made to output: 1	2	4	8	BCD Output	Switch Position	Common made to output: 1	2	4	8	BCD Output
1					0	1	•	•	•	•	0
2	•				1	2		•	•	•	1
3		•			2	3	•		•	•	2
4	•	•			3	4			•	•	3
5			•		4	5	•	•		•	4
6	•		•		5	6		•		•	5
7		•	•		6	7	•			•	6
8	•	•	•		7	8				•	7
9				•	8	9	•	•	•		8
10	•			•	9	10		•	•		9
11		•		•	10	11	•		•		10
12	•	•		•	11	12			•		11

Schematics

Binary Coded Decimal Series 126 **Complement Binary Coded Decimal Series 127**



Switch viewed from shaft end.

• = terminals provided
○ = terminals provided

Wiper shown with switch in position #1. Shaft flat diametrically opposite position #1.

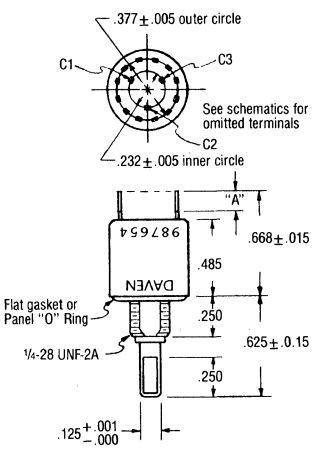
Factory fixed stops available to limit rotation.
All switching is non-shorting.

HOW TO SPECIFY

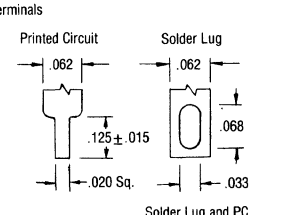
PART NUMBERING SYSTEM
126 or 127 ■ ■ - ■ ■ - ■ - ■ ■ - ■

- Series
- Case material: B=Brass Z=Die cast zinc
- Shaft material: S= Stainless steel B=Brass Z=Die cast zinc
- Number of positions: 2 through 12; Add "CR" for continuous rotation
- Type of terminals: P=P.C. S=Solder lug
- Shaft length from mounting surface: 5 through 16 in 1/16" increments
- Flat length: 0 through 8 in 1/16" increments

DIMENSIONS



Terminals



Solder Lug and PC Terminals are .020 thick.

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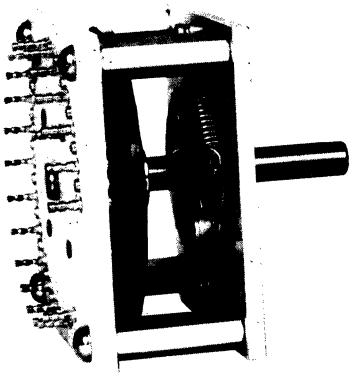
ROTARY SWITCHES SERIES C, D, AND E

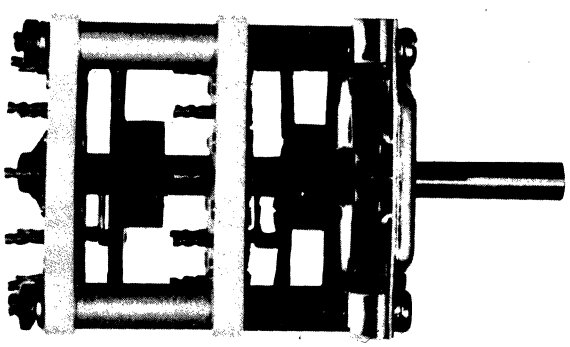


SPECIFICATIONS

GENERAL:
Meets or surpasses requirements of MIL-S-3786

ELECTRICAL:
Current carrying capacity—10 amps.
Current switching capacity—up to 2 amps.
Contact resistance—Initial—.005 ohms max.
Contact resistance—After Life—.010 ohms max.
Insulation resistance—50,000 megohms
Dielectric withstanding voltage—1500V rms
Dielectric withstanding voltage after life—1000V rms

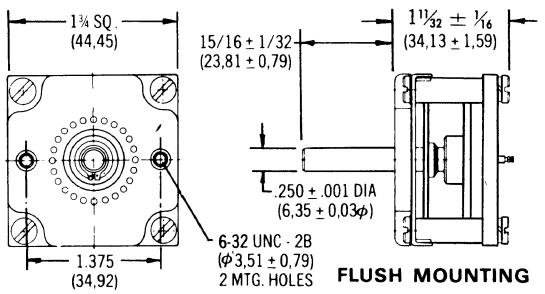
MECHANICAL:
Rotational life—50,000 cycles* min.@.250 amps.@85° C
Stop torque—50 In. Lbs.
Type construction—Open frame
Stops—Factory set to desired position.
Optional features—⅜-32 UNEF-2A bushing mount with anti-rotation pin. Shaft and front panel "O" ring seals. Spring return feature.
Concentric shafts available
Progressive shorting available
*One cycle = one full cw plus one full ccw rotation.



FEATURES OF SHALLCO 1¾, 2¼, 2¾ SQUARE SERIES C, D, E SINGLE DECK SWITCH MULTI DECKS AVAILABLE

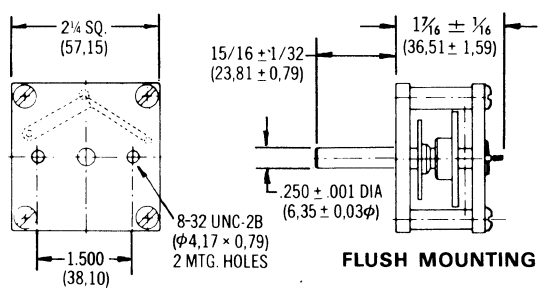
- Meets or surpasses requirements of MIL-S-3786
- Available in one pole 2-48 position through four pole 2-15 position. See ordering information
- High current carrying capacity
- Low contact resistance

SERIES C



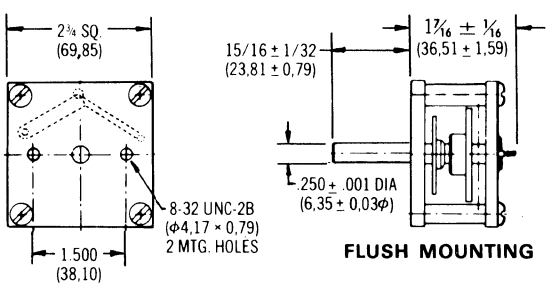
FOR ADDITIONAL DECKS ADD. 29/32 (23,02) PER DECK

SERIES D



FOR ADDITIONAL DECKS ADD 1 1/16 (26,99) PER DECK

SERIES E



FOR ADDITIONAL DECKS ADD 1 1/16 (26,99) PER DECK.

REQUEST CATALOG IO FOR COMPLETE INFORMATION

NUMBERS IN ( ) ARE METRIC EQUIVALENT (MILLIMETERS)

USE ORDER FORM

SHALLCO INC. / SMITHFIELD IND. PARK / P.O. BOX 1089 / SMITHFIELD, N.C. 27577 / (919) 934-3135

SHALLCO ORDERING INFORMATION

SHORTING				NON-SHORTING		
SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
111-CM	15°	24*	one	111-CB	30°	12**
112-CM	11¼°	32*		112-CB	22½°	16**
121-CM	15°	11	two	121-CB	30°	6
122-CM	11¼°	15		122-CB	22½°	8
131-CM	15°	5	three	131-CB	30°	3
132-CM	11¼°	7		132-CB	22½°	4
141-CM	15°	5	four	141-CB	30°	3
142-CM	11¼°	7		142-CB	22½°	4

*Maximum number of positions may be used with continuous rotation only.
**Normally supplied as continuous rotation; stops available on request.

SHORTING				NON-SHORTING		
SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
111-DM	15°	24*	one	111-DB	30°	12*
112-DM	11¼°	32		112-DB	22½°	16*
113-DM	7½°	48		113-DB	15°	24*
121-DM	15°	24*	two	121-DB	30°	12*
122-DM	11¼°	32		122-DB	22½°	16*
123-DM	7½°	23		123-DB	15°	12
141-DM	15°	11	four	141-DB	30°	6
142-DM	11¼°	15		142-DB	22½°	8
143-DM	7½°	11		143-DB	15°	6

*Normally supplied as continuous rotation; stops available on request.

SHORTING				NON-SHORTING		
SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
111-EM	15°	24*	one	111-EB	30°	12*
112-EM	11¼°	32		112-EB	22½°	16*
113-EM	7½°	48		113-EB	15°	24*
121-EM	15°	24*	two	121-EB	30°	12*
122-EM	11¼°	32		122-EB	22½°	16*
123-EM	7½°	48		123-EB	15°	24*
141-EM	15°	11	four	141-EB	30°	6
142-EM	11¼°	15		142-EB	22½°	8
143-EM	7½°	23		143-EB	15°	12
161-EM	15°	7	six	161-EB	30°	4
162-EM	11¼°	9		162-EB	22½°	5
163-EM	7½°	15		163-EB	15°	8
181-EM	15°	5	eight	181-EB	30°	3
182-EM	11¼°	7		182-EB	22½°	4
183-EM	7½°	11		183-EB	15°	6

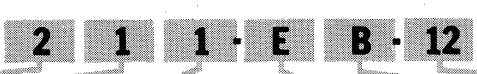
*Normally supplied as continuous rotation; stops available on request.

(Order Form to order Series C, D, E)

Order by using a six-place "shorthand" description

Example: 211—EB—12

Rotary Selector Switch, two decks, 1 pole per deck, 30° of spacing between positions, E series, non-shorting, 12 positions.



PLACE 1	PLACE 2	PLACE 3	PLACE 4	PLACE 5	PLACE 6
indicates number of decks:* 1 = One Deck 2 = Two Decks 3 = Three Decks, etc.	indicates number of poles per deck: 1 = One Pole 2 = Two Poles 3 = Three Poles 4 = Four Poles	indicates degrees of spacing between positions: Shorting 1 = 15° 2 = 11¼° 3 = 7½° Non-Shorting 1 = 30° 2 = 22½° 3 = 15°	indicates series of switch: C = C Series D = D Series E = E Series	indicates Shorting or Non-Shorting: M = Shorting (make before break) B = Non-Shorting (break before make)	indicates number of positions per pole: 2 = Two positions 3 = Three positions 4 = Four Positions, etc.

Request catalog 10 for more detailed information and additional switch types.

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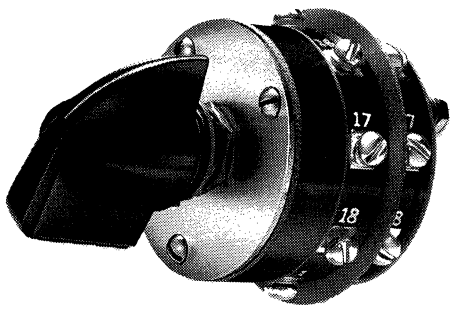
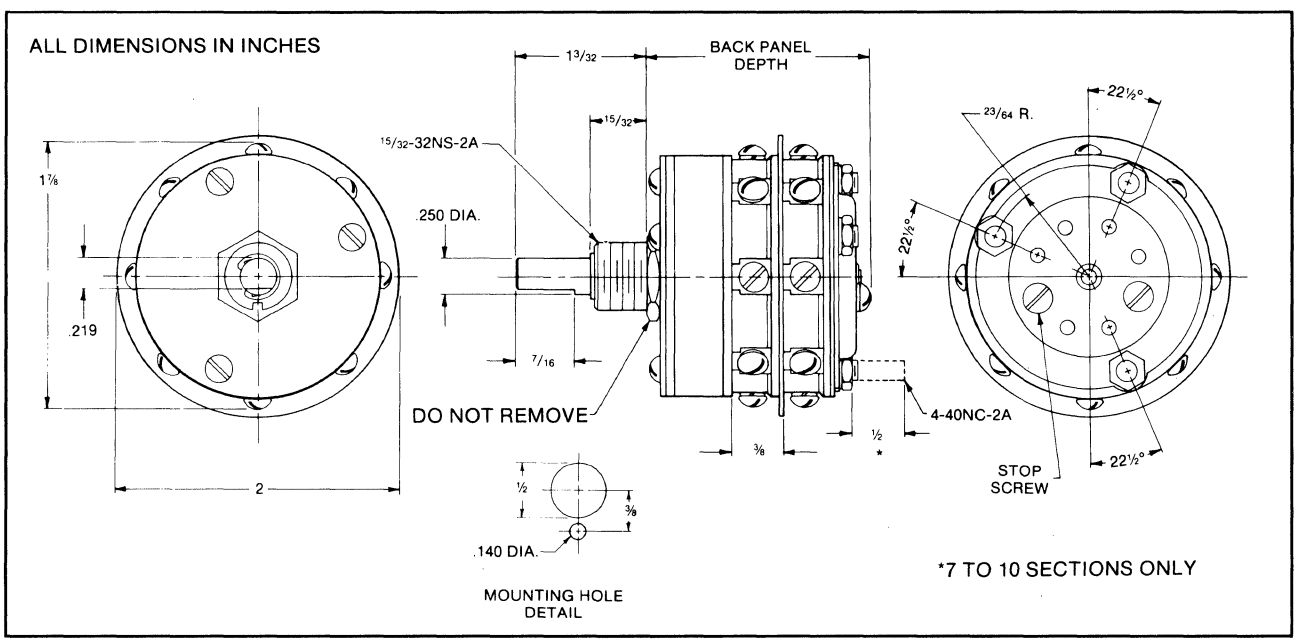
Series 16 Rotary Switch, 10 Ampere, Single-Hole Mount

General:
Meets requirements for 1 to 10 ampere switching of resistive loads to .75 power factor at voltages to 600V AC and 28V DC resistive loads

Electrical:
- Voltages: 28V DC, 600V AC
- Current carrying capacity: 10 amperes
- Current switching capacity: up to 10 amperes
- Dielectric withstanding voltage: 1500V rms, initial
- Contact resistance: Initial, 10 milliohms max.
- Insulation resistance: 1000 megohms, initial



Mechanical:
- Sections: 1 to 10; Poles 1 to 20, total
- Positions: 8, adjustable, 2 to 8 or continuous
- Shorting and non-shorting options
- Indexing: 45° positive detent
- Rotational life, mechanical: 10,000 cycles
- Rotational torque: 1-17 pound-inches, 1-10 sections
- Terminals: screw type, hardware supplied



Materials and Finishes:
- Rotors and stators: thermoset plastic, UL 94VO
- Rotor contacts: silver-plated phosphor-bronze
- Stator contacts: silver-plated copper
- Exterior metal: steel, zinc-plated, plus chromate
- Terminal hardware: silver-plated brass
- Knob: thermoset, black w/pointer

- Back-Panel Depth

Deck	Inches	Deck	Inches
1	1.16	6	3.06
2	1.54	7	3.80
3	1.92	8	4.16
4	2.30	9	4.54
5	2.68	10	4.92

- Approximate Weight
  Single deck switch: 115 grams (4 oz.)
  Each additional deck: 25 grams (1 oz.)
- Mounting hardware: supplied (nuts, non-turn tab washer and lockwasher)
- Knob: supplied

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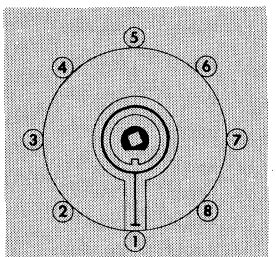
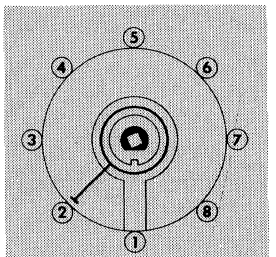
Series 16 Rotary Switch, 10 Ampere, Single-Hole Mount

Circuit Diagrams, (shown with pointer knob in the 12 o'clock position)



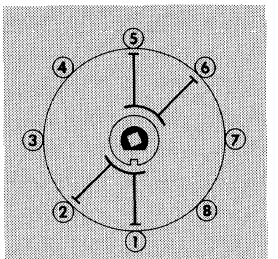
Circuit A
One pole/section
(off & 7 tap positions)

No. Sec.	P/N
1	16A1-B-1
2	16A1-B-2
3	16A1-B-3
4	16A1-B-4
5	16A1-B-5
6	16A1-B-6



Circuit B
One pole/section
(7 tap positions & off)

No. Sec.	P/N
1	16B1-B-1
2	16B1-B-2
3	16B1-B-3
4	16B1-B-4
5	16B1-B-5
6	16B1-B-6



Circuit C
Two poles/section
(double break switching)

No. Sec.	P/N
1	16C1-B-1
2	16C1-B-2
3	16C1-B-3
4	16C1-B-4
5	16C1-B-5
6	16C1-B-6

Maximum of 10 sections available

Options

- Make-Before-Break
- Custom Circuits
- Four-Hole Mounting
- Spring Return
- Terminal Jumpers
- Military Grade

Part Number Code

Series	Mounting	No. Sections
16	B	1 - B - 1
	Circuit	BBM/MBB

Example: Series 16, circuit B, single-hole mount, break-before-make, single section

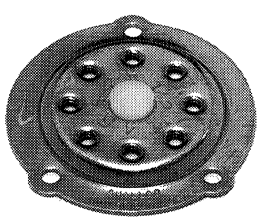
Marking of Terminals

First number = section (1 - 10)
Second number = terminal (1 - 8)

Examples: 16, section one, terminal six
24, section two, terminal four
63, section six, terminal three
105, section ten, terminal five

Adjustable Stops

All Series 16 rotary switches are equipped with an adjustable stop plate at the rear of the switch. Either one or two screws may be installed in the tapped holes provided. These screws limit the rotation of the switch to only those positions required by the user's application. All switches are supplied without the stop screws installed which allows for continuous rotation. Use only the screws and washers supplied for these stops. Fixed stops option available.



Technical Assistance

We invite your inquiries regarding a specific application. Shallco technical assistance is available by telephone and facsimile immediately. Sample units can be supplied at nominal cost and assigned a unique part number to define your design.

FAX 1-919-934-3298

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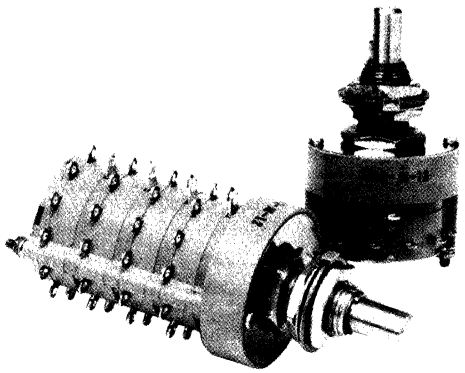
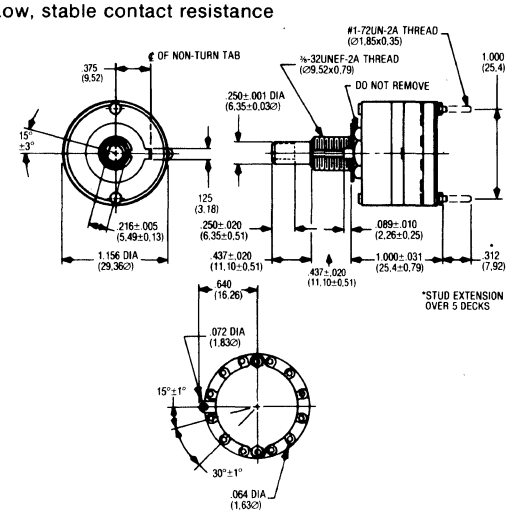
series J

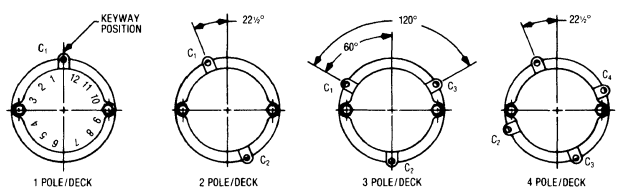
ROTARY SELECTOR SWITCHES



FEATURES OF SHALLCO ONE INCH SERIES J SINGLE OR MULTIDECK SWITCH

- Designed to meet requirements of MIL-S-3786
- Closed construction
- Smooth, positive detent
- Low, stable contact resistance





SPECIFICATIONS

GENERAL:

Designed to meet the requirements of MIL-S-3786/SR04

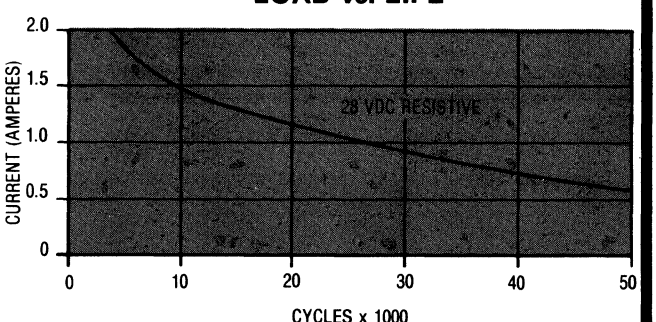
ELECTRICAL:

Current carrying capacity - 10 amperes
Current switching capacity - 1 ampere (28 VDC, Resistive)
Contact resistance - Initial - 5 milliohms maximum
Contact resistance - After Life - 20 milliohms maximum
Insulation resistance - 50,000 megohms
Voltage breakdown - 1000 VAC
Voltage breakdown - After Life - 500 VAC minimum

MECHANICAL:

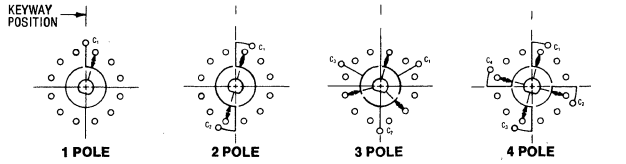
Rotational life - 50,000 cycles
Stop torque - 15 pound-inches minimum
Construction - Enclosed
Stops - Factory set
Torque - 8 to 120 ounce-inches (dependent on decks, poles/deck)
Shaft flat - Opposite moving contact, see diagrams

LOAD vs. LIFE

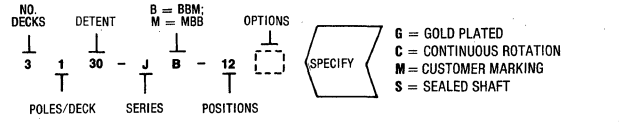


SHORTING				NON-SHORTING		
CODE	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	CODE	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
1130-JM	30°	12	ONE	1130-JB	30°	12
1230-JM		6	TWO	1230-JB		6
1330-JM		4	THREE	1330-JB		4
1430-JM		3	FOUR	1430-JB		3

SINGLE DECK SHOWN. FOR MULTI-DECK, INCREASE FIRST DIGIT OF ABOVE CODES.



(VIEWED FROM SHAFT END AND SHOWN IN POSITION 1, EXTREME CCW POS.)

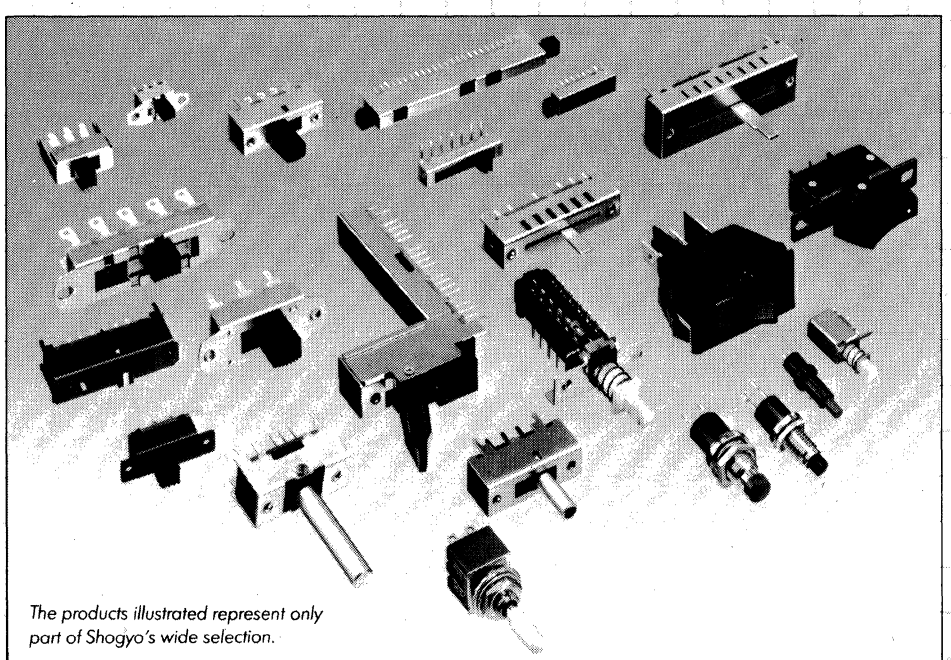


SHOGYO SWITCHES

Your design deserves Shogyo quality and reliability.
You deserve . . .
Shogyo Service . . . comprehensive, responsive and fast
Shogyo Professionalism . . . the helpful experience you need
Shogyo Prices . . . always competitive, usually better
and . . .
Shogyo Selection . . . with complete custom design capabilities

Including a diverse offering of:
- *Slide switches*
- *Toggle switches*
- *Power switches*
- *Push button switches*
- *Lever action switches*
- *Push-slide switches*
- *Leaf switches*
- *Rotary-slide switches*

And featuring:
- *PC or solder mount*
- *An extensive variety of sizes, pin types, pole and position quantities, ratings, contact and insulation resistances, and withstand voltages*
- *Electrical/mechanical endurances up to 30,000 cycles*
- *Silver plated contacts*



The products illustrated represent only part of Shogyo's wide selection.

For immediate assistance:
Telephone 516-466-0911 or FAX 516-466-0922



For complete product listings and specifications, request our free catalog.

SPECIFY SHOGYO. ELECTRONIC COMPONENTS AS GOOD AS YOUR DESIGN.
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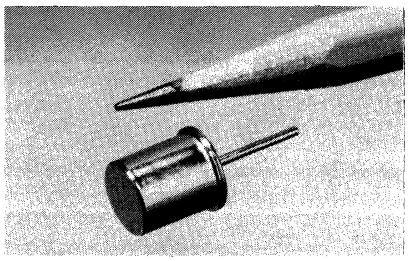
SHOGYO

NEW! TILT-MOTION-VIBRATION SWITCHES

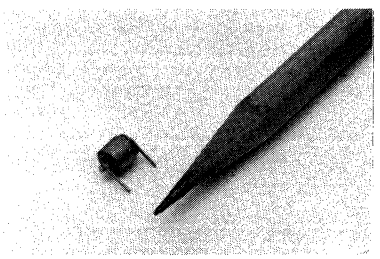
LOW COST **EASY TO USE**



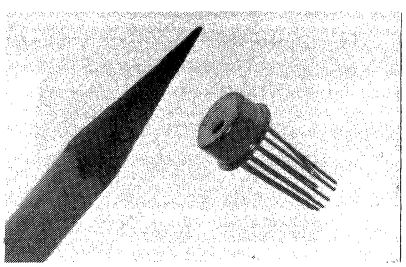
Series 2008-4

Switch has same sensitivity to vibration – motion in all positions. At rest, the SPST contacts of the series 2008-4 are always open regardless of mounting attitude. Once disturbed the contacts will momentarily close. Body length is 0.38". Diameter is 0.325".

Vibration Detector only 0.005 in³ The Series 5008-PC may be the industry's smallest vibration detection switch. No standby power required. Length is 0.19". Diameter is 0.182".



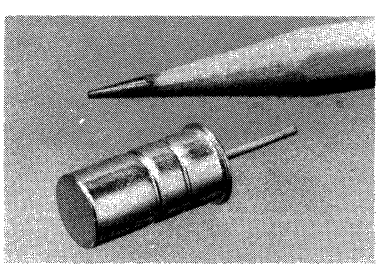
Series 5008-PC



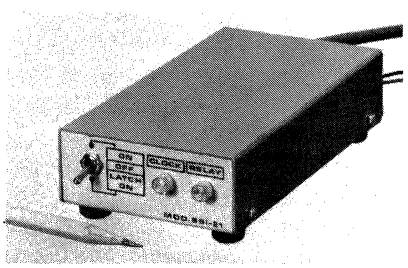
Series 2009

Who put 12 mercury contacts in that little bitty can? 12 separate contacts surround the periphery of this 0.18"H x 0.33"D, hermetically sealed switch. This versatile switch is equally adept serving as a tilt switch or as a motion and vibration sensor. The switch will not only determine the presence of tilt or vibration, but its magnitude and direction.

Crimped can gives tilt switch a 60° dead band. The series 3006-60 is designed to operate reliably in high shock environments that would normally preclude the use of a mercury tilt switch. The 60° of hysterisis also serves to eliminate repeated cycling of controlled equipment. Length is 0.66". Diameter is 0.36". Contacts rated to switch 1.0 amperes, 115 VAC.



Series 3006-60



Series 221-12

Solid state change of state latching circuit complements all mercury switches. Circuit conditions mercury contact chatter into a smooth output signal. Circuit functions from change in contact state. It works equally well with SPST-NO or NC contacts. Internal sensitivity adjustment triggers at the first or the "N"th contact pulse. Output is SPDT relay contacts. Circuit on time is fully adjustable.

THESE ARE JUST A FEW OF OUR INNOVATIVE LINE OF MERCURY SWITCHES. TO SEE THEM ALL CALL OR FAX:

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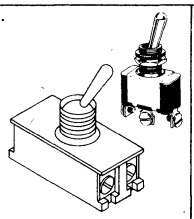
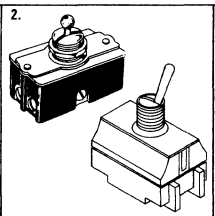
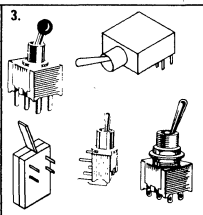
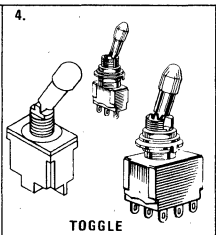
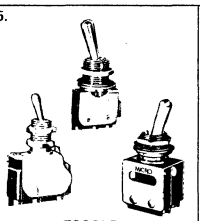
AEROSPACE – COMMERCIAL

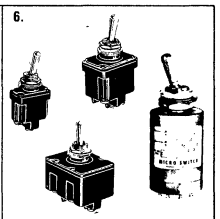
1. 
TOGGLE
General Purpose

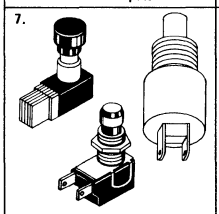
2. 
TOGGLE
High Capacity

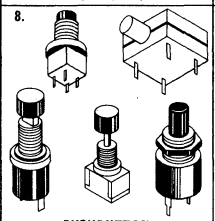
3. 
TOGGLE
Miniature & Ultra Miniature

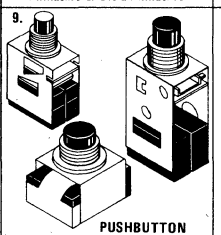
4. 
TOGGLE
Locking Lever

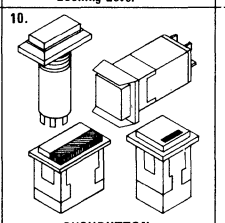
5. 
TOGGLE
Precision

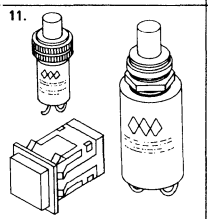
6. 
TOGGLE
Environmentally Sealed

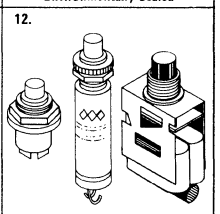
7. 
PUSHBUTTON
General Purpose

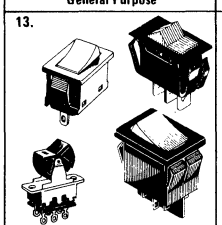
8. 
PUSHBUTTON
Miniature & Ultra Miniature

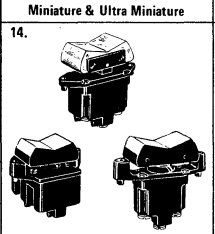
9. 
PUSHBUTTON
Precision

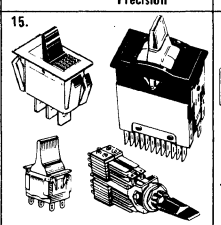
10. 
PUSHBUTTON
Lighted

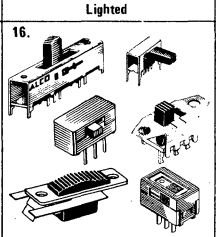
11. 
PUSHBUTTON
Reed & Solid State

12. 
PUSHBUTTON
Enviromentally Sealed

13. 
ROCKER
Lighted & Unlighted

14. 
ROCKER
Heavy Duty / Sealed

15. 
PADDLE

16. 
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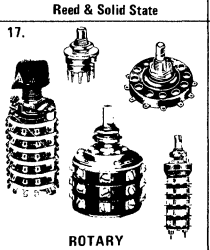
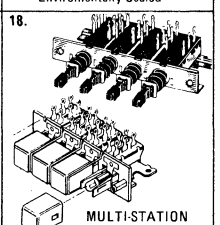
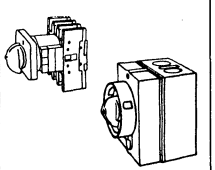
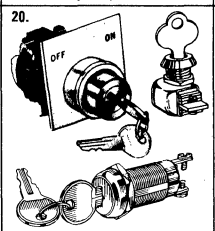
17. 
ROTARY
Electronic Duty

18. 
MULTI-STATION
Push Button Switches
Make to Spec.

19. 
CAM-ROTARY
High Capacity HP Rated
Make to Spec.

20. 

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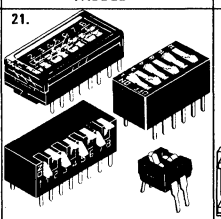
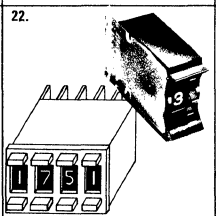
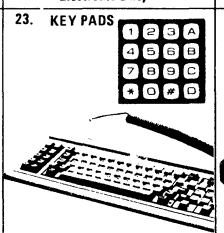
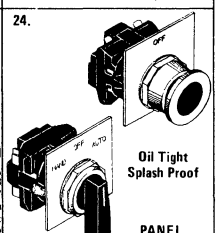
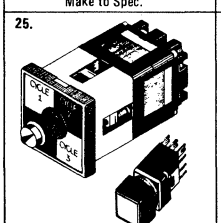
21. 
DIP SWITCH

22. 
PB/ROTARY THUMBWHEEL
Programmable Code Switch

23. KEY PADS

KEYBOARDS

24. 
Oil Tight
Splash Proof
PANEL
CONTROLS

25. 
Lighted - Oil Tight
PANEL CONTROLS

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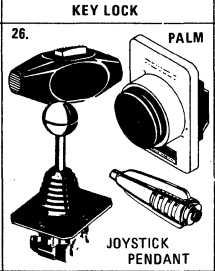
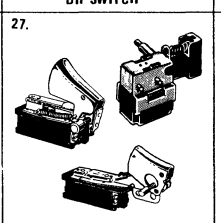
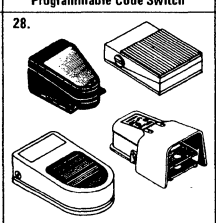
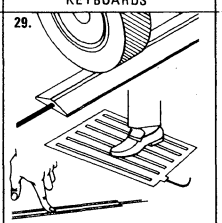
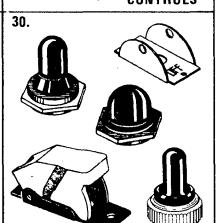
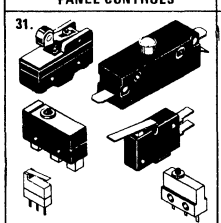

JOYSTICK
PENDANT

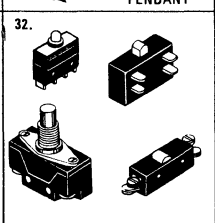
27. 
TOOL HANDLE

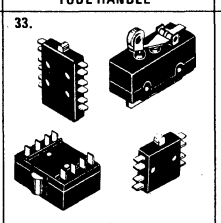
28. 
FOOT SWITCH

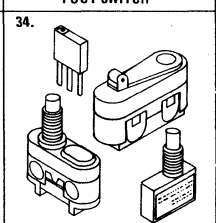
29. 
TAPE/AIR SWITCHES

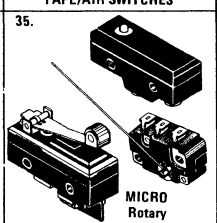
30. 
SWITCH GUARDS & SEALS

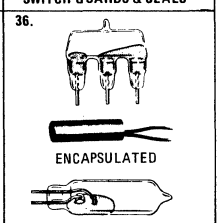
31. 
MICRO
Single Break

32. 
MICRO
Double Break

33. 
MICRO
2 & 3 Poles

34. 
MICRO
Sealed & Hi-Temperature

35. 
MICRO
Rotary
MICRO
High DC Capacity
Magnetic Blow-Out Switches

36. 
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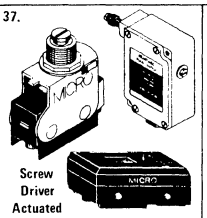
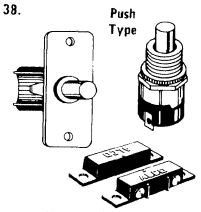
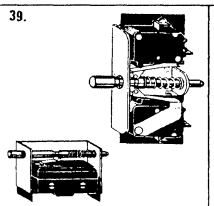
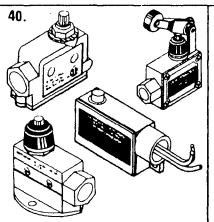
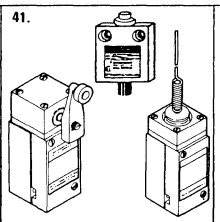
37. 

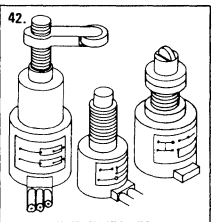
Screw Driver Actuated & PULSE SWITCHES

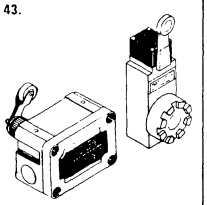
38. Push Type 
Magnetic Actuated DOOR SWITCHES

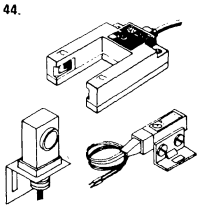
39. 
DOOR INTERLOCK

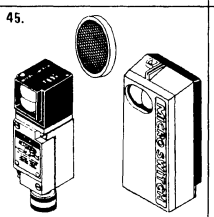
40. 
ENCLOSED SWITCHES

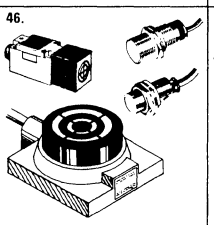
41. 
LIMIT SWITCHES

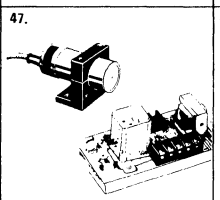
42. 
LIMIT SWITCHES Sealed & Hi-Temperature

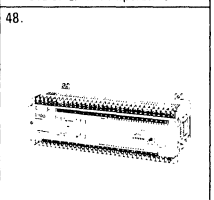
43. 
LIMIT SWITCHES Explosion Proof

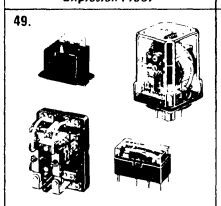
44. 
PHOTO–ELECTRIC CONTROLS Fiber Optics-LED-Incandescent

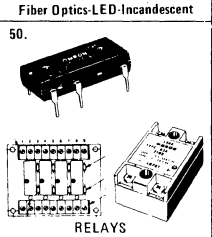
45. 
PHOTO-ELECTRIC CONTROLS Self- Contained

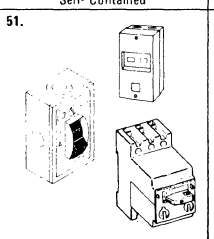
46. 
PROXIMITY CONTROLS

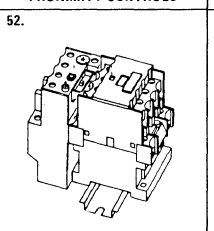
47. 
LIQUID LEVEL CONTROLS Capacitance & Resistance Type

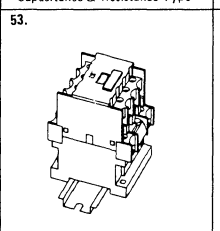
48. 
PC Programmable Controllers

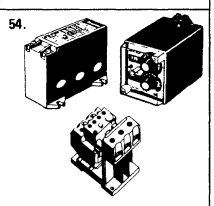
49. 
RELAYS Electro-Mechanical

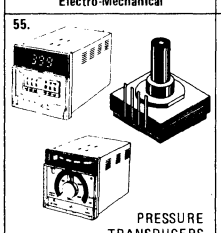
50. 
RELAYS I/O Modules/Board Reeds & Solid State

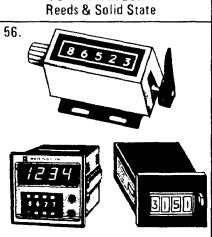
51. 
MANUAL MOTOR STARTERS

52. 
MAGNETIC MOTOR STARTERS

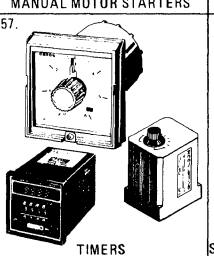
53. 
MAGNETIC CONTACTORS

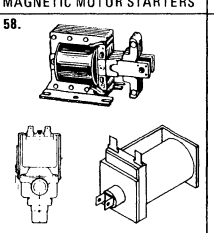
54. 
MOTOR PROTECTION Thermal - OverCurrent Open & Reverse Phase

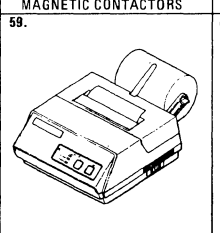
55. 
PRESSURE TRANSDUCERS TEMPERATURE CONTROLS

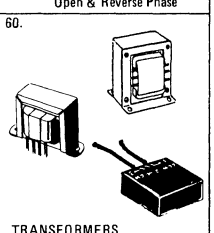
56. 

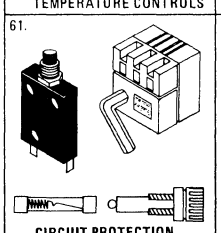
COUNTERS

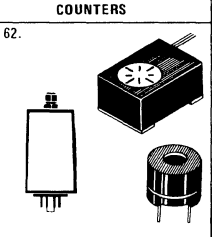
57. 
TIMERS

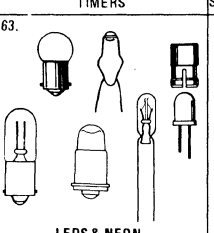
58. 
SOLENOIDS / SOLENOID VALVES

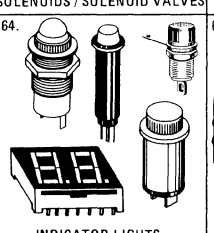
59. 
IMPACT PRINTERS

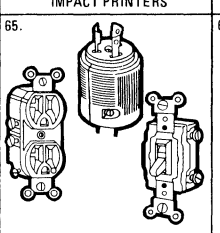
60. 
TRANSFORMERS SURGE SUPPRESSORS

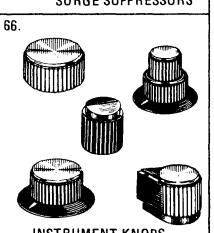
61. 
CIRCUIT PROTECTION FUSES & FUSEHOLDERS

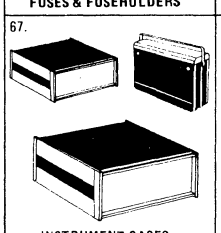
62. 
FLASHERS BUZZERS

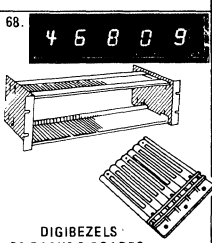
63. 
LEDS & NEON Incandescents Mini-Lamps

64. 
INDICATOR LIGHTS LED DISPLAYS

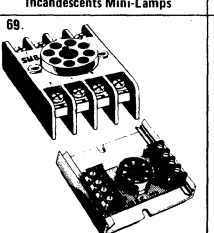
65. 
WIRING DEVICES

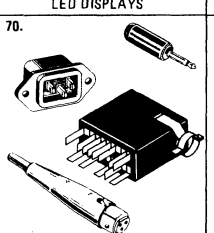
66. 
INSTRUMENT KNOBS Commercial & Military

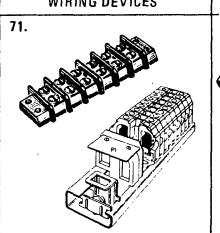
67. 
INSTRUMENT CASES BAILS & HANDLES

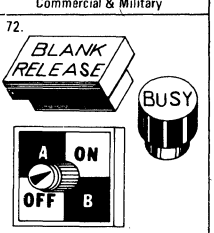
68. 

DIGIBEZELS PC RACKS & BOARDS

69. 
SOCKET SNAP–TRACKS

70. 
PLUGS JACKS & CONNECTORS

71. 
TERMINAL BLOCKS

72. 

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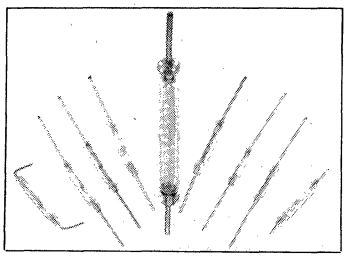
STANDEX REED SWITCHES

Setting Performance Standards Throughout the World . . .



- ☐ Tested to 1 billion operations
- ☐ Totally automated production
- ☐ Highest quality, based on computerized SPC, yielding unmatched uniformity.
- ☐ Custom cutting and forming for difficult applications
- ☐ Several standard contact materials for a broad range of applications

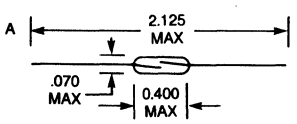
Switch Specifications:

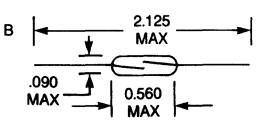
Switch Type	Switch Size	Lead Dia. (inches typ.)	Contact Material	Power Rating (VA max.) See note 3	Switching Current (amps max.)	Carry Current (amps max.)	Switching Voltage (volts DC max.)	Switching Voltage (volts AC rms max.)	Breakdown Voltage (volts DC min.)	Contact Resistance (milliohms max.)	Insulation Resistance (ohms min.)	Operate Time including Bounce (ms. typ.)	Resonant Freq. (kHz min.)	Pull-in-Range (ampere-turns)	Typical Drop-Out for 20 AT Pull-in	Typical Drop-Out for 40 AT Pull-in	Vibration 10-2000 Hz (G's max.)
GR400	A	0.018	Rhodium	5	0.5	1.0	50	50	150	150	10^{12}	0.5	4.5	10-40	14	22	50
GRU400	A	0.018	Ruthenium	5	0.5	1.0	50	50	150	150	10^{12}	0.5	4.5	10-40	14	22	50
GR560	B	0.022	Rhodium	10	0.5	1.0	100	125	250	100	10^{12}	0.6	3.0	9-50	14	28	50
GRU560	B	0.022	Ruthenium	10	0.5	1.0	100	125	200	100	10^{12}	0.6	3.0	9-50	14	28	50
GK560	B	0.022	Gold-Nickel Alloy	10	0.5	1.0	100	125	250	150	10^{12}	0.6	3.0	9-70	10	15	50
TS560	B	0.022	Noble Metal	5	0.5	1.0	50	125	200	250	10^{9}	1.0	3.0	10-100	N/A	N/A	30
GR100	C	0.022	Rhodium	10	1.0	2.0	200	250	350	100	10^{12}	0.8	2.2	9-60	12	22	40
GRU100	C	0.022	Ruthenium	10	0.5	1.0	150	150	300	100	10^{12}	0.8	2.2	9-60	12	22	40
PR100	C	0.022	Rhodium	10	1.0	2.0	250	350	1000	100	10^{12}	0.8	2.2	20-60	12	22	40
TS100	C	0.022	Noble Metal	5	1.0	2.0	100	125	300	250	10^{9}	1.0	2.2	10-100	N/A	N/A	40
GK126	C	0.026	Gold-Nickel Alloy	25	1.5	2.5	200	250	350	150	10^{12}	1.0	2.5	15-80	10	20	30

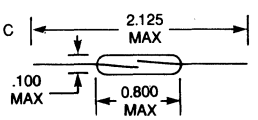
1) Contact resistance measurements are made at 10mA from a 1 volt source with 50% overdrive.

2) Storage temperature - 50°C to +155°C
Operate temperature - 40°C to +125°C

3) Consult factory for specific application assistance when using switches at or near maximum rated load. In some applications, maximum loads may be exceeded.







Contact Materials — Dry Circuit & Power Switching

Rhodium

Industry standard — recommended for general purpose applications. Low resistance, high melting point metal provides millions of trouble-free operations at low and medium loads.

Gold-Nickel Alloy

Specially developed plating and post assembly conditioning makes this alloy particularly resistant to hostile transients encountered in telecommunication circuits. Suitable for medium and high power loads.

Ruthenium

Precision controlled plating ensures contact resistance stability at low level switching over hundreds of millions of operations as required in automatic test equipment and instrumentation applications.

Detail application assistance for custom forming and proximity applications.

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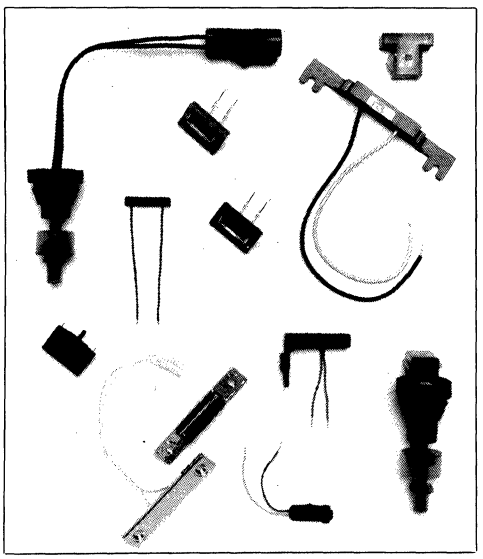
Custom Magnetic and Liquid Level Sensors



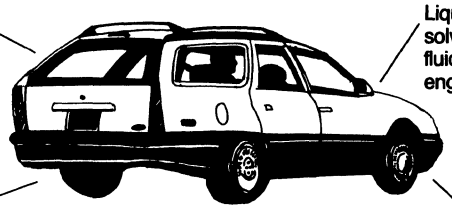
Standex Electronics designs and builds magnetic proximity sensors for a wide range of markets and applications. The basic sensing element for most applications is the hermetically sealed reed switch. Other technologies are used as the application dictates.

- ☐ Hi-Rel Switching — hermetically sealed contacts — billions of operations switching low level loads
- ☐ No External Power Required
- ☐ Power Switching — direct switching of power loads with up to 2.5 amp DC inrush
- ☐ Wide Actuation Distance — reliable actuation at up to one inch for certain applications
- ☐ Low Cost — very competitive with other technologies

RPM Sensing — cruise control, odometer, speedometer and engine control

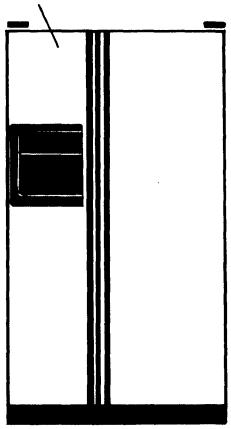
Liquid Level — washer solvent, coolant, brake fluid, transmission fluid, engine oil and fuel.

Door ajar sensing, liquid level sensing, lamp switching, dishwasher spray arm rotational sensing, and device enable applications.

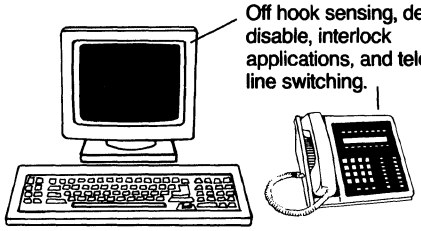


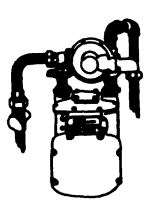
Anti-skid Braking System

Lamp Outage



Off hook sensing, device disable, interlock applications, and telephone line switching.





Rotational counting applications for gas, electric and water metering and tamper applications.

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Switchcraft
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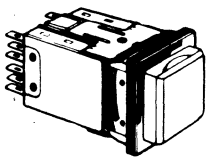
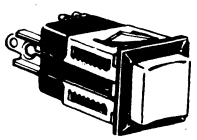
EXTENSIVE SELECTION OF PUSHBUTTON SWITCHES



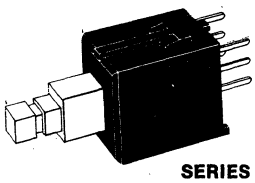
SERIES PL —
"Push-Lite" SWITCH



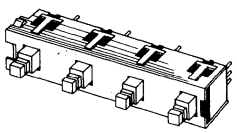
SERIES US & LUS —
"Uniswitch" SWITCHES

Standard and miniature non-illuminated or illuminated switches offer broad switching capabilities in minimal mounting space. All switches are easy to mount and are available with a variety of actuator colors, circuitry, terminal styles and mechanical functions. Current ranges from 250 mA to 8 A.

IBS MINIATURE PUSHBUTTON SWITCHES



SERIES 98000R





Type I



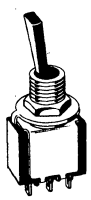
Type II

Series 98000R IBS miniature pushbutton switches can be gang mounted on common frames, up to 12 stations long with center-to-center spacing of 10 mm, 15 mm or 20 mm. Available with interlock, non-lock, momentary or push-lock/push-release mechanical functions. .130 in. (3.30 mm) x .130 in. (3.30 mm) square plungers accept a full line of industry standard pushbuttons. Switches are stocked without pushbuttons due to wide variety that can be used. Order pushbuttons separately. Switches have .157 in. (4 mm) long PC terminals for mtg. single- or double-sided PC boards up to .094 in. (2.39 mm) thick. Close stacking (centers) permit high density within minimum front panel space. Plunger travel: .144 in. (3.66 mm).

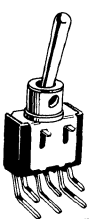
IBS PUSHBUTTONS

IBS pushbutton faces are concave for operator convenience with full legend capability. Can be mounted horizontally or vertically. Pushbutton dimensions: Type I — .388 in. (9.86 mm) W x .216 in. (5.49 mm) H x .425 in. (10.80 mm) D. Type II — .464 in. (11.79 mm) W x .288 in. (7.32 mm) H x .432 in. (10.97 mm) D. Pushbuttons must be ordered separately.

MULTI-SPEC® INTERNATIONALLY APPROVED SWITCHES

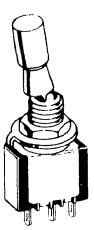


Miniature Flat Toggle



Miniature Toggle Right Angle PC, Horizontal Lever Action

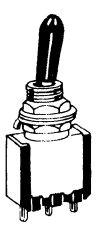
NOT AVAILABLE FOR SALE IN EUROPE



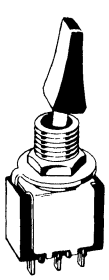
Locking Toggle



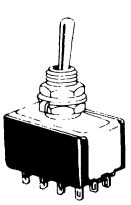
Black Paddle (L41)



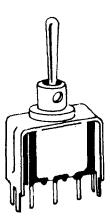
Black Insulated Toggle



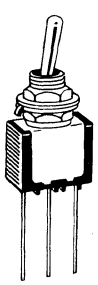
Paddle



Bat Toggle



Bat Toggle



Bat Toggle

1-4 pole toggle switches offer a wide selection of standard and special features. In miniature size they are designed for bushing or PC board mounting. Terminal choices include solder lug, PC, wire-wrapping, quick-connect. They have most European approvals. There's a selection of gold and silver contacts with ratings from 100 mA to 6 A.

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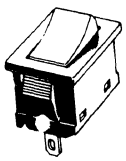
A **Raytheon** Company

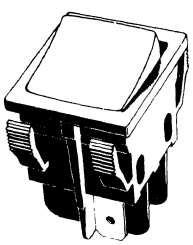


SERIES 150 MINIATURE ROCKER SWITCHES

UL and CSA recognized (VDE pending) switches have up to 8 A switching; 1A, 1C or 2C circuitry; solder or .187 in. quick connect terminals; locking or momentary action; black housings; and black, red/black or red rockers. Snaps into a .756 +.004/–0 in. (19.2 +0/–.1mm) × .508 +.004/–0 in. (12.9 +.1/–0 mm) panel openings from front. Dim.: .825 in. (20.95 mm) long × .59 in. (4.98 mm) wide × 1.04 in. (26.42 mm) max. depth from front of panel. Current ratings: 4 A, 250 VAC & 8 A, 125 VAC (UL & CSA).

Part No.	Circuitry[1]	Terminals	Housing Color	Rocker Color	Legend
150B98NN	1A, ON-OFF	Quick Connect	Black	Black	—
150B98NNR	1A, ON-OFF		Black	Black/Red	—
150B98NR	1A, ON-OFF		Black	Red	—
152B2NN	1C, ON-ON	Solder Lug	Black	Black	—
152B2NNE	1C, ON-ON		Black	Black	I-O (vert.)
153B2NN	1C,(ON)-(ON)		Black	Black	—
162B2NN	2C, ON-ON		Black	Black	—
162B2NNE	2C, ON-ON		Black	Black	I-O (vert.)
163B2NN	2C,(ON)-(ON)		Black	Black	—

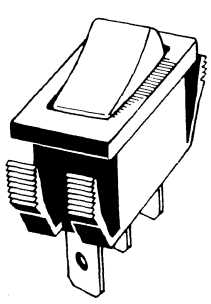
NOTES: [1]All switches have locking action, except 153B2NN and 163B2NN are momentary action. ( ) means momentary.



SERIES 350 SINGLE & DOUBLE POLE, 2- & 3-POSITION, NON-ILLUMINATED ROCKER SWITCHES

UL and CSA recognized (VDE pending) switches have up to 20 A switching; 1A, 2A or 2C circuitry; .25 in. quick connect terminals; locking action; black housings; and black, amber or red rockers. Snaps into a 1.181 +0/–.004 in. (30 +0/–.1 mm) × .866 +.004/–0 in. (22 +.1/–0 mm) panels openings from front. Current ratings: 15 A, 250 VAC; 20 A, 125 VAC (UL & CSA).

Part No.	Circuitry	Housing Color	Rocker Color	Illum.
350B5NN	1A, ON-OFF	Black	Black	No
360B5NN	2A, ON-OFF	Black	Black	No
360NB5ANKA	2A, ON-OFF	Black	Amber	Yes
360NB5ANKR	2A, ON-OFF	Black	Red	Yes
362B5NN	2C, ON-ON	Black	Black	No



SERIES 1950 SINGLE POLE, 2 POSITION, HIGH CURRENT, ILLUMINATED & NON-ILLUMINATED ROCKER SWITCHES

Series 1950 offers advanced curved rocker faces with matte finish for new and retrofit applications. UL and CSA recognized (VDE pending) switches have up to 16 A switching; 1A or 1C circuitry; .25 in. quick connect terminals; locking action; black housings; and black, black/red, amber or red rockers. Snaps into 1.072 to 1.125 in. (27.23 to 28.58 mm) × .48 to .55 in. (12.19 to 13.97 mm) panel openings from front. Current ratings: 16 A, 125 VAC, 10 A, 250 VAC (UL & CSA).

Part No.	Circuitry	Housing Color	Rocker Color	Illum.	Legend
1950B5NN	1A, ON-OFF	Black	Black	No	—
1950B5NNE	1A, ON-OFF	Black	Black	No	I-O-(vert.)
1950B5NNR	1A, ON-OFF	Black	Black/Red	No	—
1950B5NNRI	1A, ON-OFF	Black	Black/Red	No	ON OFF (vert.)
1950NB5ANKA	1A, ON-OFF	Black	Amber	Yes	—
1950NB5ANKR	1A, ON-OFF	Black	Red	Yes	—
1952B5NN	1C, ON-OFF	Black	Black	No	—
1954B5NN	1C, ON-OFF	Black	Black	No	—

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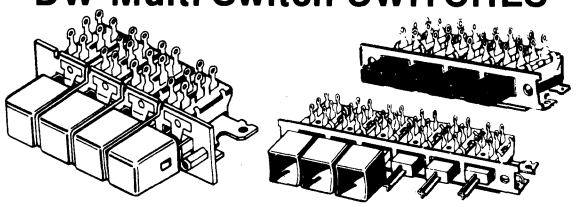
DW Multi-Switch SWITCHES



The DW (double-wipe) Multi-Switch switch is available up to 18 stations in a single row & ganged assemblies with interaction between rows. Max. switching per station is 4-C (4PDT). Each station utilizes specially designed switching modules with U-shaped, high reliable bifurcated contactors rated at 3 amps, A.C.; 0.5 amp, D.C., 125 V, non-inductive load. DW Multi-Switch switches are available in 5 series: 65000, 66000, 67000, 70000, and 71000. All provide four standard functions: **Interlock** — actuating a pushbutton automatically restores to normal the pushbutton previously actuated. **Lock-Out** — prevents operation of more than one pushbutton at a time. This feature is included on all interlock switches. **Non-Lock** — each pushbutton has momentary action. **All-Lock** — all pushbuttons, except release, lock when depressed. All pushbuttons restored to normal by actuating (momentary) release pushbutton. **Push-Lock/Push-Release** — pushbuttons lock when depressed and release when again depressed. **All Series** — pushbuttons on $^{3}/_{8}$" centers. DW Multi-Switch switches are available in single row assemblies with interlock and all-lock functions from one to twelve stations; with non-lock and push-lock/push-release functions up to 18 stations.

Series 65000—Non-illuminated, integral pushbutton.
Series 66000—Non-illuminated version of Series 67000.
Series 67000—Illuminated pushbuttons.
Series 70000, 71000—Non-illuminated, cross-rib plungers, accept up to 12 different styles of pushbuttons.

MOMENTARY Button Switch SWITCHES

Miniature pushbutton switches are enclosed in metal housing. Terminals: solder lug. Contacts: internal nickel silver, 250 mA, 30 W max., AC, non-inductive. **Series 903, 913:** behind panel mtg. **Series 923, 933:** front mount. All switches: bushing mount.

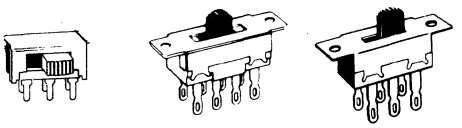


903 & 913



923 & 933

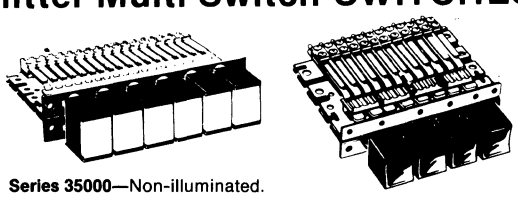
"Tini-Slide" SWITCHES



Miniature "**Tini-Slide**" switches are precision locking switches with unique lift/wipe/slide action and silver contacts. Ratings: 0.5 A, 125 V AC or DC, non-inductive. 2- and 3-position types. U.L. listed. Solder lugs or PC terminals. Crowned knobs.

Series 56000 — DPDT & DPTT **Series C63000 — 4PDT**
Series C62000 — Side Knobs

littel Multi-Switch SWITCHES



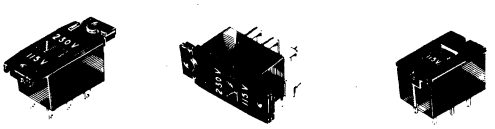
Series 35000—Non-illuminated.
Compact, rugged multiple-station switches feature up to 6PDT per station in .6 square inch space. Excellent selection of contacts for low or high current switching. Plungers accept nine different Switchcraft pushbuttons. Mechanical functions are: interlock, all-lock, non-lock and push-lock/push-release. One to 18 stations; many legends are possible.

Series 37000—Single lamp illumination at each station. All other basic functions and features are same as Series 35000.

Series 38000—Twin lamp illumination using low power, low heat lamps. All other basic functions and features same as Series 35000.

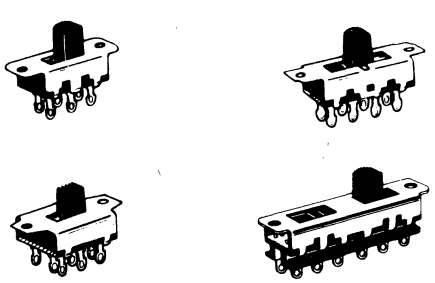
EUROPEAN LINE VOLTAGE SELECTOR SWITCHES

NEW! 10 A SWITCH



Durable slide switches provide quick and easy programming/ selection of 115 V or 230 V primary power in electrical/electronic equipment for international marketplace. UL. CSA and VDE (Verband Deutscher Elecktrotechniker) approved. Mountings are flange or PC (straight or right angle). DPDT, locking. Ratings: UL & CSA: 2A, 250 V AC & 4A, 125 V AC. VDE: 2 A, 250 V AC. Switches also designed to comply with CEE and IEC requirements Legends: 115 V-230 V. New 10 A switch rated: 10.1 A, 125 V AC; 5 A, 250 V AC. Submitted to UL & CSA for listing.

SLIDE SWITCHES



Instrument quality Switchcraft slide switches have low cost, precision "double-wipe" contacts with "U"-shaped bifurcated contacts rated at 0.5 A DC, 3 A AC, 125 V, non-inductive. Solder lugs have $^{5}/_{64}$" dia. center holes and wrap-around notch. Various knob styles: crowned, rocker, flush. U.L. & C.S.A. listed types and heights. Up to 4 poles of switching with locking or momentary action.

Series 46000—General purpose slide switches
Series 47000—Tandem switches
Series 50000—2-position, 3 & 4 poles

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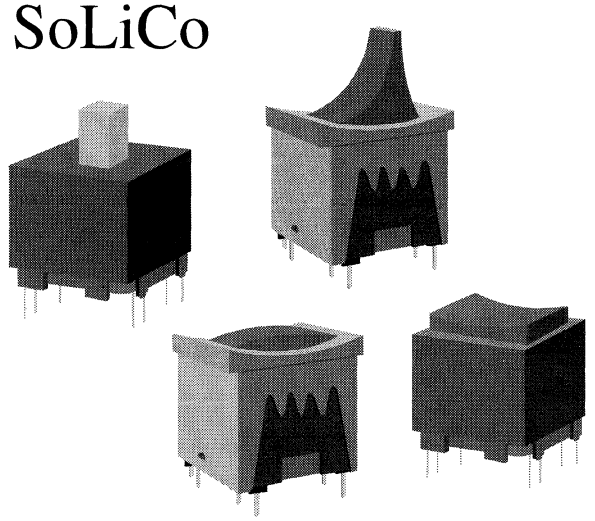
UNIQUE SWITCHES AVAILABLE FROM SoLiCo/mec

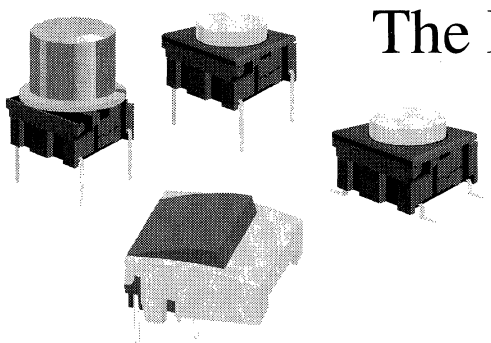
The Unimec Switch from SoLiCo

- Momentary and Alternate action
- Can be used alone or with a variety of cap, bezel, and LED options
- PC Mountable
- Multi-contact functions
- Hundreds of standard keycap legends
- Vario-support mounting is available for customs keypads
- Optional cap available in 6 colors provides switch with a splashproof feature
- Momentary lifetime - 1,500,000 cycles
- Alternate lifetime - 500,000 cycles
- Rated for 250mA @ 120V
- Undisputable Danish quality and workmanship!



Actual size without cap or bezel - 12mm x 12mm

Call today for free catalog!

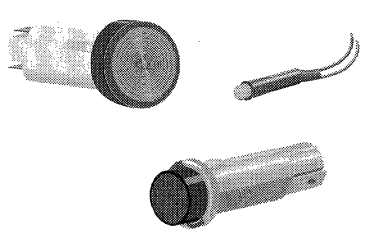


The NEW Multimec Switch

- Environmentally sealed
- Available with either thru-hole or surface mount terminals
- Withstands wave soldering procedures
- Various cap and bezel options
- Ten standard colors available
- Can be used with a foil overlay to simulate a membrane switch
- 150g key pressure actuation force, 1mm key travel
- Rated for 50mA @ 24VDC
- High reliability — 5 million cycles!

Actual size without cap or bezel - 10mm x 10mm

Call today for information!



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Hartford, CT 06114

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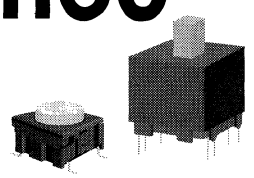

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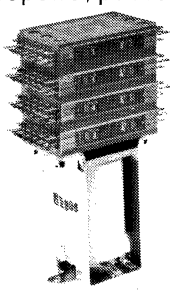
T-bar® THE SOURCE FOR MULTI-CONTACT RELAYS AND SWITCHES

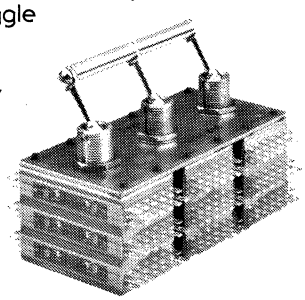
RELAYS

General purpose 800-series, with contact ratings to 5A, and 900-series with low-level to 1A ratings. Both available with 12, 24, 36, 48, and 52 poles in form A (N.O.), form B (N.C.), and form C (D.T.) and 60 poles, form A. Operation from continuous ac or dc power, pulsed power (latching), or solid-state logic. Environmentally sealed and hermetically sealed relays for aerospace, shipboard and ground support hostile environments are available.



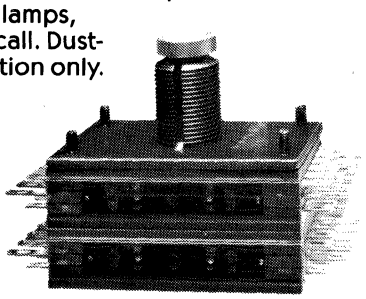
TOGGLE SWITCHES

Same 800-series and 900-series as relays. Available with 12 to 144 poles in form C, maintained action. Typical life in excess of 50,000 operations. Normally dust-tight, T-Bar toggle switches are also available in an environmentally sealed version.



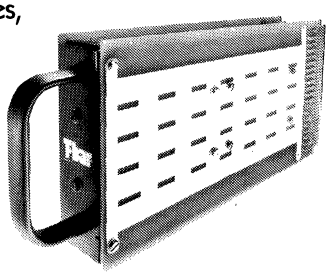
PUSHBUTTON SWITCHES

Momentary pushbutton switches, 800-series only are available with 12 to 36 poles, form C. Typical applications include press-to-test for control panel lamps, reset, and all-call. Dust-tight construction only.



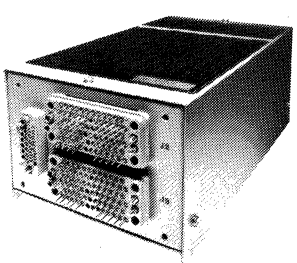
PLUGGABLE MODULES

Pluggable modules use standard T-Bar multi-contact relays in either a one relay configuration or two relays independently controlled with no common failure mode. Plugged into T-Bar printed circuit card cages, any desired switching configuration can be established by backplane wiring.



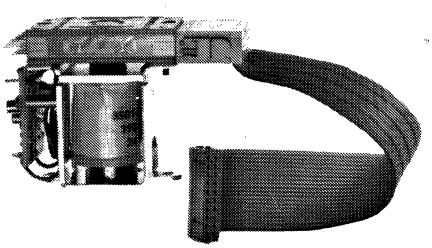
SELECTOR UNITS

Standard T-Bar relays, 800 or 900-series, are packaged as an automatic selector unit to random or sequential circuit selection and addressed through binary weighted coils. Available as Treeselect (all unaddressed lines remain open) or Norselect (all unaddressed lines connected to a bus), selector units can be provided with 16 to 128 positions.



CONNECTORS

T-Bar plug-on connectors are available for all relays and switches. Each connector provides wiring to one-half of a wafer deck (6 poles; A, B, or C). A 36-pole device, for example, requires 6 connectors. Two connector versions are available. One accommodates individual wiring with crimp-on connectors; the other is used to mass-terminate ribbon cable.



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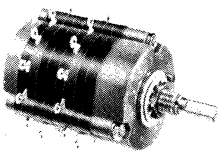
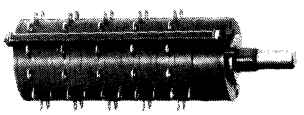
ROTARY SWITCHES



TYPE 2000
- Low Contact Resistance <1 Mili-Ohm
- Insulation Resistance >1 Million Meg-Ohms
- Sizes: 2⅝2″ Dia. x 1⅛″ Depth/Deck
- SP or DP/Deck
- 6 or 12 Pos./Pole MBB
- Indexing: 30° or 60°
- Current Capacity: 5 Amps Continuous



TYPE 3 UL LISTED
- Enclosed Molded Construction
- Size: 1¼″ Dia. x ½″ Depth/Deck
- SP or DP/Deck
- Up to 12 Pos./Pole BBM or MBB
- Indexing: 30°, 60° or 90°
- UL Listed: 3 Amp Resistive 120 VAC
  3 Amp Resistive 28 VDC

TOGGLE SWITCHES



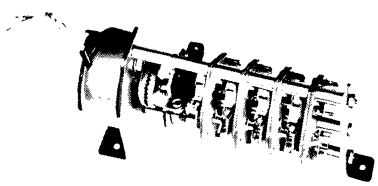
SPST



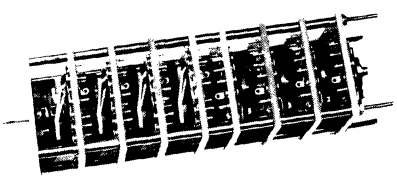
DPDT

- Meet or Exceed MIL-S3950, MS75028 & 029
- Size: ¼″ × ½″ × 5⁄16″ for SPST
- Size: ½″ × ½″ × 5⁄16″ for DPST
- Contact Resistance: 10 Milli-Ohms
- ¼ – 40 Mtg. Bushing, ¼ or ⅜ lg.
- Various Combinations of Bushings, Terminals, Handles and Housings Available.
- Contact Rating: 5 Amps @ 28 VDC
  5 Amps @ 125 VAC Inductive Load

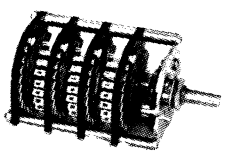
OPEN FRAME ROTARY SWITCHES



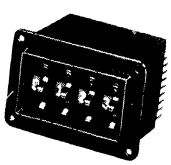
REMOTELY CONTROLLED
- Available as: Stepping Switch
  Motor Driven Solenoid Drives
  Motor and Geneva Drives
  Enercon AC Incremental Motor Drive
- Interrupters or Homing Decks Available.
- May be Remotely Controlled by MasterSlave Arrangement: Computer, External Pulse or Other AC or DC Operation.



SQUARE TYPE
- 13 Styles Available
- Sizes: 1⅝″ x 1⅝″ up to 8″ x 8″ sq; 15 Decks max.
- 1 to 12 Poles/Deck
- Up to 150 Positions/Pole
- Current Capacity 15 Amps Continuous

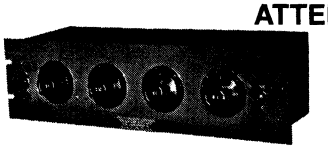


TYPE 2
- Single Hole Bushing Mtg.
- Size: 1¾″ x 2¼″; ¾″ Depth/Deck
- 1 to 4 Poles/Deck
- Up to 24 Positions/Pole MBB
- Up to 12 Positions/Pole BBM
- Indexing: 15°, 30°, 45°, or 60°
- Current Capacity: 5 Amps Continuous



THUMBWHEEL SWITCHES
- Compact Modular Construction
- Size: ½″ Wide Modules
- Positive Detent 10, 11, 12 Positions
- Wide Range of Codes
- Various Terminations
- Kelvin Varly Voltage Divider
- Decade Transfer Drive Between Digits
- Capacitance Decades
- Precision Resistance Decades
- Current Capacity: 1 Amp. Continuous

ATTENUATORS



PRECISION ATTENUATORS

TYPE 11T AND 11H PRECISION ATTENUATORS — DC to 10 MHz*
- Circuit: "T" or Balanced "H"
- Impedance: 50 to 600 ohms, as specified
- Resistor Accuracy: ±0.1% or better
- Accuracy: ±0.1 db to 200 KHz (overall) ±0.6 db to 2 MHz. Lower values of loss, essentially flat to 10 MHz

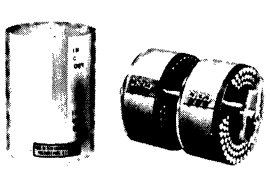
Type No.	Circuit	db Range	db/ Step	Dimensions
11-T	"T"	111	0.1	5¼″x19″5″
11-H	Bal. "H"	111	0.1	5¼″x19″x10″

* On Low Impedance Units, Lower Losses Usable to 100 MHz.

TYPE 850T AND 850H FOR THE AUDIO RANGE
- Circuit: "T" or Balanced "H"
- Impedance: 600/600 ohms unless specified —Other values to order
- Range: 2 dial unit gives 93 db in 0.1 db steps: 3 dial unit gives 111 db in 0.1 db steps
- Terminals: Telephone type jacks for input and output — Solder terminals provided on rear for permanent connections: Insertion of plugs into jacks lifts rear connections
- Accuracy: Resistors adjusted to ±0.1% excepting low values of loss are ±.25%



FIXED ATTENUATORS
- Two basic models
- Standard circuits "T" and Bridged "H" — others available
- Octal plug-in base available
- Up to 80 db loss
- Many impedance available



ROTARY/VARIABLE ATTENTUATORS
- Five basic models — 1⅞″ to 3″ dia.
- All circuit configurations
- Wide range of impedance
- Available with detents, tapers and cueing
- Aluminum anodized can
- Precious metal contacts
- Up to 45 steps
- Audio, video and RF

Tech Labs will undertake special prototype design and manufacturing of your switch and attenuator requirements. We can also customize and supply completely pre-wired units.

Contact our factory for competitive quotations.

Pushbutton Switches

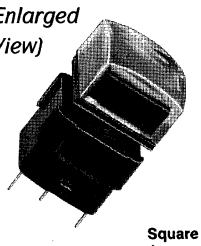
It's the Touch that Counts! Experience the smooth, positive action of VEETRONIX SWITCHES!

Hardly a day passes without someone calling to say, "I like the touch of your switches."

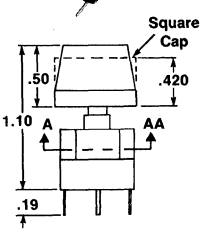
- **KEYBOARD SWITCHES**
- **PANEL SWITCHES**
- **OPTIONAL ILLUMINATION**
- **HERMETICALLY SEALED CONTACTS**
- **CHOICE OF SWITCH FORMS**
- **BI-LEVEL & ALTERNATE ACTION**
- **REGULAR & LOW PROFILE UNITS**

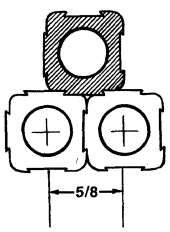
KEYBOARD SWITCHES

Low Profile Keyboard Switch

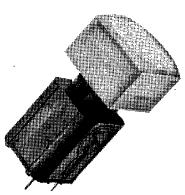


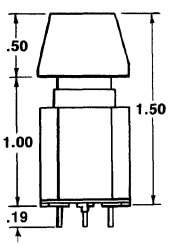
Illuminated or Nonilluminated
Contact Forms: A or AA (see table)
Action: Momentary or Latching
Base Dimensions: 0.600" x 0.600"





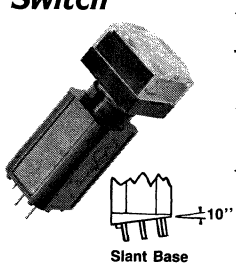
Short Series Keyboard Switch

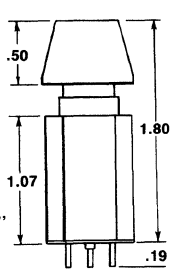




Illuminated or Nonilluminated
Contact Forms: A, AA, B, BB, AB
Action: Momentary
Base Dimensions: 0.600" x 0.700"

Long Series Keyboard Switch

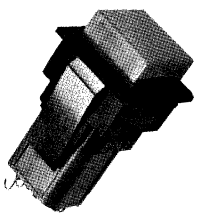


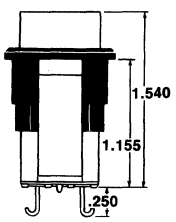


Illuminated or Nonilluminated
Contact Forms: A, AA, B, BB, AB
Action: Momentary, Latching, or Bi-level
Base Dimensions: 0.600" x 0.700"

PANEL SWITCHES

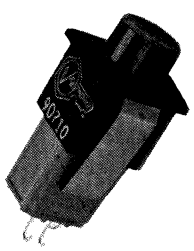
Square Top Panel Switch

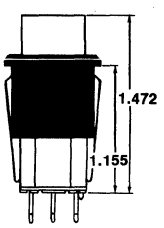




Illuminated or Nonilluminated
Contact Forms: A, AA, B, BB, AB
Action: Momentary*

Square Top, Round Cap Panel Switch

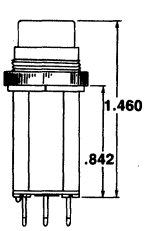




Illuminated or Nonilluminated
Contact Forms: A, AA, B, BB, AB
Action: Momentary*

Nut & Collar Mount Panel Switch



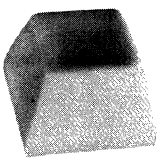


Illuminated or Nonilluminated
Contact Forms: A, AA, B, BB, AB
Action: Momentary*

*Long series panel switches offer choice of momentary, latching, or bi-level action.

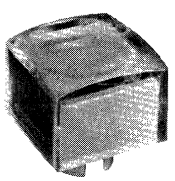
A Touch Above the Rest!
Not loose, not tight....but just right!

CAPS FOR KEYBOARD SWITCHES
Pyramidal Style



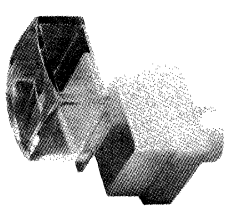
Pyramidal keycaps are provided in a wide variety of colors. They may be engraved, either at the factory or by the user. Caps are available in sizes as follows: 1, 1-1/2, 2, 8, and 9 spaces. Pyramidal caps with slanted tops also available. All caps come with adapters for either illuminated or nonilluminated switches.

Square Style



Square caps supplied in both concave and flat top styles are available in a wide variety of colors. Square caps come in two sizes: 0.600" and 0.720". They come with adapters for either illuminated or nonilluminated switches.

Relegendable Caps



These caps consist of four pieces as follows: cover cap, insert, base, and adapter. They come in a wide variety of colors, and are sufficiently transparent for ease in reading legends. Easily disassembled to alter legend as desired. Relegendable caps are available in single space, and two-space sizes with adapters for either illuminated or nonilluminated switches.

SWITCH CONTACT FORMS

Switch Form	Circuit Diagram	Switching
A		Single Pole Single Throw Normally Open
B		Single Pole Single Throw Normally Closed
AA		Double Pole Single Throw Normally Open
BB		Double Pole Single Throw Normally Closed
AB		Double Pole Single Throw 1 Open/1 Closed (Break Before Make)
LAMP		Voltage And Amperage At Option

ELECTRICAL DATA

Switch Forms

Single or double pole normally closed, normally open, or combination thereof. See table above. Internal diodes are available.

Max. Current (except special order)

Form A or AA: 500 milliamps (resistive)
Others: 250 milliamps (resistive)

Max. Voltage

Form A or AA: 200 VDC (resistive)
Others: 100 VDC (resistive)
Low Profile Switch: 50 VDC

Max. Power Loading

Form A or AA: 10 watts (resistive)
Others: 7 watts (resistive)
Low Profile Switch: 5 watts

Max. Initial Contact Resistance

100 milliohms
Low Profile Switch: 150 milliohms

Max. Contact Bounce (total time to settle)

Form A or AA: 0.5 milliseconds
Others: 0.6 milliseconds

Longest period of open-circuit elapsed time during any one event in a closure sequence:

50 microseconds

Min. Breakdown Voltage

250 VCD
Low Profile Switch: 150 VDC

Min. Insulation

100 megohms

Min. Life (reed)

50 million cycles

Lamp

T-1-3/4 bi-pin; optional voltage 3-28

LED

Bi-Pin LED, without resistor. Resistor available at extra cost.

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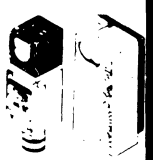
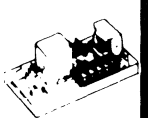
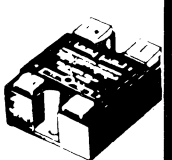
TOGGLE SWITCHES

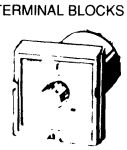

PHOTOELECTRICS

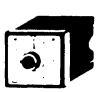

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS


TERMINAL BLOCKS


TEMPERATURE CONTROLS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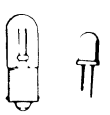
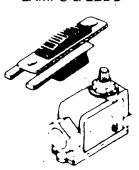

LAMPS & LEDS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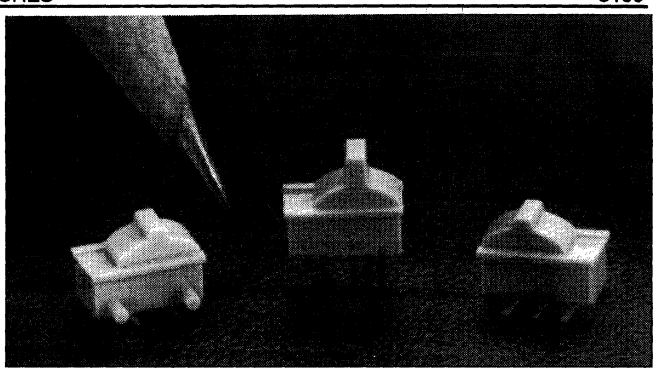
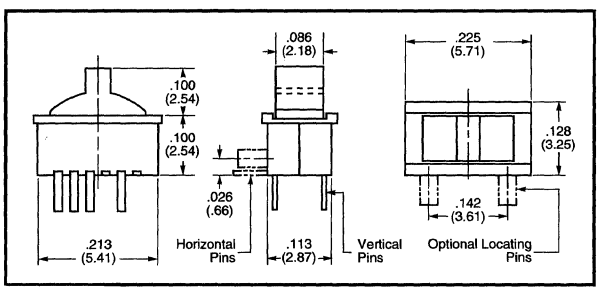
Model 2005 Slide Switch



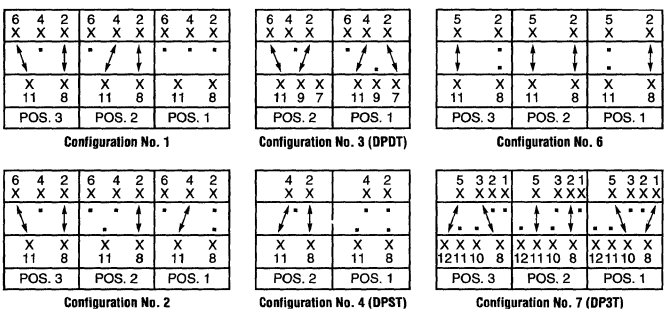
The Model 2005 Slide Switch is designed for ultra-miniature switching applications.

Special Features

- Ultra-miniature size
  - .029 inches^2 surface area
  - .0048 inches^3 volume
- Six electrical configurations
- Choice of terminal orientation
- Make-before-break contacts
- Two driver profiles
- Switch can be color coded for easy identification in manufacture and test



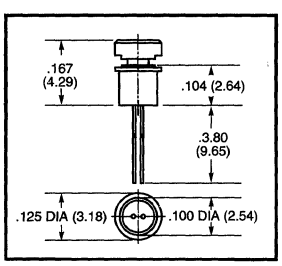
Electrical Configurations

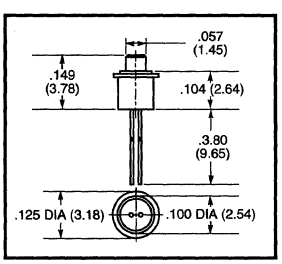


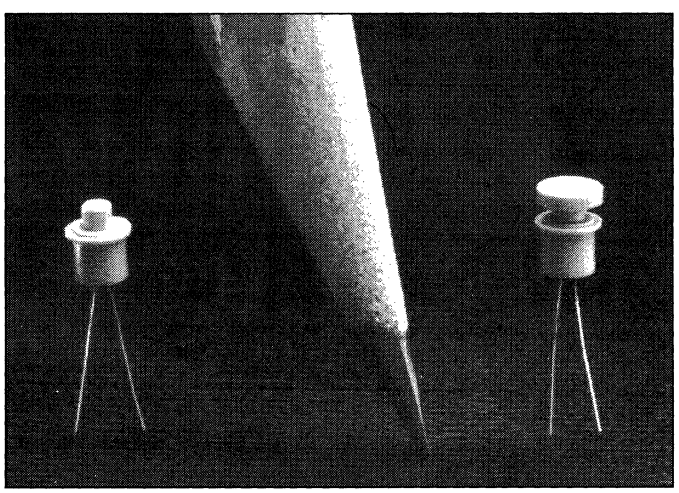
Model PBS Ultra-Miniature Push Button Switch

Special Features

- Ultra-miniature size
  - .0123 inches^2 surface area
  - .0011 inches^3 volume
- SPST normally open switch
- Gold plated contacts
- Two push button options
- Switch can be color coded for easy identification in manufacture and test







The PBS is designed for use where size plus reliability is critical.

The quality program in our Huron, South Dakota factory, where these parts are manufactured, meets or exceeds MIL-Q-9859A. Call or write for our complete catalog.

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eem selection guide keyboards/keypads-5150

KEYBOARDS/KEYPADS

Manufacturer	Starting EEM Page No.	Type						Features								
						Membrane										
		Key Switch	Mechanical (Hard Contact)	Capacitive	Hall Effect	Full Travel	Not Full Travel	Conductive Elastomers	Low Profile	Sealed Keyboard	Back Lighted	Illuminated Switch	Modular	Custom Legends & Symbols	Custom Capabilities	Custom Keypads
Advanced Input	B•1795	√	√	√		√	√	√	√	√	√	√	√	√	√	√
AmKey	B•1796			√					√	√		√		√	√	√
Aztec	B•1799						√	√	√	√	√	√	√	√	√	√
Bergquist	B•1800					√								√	√	
Cherry	B•1802		√			√			√					√	√	
Cortron	B•1803	√							√	√	√	√				
Datalux	B•1804	√							√					√	√	
Digitran	B•1805	√	√	√		√	√	√	√	√	√	√	√	√	√	√
Elma Electronics	B•1806	√	√			√	√		√	√	√	√	√	√		√
Flex-Key	B•1807	√	√			√	√		√	√	√	√		√	√	√
Fujitsu Components	B•1808								√						√	√
George Risk Ind.	B•1809	√	√						√		√	√		√	√	√
Glowlite Corp.	B•1811							√	√	√	√	√		√	√	√
Grayhill	B•1812		√						√	√			√	√	√	√
IEE (Industrial Electronic Engineers)	B•1814	√	√				√	√	√	√	√	√	√	√	√	√
Intaq Electrotouch	B•1815					√	√	√	√	√	√	√		√	√	√
Interswitch	B•1817		√							√						
Jayco	B•1818						√	√	√	√	√			√	√	
Low Key Corp.	B•1820	√					√		√	√	√	√		√	√	
Lucas Duralith	B•1822	√				√	√	√	√	√	√	√	√	√	√	√
LZR	B•1823	√							√				√	√	√	
Memtron Technologies	B•1824						√			√	√	√		√	√	√
NEK (New England Keyboard)	B•1825	√				√	√	√	√	√	√	√	√	√	√	√
Orbit Instrument	B•1826	√	√					√	√	√	√	√		√	√	
Preh Electronic	B•1827					√			√	√				√	√	√

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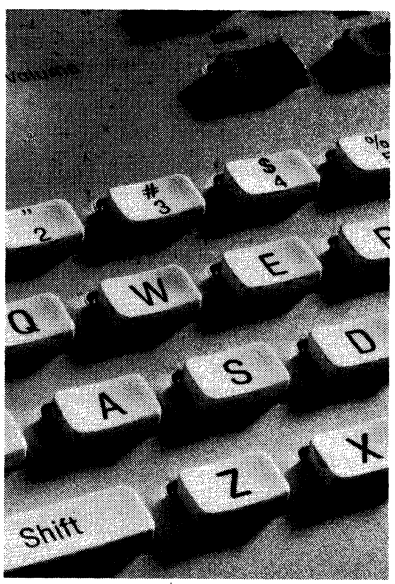
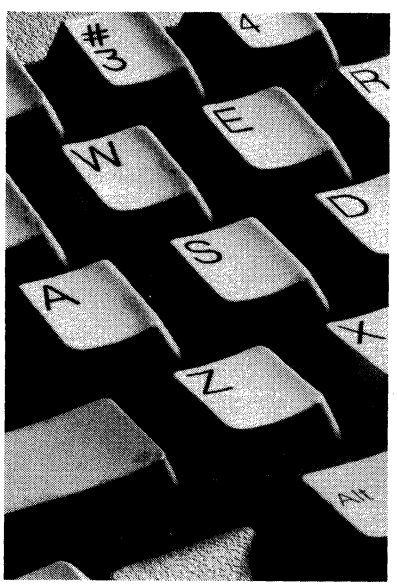
FLAT PANEL



SHORT TRAVEL



FULL TRAVEL

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Whatever key travel you require, Advanced Input Devices has the technology, experience, tools and support you need to make your next custom keyboard project a success. In fact, more than 700 electronics manufacturers – including Hewlett-Packard, IBM, Medtronic, NCR, and Tektronix – have found the keyboard supplier they depend on in Advanced Input Devices. Starting a project? Call for a free Designer's Guide. In a hurry? FAX us your sketch and our applications engineers will get right back to you.



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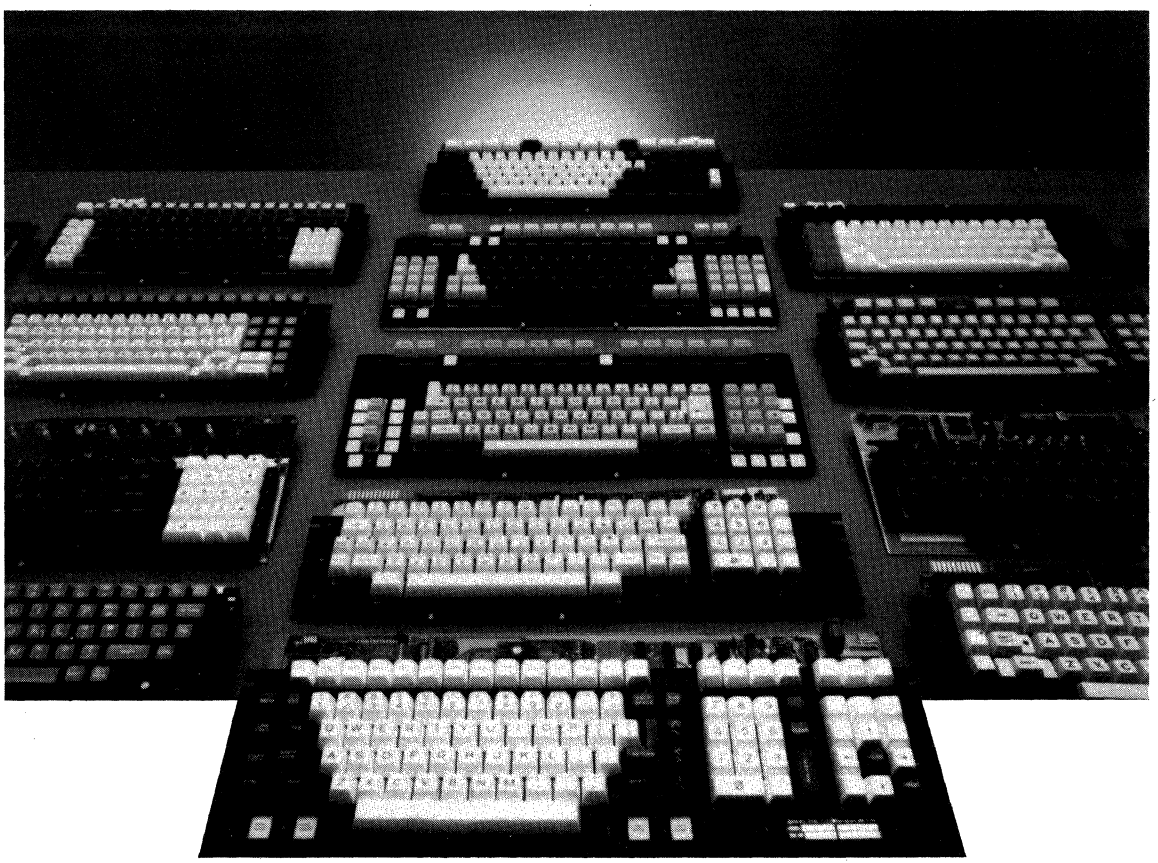

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- Full travel DIN standard/sculptured/stepped/sloped keyboards
- Hardware options—clickers, beepers, LEDs, displays, lighted targets, trackballs, mice, joysticks, etc.
- Prompt delivery

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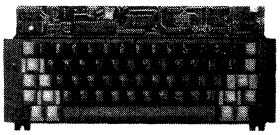
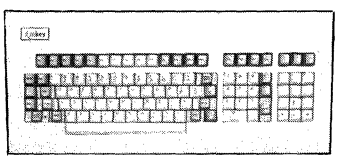
Solid State Keyboards

DIN-64



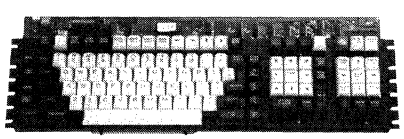
STANDARD FEATURES
- 19mm solid state switches to meet 30mm ergonomic requirements (DIN standard) with .150" total key travel
- Solid state capacitance technology
- MCS-48 series microcomputer controlled (8048,8035, etc.)
- Cursor control keys
- Amkey's patented phase-detector
- +5 volt operation
- Asynchronous serial TTL ASCII output
- Automatic-repeat enable/disable
- Power-up reset
- 4 Modes
- Two shot molded keytops with sculptured typing area and matte surface

DIN 124



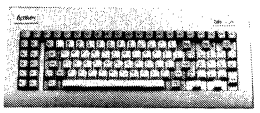
STANDARD FEATURES
- 19mm solid state switches to meet 30mm ergonomic requirements (DIN standard) with .150" total key travel
- Solid state capacitance technology
- Microcomputer controlled
- 20 function keys across top row for improved software capability
- Amkey's patented phase-detector
- Asynchronous serial ASCII output and input
- RS-232 9600 baud
- Automatic-repeat enable/disable
- 4-led display
- Power-up reset
- 4 Modes
- 3 user location homing bump keys
- Two shot molded keytops with sculptured typing area and matte surface

MPNK 114



STANDARD FEATURES
- Microprocessor controlled
- Single +5 VDC supply
- Eprom programmable
- Solid state circuitry
- N-key rollover
- Automatic repeat enable switch
- Two-shot molded key tops
- High reliability
- Rigid chassis mounting
- Low profile
- Rugged construction
- Low power requirement
- Sculptured typing area
- Shift lock and caps lock w/LED target in key
- Serial transmission at multiple baud rates

DIN 106-1



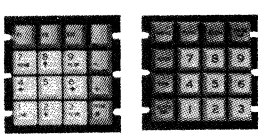
STANDARD FEATURES
- 19mm solid state switches to meet 30mm ergonomic requirements (DIN standard) with .150" total key travel
- Solid state capacitance technology
- MCS-48 series microcomputer controlled (8048,8035, etc.)
- Full 21 function keys across top row for improved software capability
- Amkey's patented phase-detector
- +5 volt operation (12V option on longer cable)
- Asynchronous serial RS-422 ASCII output with jumper selectable 300, 2400, 4800, 9600 baud
- Automatic-repeat enable/disable
- Power-up reset and externally resettable
- Selectable serial logic
- 5 Modes
- 3 user location homing bump keys
- Two shot molded keytops with sculptured typing area and matte surface

MPNK 101



STANDARD FEATURES
- Microprocessor controlled
- Single +5 VDC supply
- Eprom programmable
- Solid state circuitry
- N-key rollover
- 5 modes
- Automatic repeat enable switch
- High reliability
- Sculptured typing area
- Two-shot molded key tops
- Rigid chassis mounting
- Low profile
- Rugged construction
- Low power requirement
- Lock key with LED target
- Serial or parallel output
- Multiple baud rates

SNK 16



STANDARD FEATURES
- Serial RS 232C interface
- Prom Programmable
- Solid state circuitry
- N-key rollover
- Two-shot molded key tops
- High reliability
- Rigid chassis mounting
- Rugged construction
- Low power requirement

Hearst Engineering Software



ICMASD...IC Alternate Source Directory

The all new 1991 version of the world famous Alternate Source Directory is now available in floppy disk form for your IBM XT & AT and 100% compatible personal computer with hard drive.

The **1991 ICMASD** contains the more than 180,000 listings that appear in the Alternate Source Directory Section contained in Volume Two of the printed version of the 1991 IC Master ...plus additional discontinued parts. The database includes complete vendor addresses and phone numbers.

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For greater flexibility the base number search feature enables you to access parts by base number, i.e., the device number stripped of prefixes and suffixes. You don't need to know the manufactures codes to call up any of the alternates to these devices.

The **1991 ICMASD** is fast, convenient and very user friendly!

Complete program documentation is included. When ordering, be sure to specify if you want the **1991 ICMASD** on three, double-sided, double-density disks OR on one high-density disk.

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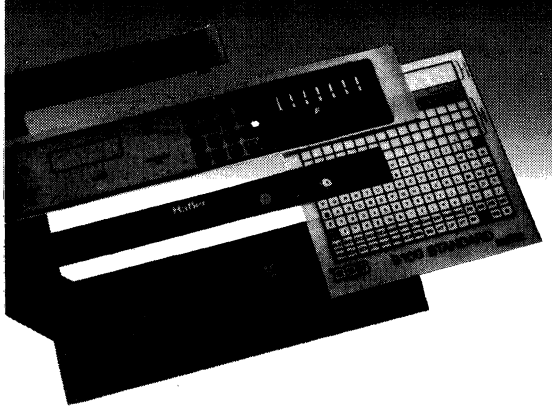
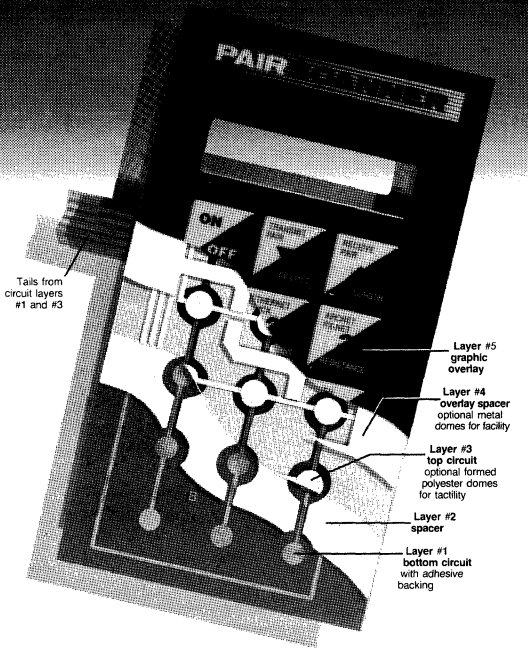
Touch the Future℠

WITH A LEADER IN MEMBRANE SWITCH TECHNOLOGY





OEMs Take Note. Increased efficiency and reduced cost is a performance fact when membrane switches, decorative overlays and flex circuits are put to work.

Reliably Simple Membrane Switches

Membrane Switches meet tight schedules by shortening development times. One piece construction controls costs. The Lexan™ finish offers many texture options. Colors appear more saturated and vibrant. Sealed surfaces prevent blunders from botching systems. Second-surface printing stands up to scratches and wear.

Decorative Overlays a Marketable Presence

Decorative Overlays ensure enduring quality. Richness and luster remain intact under heavy use. Affix to practically any surface: glass, metal, plastic, wood, etc. Updates achieved without system redesign.

Flex Circuits Reduce Space Problems

Flex Circuits fold or flex to a product's available space. Reduced tooling accelerates production and puts a halt to cost overruns. Virtually no moving parts to wear out. Smooth, flat surfaces clean easily. Works in tangent with Membrane Switches or stands alone.

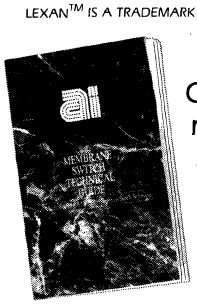
LEXAN™ IS A TRADEMARK OF GENERAL ELECTRIC CORPORATION

Specifications

Operating power	1 watt
Contact resistance	2-10 ohms
Contact bounce	5 milliseconds
Circuit resistance	5-100 ohms
Actuation force (normal range)	
Membrane	2-16 oz. ± 25%
Polyester dome	6-16 oz. ± 25%
Metal dome	5-10 oz. ± 25%
Life expectancy (cycles)	
Membrane	10 million
Polyester dome	1 million
Metal dome	1 million
Travel	
Membrane	.002"—.010"
Polyester dome	.020"—.040"
Metal dome	.010"—.020"
Operating temperature	—20°C to 65°C
Storage temperature	—40°C to 65°C

A Quarter Century of Experience

A long standing presence in the industry is required to meld the disciplines of electronics, mechanics and production. The results: devices that are economically attractive, aesthetically pleasing and function faultlessly.



Contact us today and receive this 10 page Membrane Switch Technical Guide filled with all the information needed to design your project.

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BERGQUIST MEMBRANE SWITCHES

Graphic layer
7 mil - std. for polyester
7, 10 mil - std. for polycarbonate

Graphic adhesive
5 mil standard

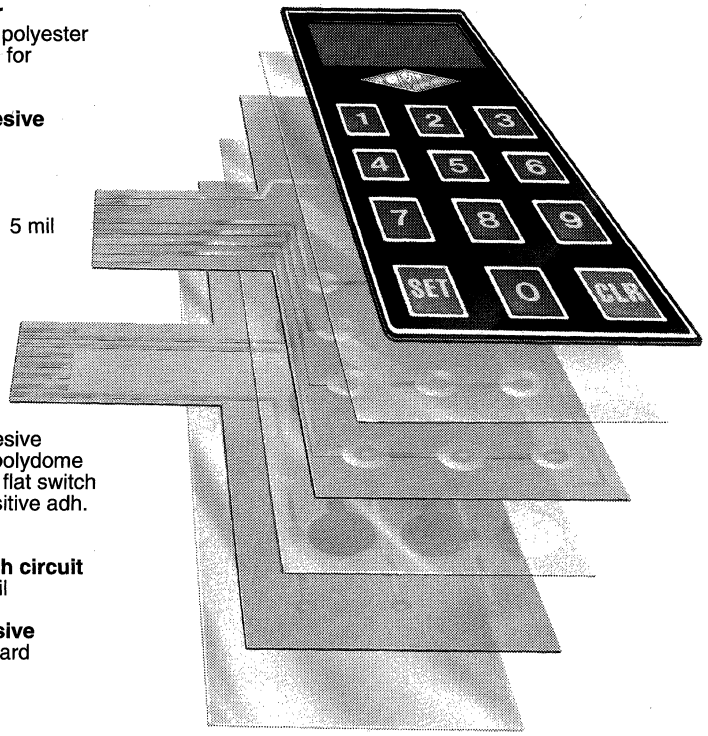
Top switch circuit layer 5 mil



Spacer layer
Heatseal adhesive
5 mil - for polydome
10 mil - for flat switch
Pressure sensitive adh.
8 mil - std.

Bottom switch circuit Layer 5 mil

Backer adhesive
5 mil standard



HeatSeal®

The Bergquist Heatseal Switch

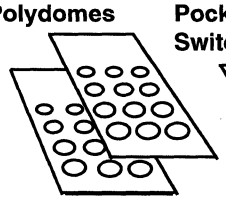
- Dry film adhesive bonded with pressure
- Completely sealed against moisture and contaminants
- Operate underwater and in high and low temperature extremes
- Superior to pressure sensitive adhesive construction
- Resists cleaning agents and solvents

THE SMART SWITCH

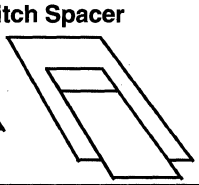
- PCB with a membrane switch on one side and components mounted on the back.
- Eliminates secondary PC board, connection components and vendors.
- Saves space and reduces costs

Optional Features
Dome Cage
Used with flat or rim embossed graphic

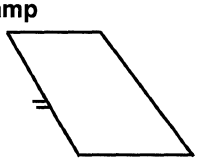
Polydomes



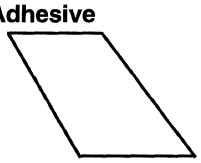
Pocket Switch Spacer



Electroluminescent Lamp



Shield With Adhesive



MATERIAL

Polyester (standard thickness .007 in.) The preferred choice for long life and chemical resistance. Polyester is available in a variety of hardcoat textures and finishes.

Polycarbonate (standard thickness .007 and .010 inches) available with mechanical velvet texture.

HARDCOATS

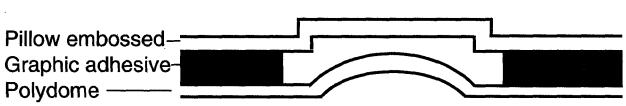
Gloss, semi-gloss and matte finishes are available on polyester and polycarbonate to help reduce scratching and increase chemical resistance. Some of the finishes can be selectively applied to create display windows and decorative finishes.

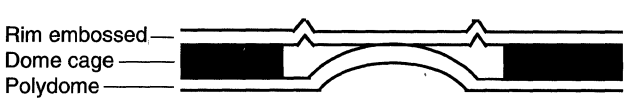
COLORS

Colors for your membrane switch are selected from the Standard Pantone Matching System or we will match your custom color chip. Transparent and translucent colors are available for backlighting and window areas. Deadfront is also available in certain applications where legends or LED windows remain hidden until a light shines from behind it.

EMBOSSING

Standard graphic embossing styles are pillow embossing, generally used over polydomes and rim embossing for locating pads by feel.





SWITCH TYPE

The most economical switch type is the screened silver circuit, for switching loads under 1 watt. A printed circuit board construction with copper circuitry can be used when switching loads are 1 watt or more and when temperatures are too high for polydomes or if other components such as LED's and displays are included in the assembly.

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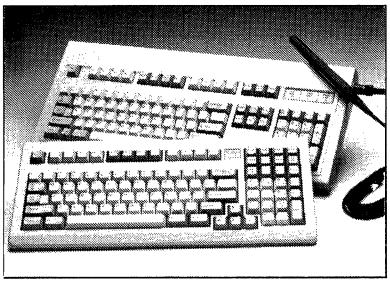
G80-1600 & G80-1800



G80-1600

IBM Compatible Keyboard with Built-In Bar Code Reader. For PC, XT, AT, and PS/2 Systems.

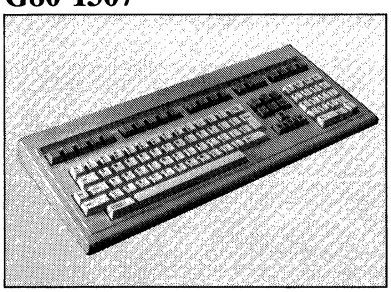
- Input port for bar code stylus, laser scanning gun, or slot reader.
- Bar codes are automatically identified and differentiated (all resolutions).
- 103 keys (2 keys for programming mode) conforming to ASCII international key layout per DIN 66003/66303.
- Superior Cherry MX keyswitches with "Gold Crosspoint" contacts help eliminate input errors.

G80-1800

Compact, 101 Key, IBM Compatible Keyboard with Separate Numeric Keypad. For PC, XT, AT and PS/2 Systems.

- Fits into 19 inch rack (less than 16 inches wide).
- 101 keys for PC*, XT*, AT*, and PS/2* systems as well as IBM* terminals.
- Switch selection of PC*, XT*, AT*, and PS/2* modes. LED's indicate the mode selected.
- Superior Cherry MX keyswitches with "Gold Crosspoint" contacts help eliminate input errors.

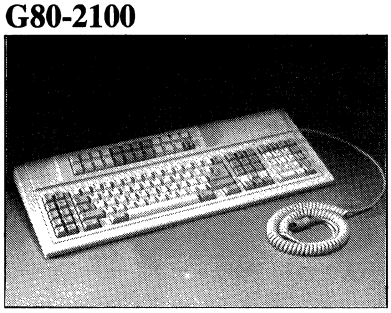
G80-1307



DEC VT-220 Layout with IBM* Compatibility

- 105 keys using superior Cherry MX keyswitches with "Gold Crosspoint" contacts to eliminate input errors.
- High reliability:
  MCBF = 1 x 10^9 operations.
  MTBF = 80,000 hours.
  MCBF (each keymodule) > 50 x 10^6 operations.
- Ergonomic, low profile design with "cylindrical style" key layout for easy operation.
- Full-travel (4mm) key switches.
- Includes housing and cable.
- Rugged construction.
- "Deep Dish" for home keys F and J with dimple on key 5 for touch typing.
- Matte finished, 2-shot molded keycaps are wear resistant and easy to clean. Keycaps colors are: beige/grey (code U9), white/grey (code L9).
- Materials conform to UL 94.
- Separate cursor pad.
- Full N-key rollover.
- Autorepeat; delay time and rate are programmable from the system.

G80-2100



IBM Compatible Keyboard with 23 Programmable Function Keys. For PC, XT, AT, and PS/2 Systems.

- 123 keys — 23 function keys can be programmed with up to a total of 2K characters and "locked" with switch located on underside of keyboard.
- Programmable function keys can be labeled with appropriate legends.
- Non-volatile memory retains function programming.
- Synchronous data format.
- Full travel (4mm) Cherry MX keymodules with "Gold Crosspoint" contacts help eliminate input errors.
- System download capability.
- High reliability:
  MCBF = 1 x 10^9 operations
  MTBF = 80,000 hours.
  MCBF (each keyswitch) > 50 x 10^6 operations.
- Rugged construction.
- Ergonomic, low profile design with "cylindrical style" key layout for easy operation.
- "Deep Dish" for home keys F and J with dimple on key 5 for touch typing.
- Matte finished, 2-shot molded keycaps are wear resistant and easy to clean. Keycap colors are: beige/grey (code U9), white/grey (code L9).
- Materials conform to UL 94.
- Full N-key rollover.

G81-3000

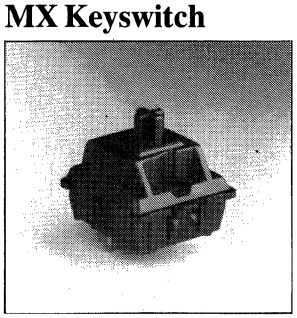


FTSC Full Travel Membrane Switch Technology with Ergonomic Housing.

- 101 keys for PC*, XT*, AT*, and PS/2* systems as well as IBM* terminals.
- Switch selection of PC*, XT*, AT*, and PS/2* modes LED's indicate the mode selected.
- High reliability:
  MCBF = 1 x 10^9 operations.
  MTBF = 80,000 hours.
  MCBF (each keymodule) > 50 x 10^6 operations.
- Ergonomic, low profile design. Height of third keyrow is 1.18" (30mm) (flat keyboard position). Angle of inclination is 6.2°.
- Includes housing and cable.
- Rugged construction.
- Full-travel (4mm) key switches.
- Matte finished, 2-shot molded keycaps are wear resistant and easy to clean. Keycap colors are: beige/grey (code U9), white/grey (code L9).
- Materials conform to UL 94.
- IBM* overlays fit housing.

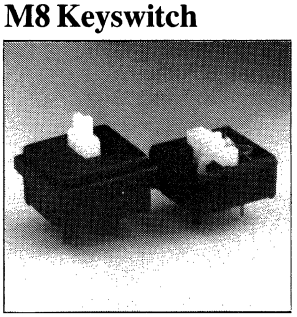
*IBM, PC, XT, AT and PS/2 are trademarks of International Business Machines Corporation.

MX Keyswitch



- "Gold Crosspoint" contacts ensure the highest standards of reliability — even during high speed or repeated actuation.
- Full travel (4mm) operation yet fits into modern low profile keyboard designs.
- Meets all current ergonomic standards for word processing and data entry applications.
- Range of actuation choices.
  Momentary. Linear feel.
  Alternate. Tactile feel.
- Keyswitches can be snapped into a frame or mounted directly onto the printed circuit board.
- Low contact resistance.

M8 Keyswitch



- "Gold Crosspoint" contacts ensure the highest standards of reliability — even during high speed or repeated actuation.
- Extremely low profile with 2.5mm travel.
- Choice of linear and tactile feel.
- Single pole or double pole switching.
- Low cost keyboard assembly — keyswitches mount directly to circuit board.
- Low contact resistance with choice of contact materials to suit electrical requirements.
- Two standard keycap heights—6mm and 12mm. Special keycaps are also available.
- Angled stems available for "stepped" keyboard design.
- Optional LED indicator.

CIRCUIT

Various circuit types are available depending on the design. Matrix and short to ground are the most common. Please contact us early in the design so we can work with you to ensure the design meets manufacturing capabilities.

SHIELDS

For ESD protection a screened silver grid is applied to the top side of the silver circuit. Aluminum and gold vapor deposition can also be used for ESD, EMI and RFI protection.

SPACERS

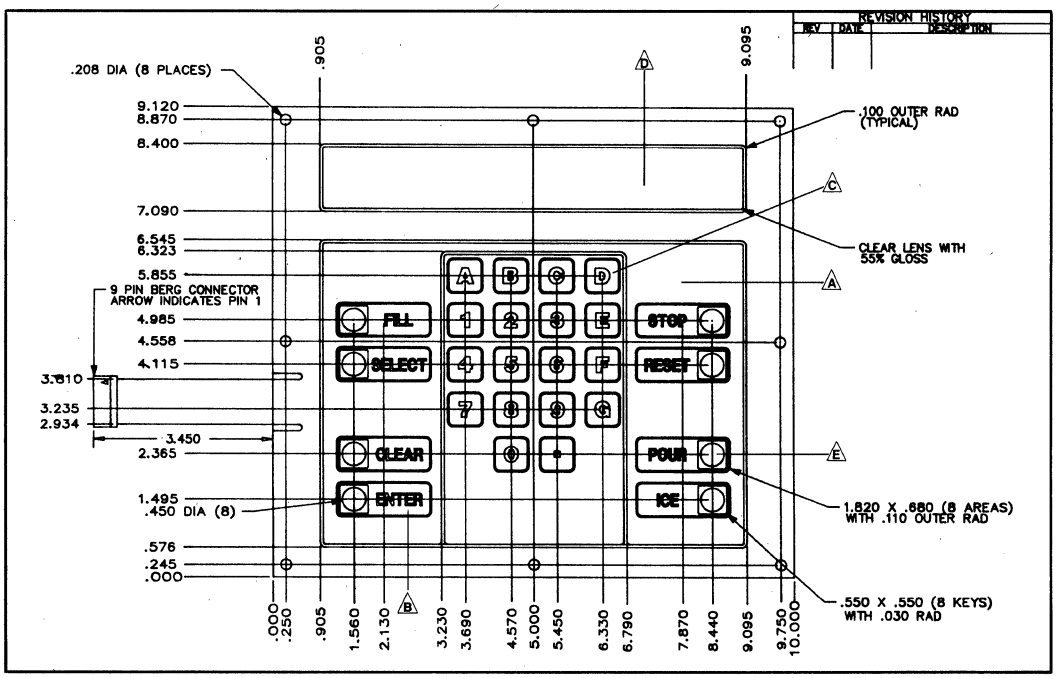
When the environment is not a problem pressure sensitive adhesives are commonly used. Bergquist HEATSEAL is recommended when moisture, spills, vapor and other extreme conditions are expected.

CONNECTOR

Many types and styles of connectors can be designed into your membrane switch. Screened silver switches are available with female and male connectors and with solder pins. PC board connectors are available with a wide variety of connectors including single and double row headers, shrouded headers and flat cable connectors.

TACTILE FEEL

Polydomes are available on silver circuits and as shunts on the PC board. They provide tactile feel and long life. On nickel plated copper or PC boards stainless steel snap domes are used where tactile feel is needed and when temperatures are higher than 150°F.



Membrane Switch Specification Examples:

Graphic Specifications:

Material		.007 Polyester with selective hardcoat matte texture
Colors	A	Process Black (background and all legends in gray switches)
	B	PMS 430 gray (rectangular keypads, logo, all borders and legends in blue keys)
	C	PMS 300 Blue (square keypads)
Lenses	D	Rectangular window 55% gloss
	E	Round LED windows the same matte texture as the rest of the graphic
Type		All type to be 16 point upper and lower case
Embossing:		Each keypad to be perimeter embossed .030 wide and .010 high (nominal)
Inspection:		Per Bergquist inspection procedure

Electrical Specifications:

5 Volts	10 MA
Bounce	<25 ms
Loop Resistance	<100 Ohms
Life	1 million cycles
Circuit	4 X 5 xy matrix
Shield	Screen Silver Grid on top side of circuit layer
Pin out	Vendor to determine

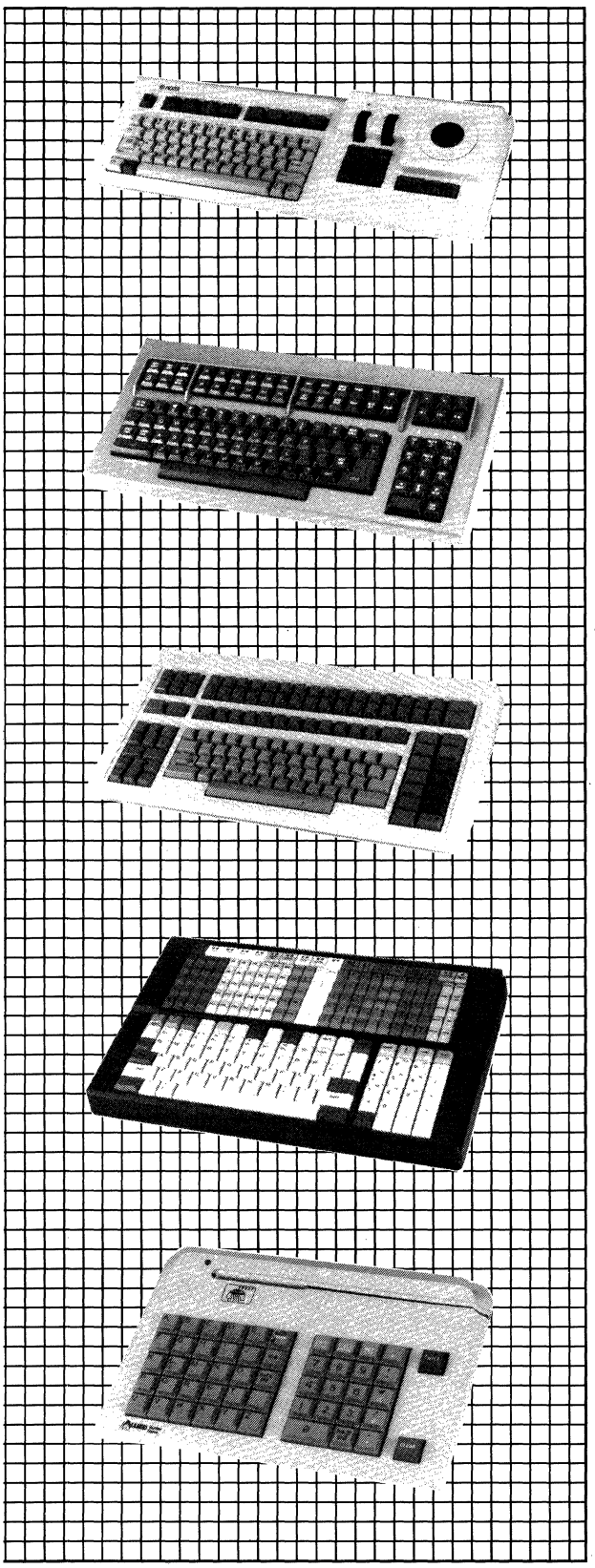
Physical Specifications:

Actuation Force	12 oz ± 4 oz
Operation Temp.	-20° C to +60° C
Storage Temp.	-20° C to +60° C
Tolerance	± .015
Connector	9 pin tin Berg or 0equivalent

BERGQUIST 5300 Edina Industrial Blvd., Minneapolis, MN 55439 • Tel: (612) 835-2322 • Fax: (612) 835-4156

Cortron

Custom Keyboards



- Trackball
- Z Axis Ring
- Level Controls
- Custom Foam Molded Enclosure

- Backlighted Legends
- MIL Spec
- Special Tone Generation
- Custom Metal Enclosure

- Drip Proof
- Quad Mode for Use on Multi-Computer Systems
- DIN Low Profile
- Safe in Explosive Environments

- NEMA 4, 12, 13 Enclosure
- Solid State Keys
- Tactile/Mechanical Function Keys
- TEMPEST

- U.L. Certified
- FCC Certified
- Complete with Card Reader
- Custom Configuration

Cortron, Inc. 1 Aegean Dr., Methuen, MA 01844 • Tel. (508) 975-5445 • Fax: (508) 975-0357

DATALUX

As of June 15th 1990, MEI Mechanical Enterprises Incorporated became **DATALUX Corporation** and moved to a new manufacturing plant in Winchester, Virginia

Our new address is:

DATALUX Corporation
2836 Cessna Drive
Winchester, VA 22601

Phone
(703) 662-1500
FAX
(703) 662-1682

Space Saver Keyboard

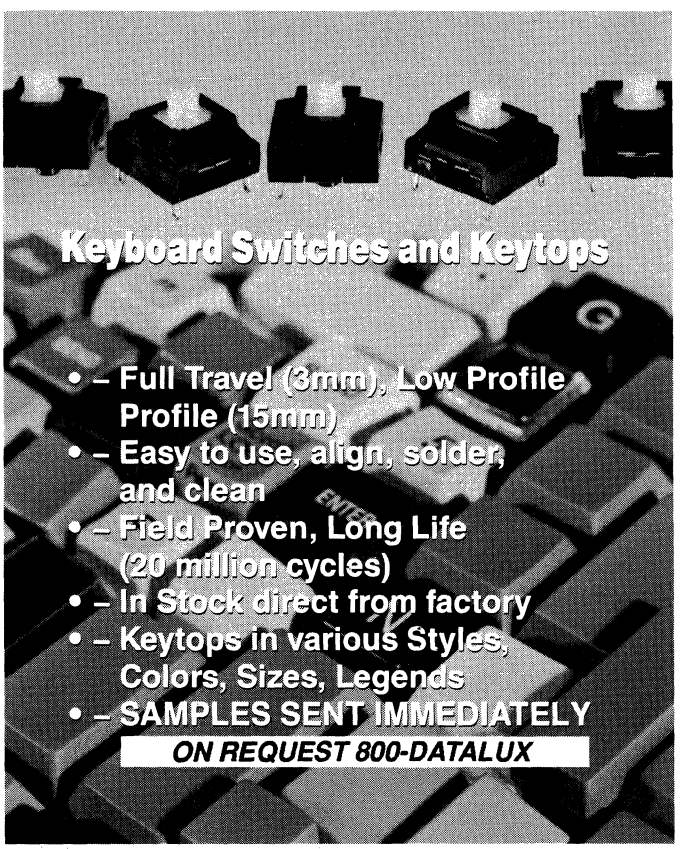
for Desk or Imbedded PC Control



Flat Model for Rack or Panel Mount 10.75 X 6.5 X 0.75 in. with RJ modular connector.

Stand Alone Model in Case 10.75 X 6.0 X 2.6 in. with circular DIN connector

- – IBM XT/AT Compatible
- – 100 Key Full Featured AT Enhanced Equivalent
- – Full Travel, Long Life Switches
- – Special Legends, Key Colors, Coding available
- – Low Cost from volume production in USA

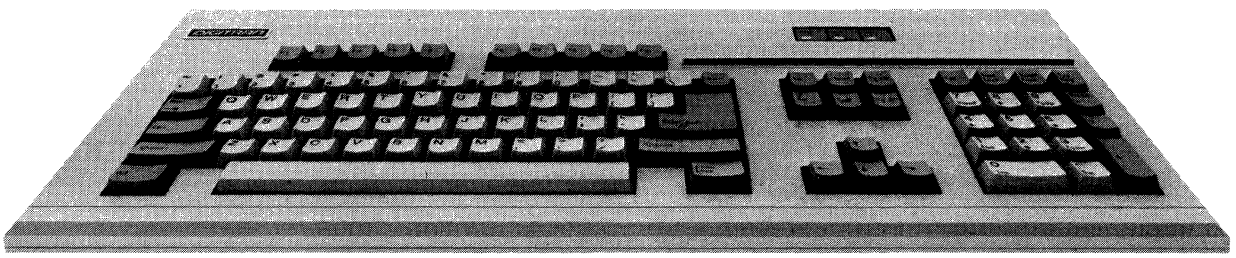


DATALUX

DATALUX Corporation
2836 Cessna Drive
Winchester, VA 22601

Phone 703 662-1500
Fax 703 662-1682

CUSTOM KEYBOARDS FOR UNIQUE OR DEMANDING APPLICATIONS



For the past 15 years, Digitran has successfully offered custom keyboards for the most demanding applications. Our keyboard customers buy from us because our keyboards are reliable, rugged and can with stand the solvents, solutions, liquids, dust and temperature ranges to which their equipment is exposed. Every keyboard we manufacture is designed to meet our customer's unique key layout, dimensions, environment, specifications, options and enhancements.

Experienced, innovative design along with automated, vertically integrated manufacturing enables Digitran to offer unmatched flexibility and freedom in keyboard layout and features. Application by application, Digitran's custom keyboards have built a proven record of field tested reliability. We specialize in rigorous applications such as:

- Point of Sale Terminals
- Industrial Controllers
- Medical Instrumentation
- Telecommunications Systems
- Military Systems
- Intelligent Terminals
- Graphics CAD/CAM Terminals
- Test Instrumentation

Our microprocessor based, intelligent keyboard and application specific firmware allows us to integrate a multitude of Electrical Interface Protocols and Data Input Peripherals, including:

INPUT PERIPHERALS:

- Mouse, Trackball, Lightpen or Isopoint
- Bar Code and Magnetic Stripe Readers
- LCD Displays
- Infra-Red Remote Control
- Touch Sensitive Input Pads

INTERFACE PROTOCOLS:

- PS-2, PC-AT & PC-XT
- ASCII & TTL
- RS-232 Asynchronous
- RS-422 Synchronous
- RS-423 & Parallel
- Variable BAUD Rates
- Multiple Level Key Encoding

RELIABLE, EXTENDED LIFE: Our full-travel keyboards use our patented capacitance keyswitches which have a rated life of 100 million cycles. We use double-shot legended keycaps and rigid FR4 printed circuit boards to provide the component reliability required to remain compatible with our 100 million lifecycle capacitance switches.

ENVIRONMENTALLY QUALIFIED: We provide keyboards for the widest of temperature ranges. All of our full travel, capacitance keyboards include our PF-SHIELD: a thermoplastic film that provides environmental protection against dust, liquid spills, water spray, industrial solvents and most laboratory solutions. To maintain the professional image of your equipment, PF-SHIELD is "hidden" underneath your enclosure or front panel, eliminating unsightly plastic, rubber or membrane keyboard overlays.

CUSTOM LAYOUTS: We offer custom layouts from 2 to 400 key positions. Our keyboards can be open frame to mount directly in the host system, or we can provide metal and plastic enclosures for standalone keyboards. In addition, any combination of standard or custom legends, keycap colors and clear plastic, relegendable keycaps may be selected to meet the specific application.

SUBSYSTEM ENGINEERING & MANUFACTURING

In addition to keyboards, XCEL Corporation offers the design, manufacturing and integration of electronic data input and display devices into complete subsystems. We design and manufacture data input devices using our patented capacitance switch technology, as well as membrane, conductive rubber, and snap dome switch technologies. We design and manufacture our own CRT monitors, and have considerable expertise integrating flat panel displays including LCD, plasma, electroluminescent (EL) and vacuum fluorescent. We can design and integrate specialty lighting including LED, EL, ANVIS Night Vision, fiber optic and Infra-Red.

XCEL Corporation combines 35 years experience designing and developing data input and display devices with our extensive, vertically integrated manufacturing capability to offer a complete solution: From concept through design to zero-defect manufacturing. Our goal is to become an extension of your engineering and manufacturing team by reducing your data input and display design and manufacturing costs, your vendor coordination, and your capital equipment investment. XCEL Corporation specializes in:

- Custom Control Panels, Front Panels & Display Panels
- Custom Keyboards & Keypads
- Very Broad Range of Digital Switches Including Thumbwheel, Lever, Push-button & Push Wheel
- High Resolution Color and Monochrome CRT Monitors and Power Supplies
- Custom Applications of Flat Panel Displays Including LCD, Electroluminescent, Plasma and Vacuum Fluorescent
- Specialty Lighting Including LED, EL, Fiber Optic, ANVIS Night Vision, Infra-Red

For conceptual design assistance, technical and budgetary proposals, or ordering information, contact our Marketing Director.

Let Digitran integrate your keyboard/keypad into your subassembly. Contact Digitran's Subsystems Engineering and Manufacturing Services Center at (714) 391-4321. Also see our monitors (2450) and switches (5100).

PS-2, PC-AT & PC-XT are registered trademarks of the International Business Machines Corporation.

DIGITRAN®
A DIVISION OF XCEL CORPORATION
4290 East Brickell St. Ontario, CA 91761
(714) 391-4321 • FAX: (714) 391-4558

ELMA

ELMA Electronic Inc.

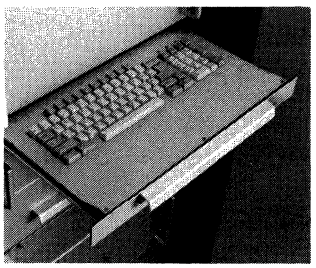
FULL LINE OF 19″ RACKMOUNT KEYBOARDS AND ACCESSORIES

A Member Of The Sulzer Group, 41440 Christy Street, Fremont, CA 94538 • (415) 656-3400

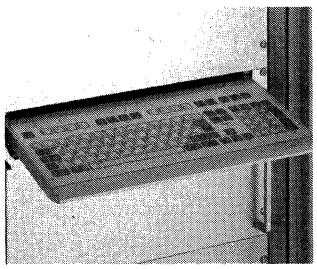
All ELMA products are available off-the-shelf and REASONABLY PRICED

19″ Rackmount Keyboards, Drawers, Panels and Modules

Elma, the leader in PC computer products, now introduces the largest family of 19" rackmount keyboards, keyboard drawers, panels and modules compatible with IBM, XT, AT and PS2 (MCA).
There are two keyboards; one, a full travel and the other, a completely sealed membrane. These keyboards are designed with ruggedness in mind. The keyboards have a rugged aluminum case and conform to DIN 41494 and protection per IP-65. Suitable for harsh industrial environments. Some of the main features of the keyboards are:



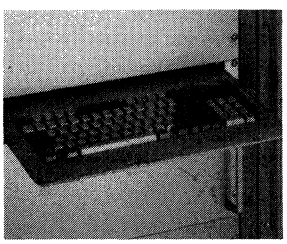
70-030-10



70-080-10

- **19″ rackmount**
- **IBM PC, XT/AT, PS2 compatible**
- **Dust proof protection per IP-65 (membrane)**
- **Switch selectable AT, PC/XT**
- **101 keys**
- **LED's for status display**
- **Only IU (1.75″) vertical space required**
- **US and International versions (6 countries) For list of countries contact factory.**
- **Contact making by Gold/Gold contact (membrane)**
- **12 function keys**
- **Automatic repeat**
- **Optional slides**
- **Powder coated, light grey finish**

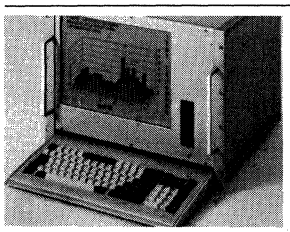
FULL TRAVEL



19″ Keyboard module 1U

FEATURES
- This general-purpose 19″ keyboard module to DIN 41494.
- Easy to mount in a cabinet.
- 4 screws for fixing the frontplate.
- Takes up only 1U of space and is 300mm deep.
- Two supports provided for firmer mounting of the 19″ module.
- The keyboard is locked and slightly angled in the working position.
- A spring lock ensures easy opening and closing of the hinged frontplate.

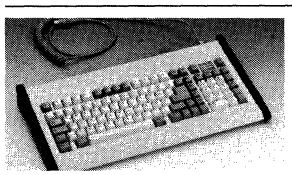
Ordering Information
70-060-10 . . . . . .19″ keyboard module



84HP keyboard module 1U

FEATURES
- Can be mounted in an enclosure.
- Easy to mount.
- Module takes up only 1U of space and is 292mm deep.
- The keyboard is locked and slightly angled in the working position.
- A spring lock ensures easy opening and closing of the hinged frontplate.

Ordering Information
70-040-10 . . . . . .HP keyboard module 1U

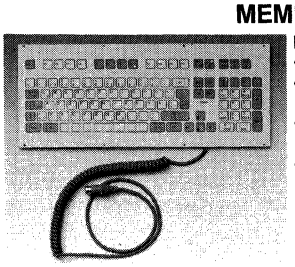


Compact keyboard in metal case

FEATURES
- PUR integral foam-protected side pieces prevent damage.

Ordering Information
70-070-10 . . . . . .compact keyboard in metal case
. . . . . (8.97"D x 17.08"W x 2.20"H)

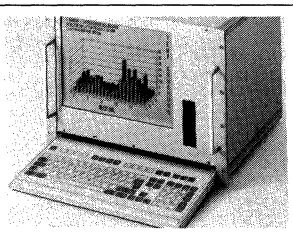
MEMBRANE



19" Keyboard panel 4U/84 HP

FEATURES
- Protection to IP65.
- Jumper for changeover from AT to XT mode.
- Positive tactile switching via metal snap discs.
- Contact-making ensured by gold/gold contacts.
- Service life: 1 million activations per key.

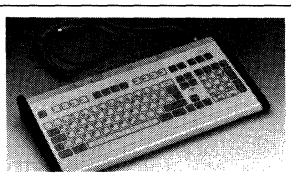
Ordering Information
70-095-10 . . . . . .19″ keyboard module



84HP keyboard panel module 1U

FEATURES
- Designed for mounting in an enclosure.
- Strengthened version with protective caps.
- Hinged frontplate with springlock.
- The panel is locked and slightly angled in the working position.
- A spring lock ensures easy opening and closing of the frontplate.
- Can be easily mounted.
- It takes up only 1U of space, 292mm deep.

Ordering Information
70-085-10 . . . . . .HP keyboard module 1U

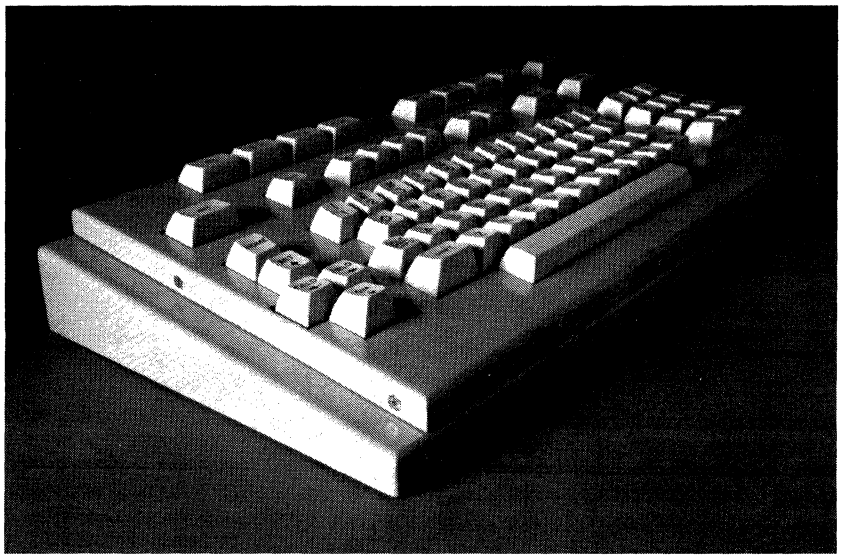


Keyboard panel in metal case

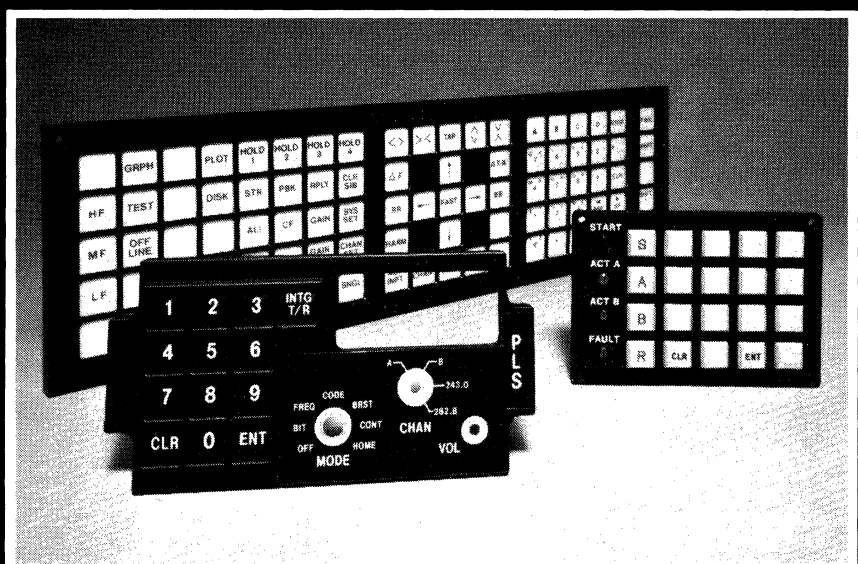
FEATURES
- PUR integral foam protected side pieces.
- It is protected per IP-65.
- Strengthened version with protective caps.

Ordering Information
70-090-10 . . . . . .keyboard panel in metal case
. . . . . (8.97"D x 17.08"W x 2.20"H)

See Section 1400 (Cabinets, Enclosures, Racks & Chassis), section 2400 (Panel Hardware, Bezels, Dials, Knobs, etc.) section 5100 (Switches) for additional products!



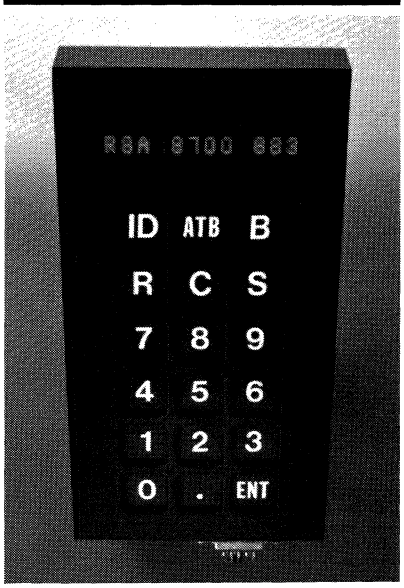
FLEX-KEY



specialists in military keyboard systems

KEYBOARD OPTIONS INCLUDE:

- TRACKBALL INCORPORATION
- BACKLIGHTING
- TEMPEST
- HAND HELD TERMINALS
- EMI/EMP SHIELDING
- HARSH ENVIRONMENT OPERATION
  - SHOCK
  - VIBRATION
  - DRIP/WATER PROOF
  - HIGH/LOW TEMPERATURE



Flex-Key has designed and manufactured keyboards for military applications since 1974. Our focus has resulted in unique knowledge and experience in our chosen specialty. To our customers, this means unmatched competence in military keyboard technology.

Defense electronics companies from around the globe have come to rely on Flex-Key for the highest quality product, engineered and manufactured to meet rigorous specifications.

Contact Flex-Key to learn what our dedication to military keyboards can mean for your hardware system.

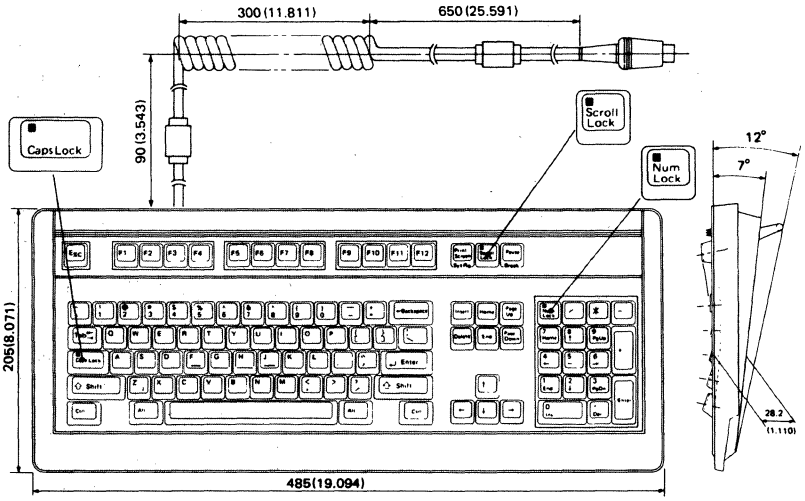
FLEX-KEY AN ASTRONICS CO.

FLEX-KEY CORPORATION, EMERSON AVENUE, GLOUCESTER, MA 01930
Phone: (508) 281-2040 Fax: (508) 281-4730

KEYBOARDS

FUJITSU

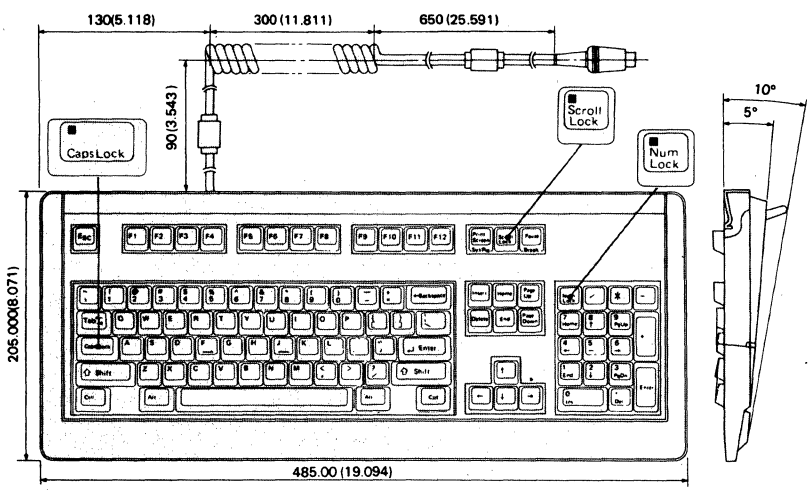
FUJITSU KEYBOARD FKB 4700 SERIES



Unit: mm (inch)

Mechanical		
Item		Specification
Operating force		55 ± 25g
Stroke		3.8 ± 0.5mm (.150 ± .020in.)
Tactile		20g typ
Operating life		30M ops. min.
Number of keys		US: 101 keys, Others: 102 keys
Keytop	Shape	Rectangular cylindrical
	Form	Step sculptured (curve)
Tilt		2 level
Environmental		
Operating temp.		0 to 50°C
Storage temp.		–20 to 60°C
Humidity		90% RH at 40°C max. inverse proportionally change to 50% RH at 60°C
Electrical		
Contact resistance		500Ω max. (DC 5V, 1mA)
Power supply		5 ± 0.25V DC, 250mA max.
Interlock		F key roll over
Repeat		All keys (AT* mode: repeating rate specified by command)
Interface		
Data transmission		Serial transmission (synchronous system)
Data format	AT* mode	11 bit (1 start + 8 data + 1 parity + 1 stop)
	XT* mode	9 bit (1 start + 8 data)
Connector		5-pole DIN connector (6-pole Mini DIN connector is available)

FUJITSU KEYBOARD FKB 4800 SERIES



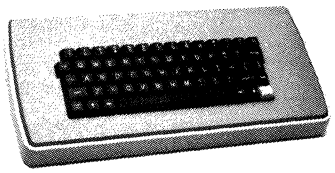
Unit: mm (inch)

Mechanical		
Item		Specification
Operating force		55 ± 25g
Stroke		3.8 ± 0.5mm (.150 ± .020in.)
Tactile		20g typ
Operating life		10M ops. min.
Number of keys		US: 101 keys, Others: 102 keys
Keytop	Shape	Rectangular cylindrical
	Form	Step sculptured
Tilt		2 level
Environmental		
Operating temp.		0 to 50°C
Storage temp.		–20 to 60°C
Humidity		90% RH at 40°C max. inverse proportionally change to 50% RH at 60°C
Electrical		
Contact resistance		500Ω max. (DC 5V, 1mA)
Power supply		5 ± 0.25V DC, 250mA max.
Interlock		F key roll over
Repeat		All keys (AT* mode: repeating rate specified by command)
Interface		
Data transmission		Serial transmission (synchronous system)
Data format	AT* mode	11 bit (1 start + 8 data + 1 parity + 1 stop)
	XT* mode	9 bit (1 start + 8 data)
Connector		5-pole DIN/Mini DIN connector

*AT and XT are trademarks of International Business Machines Corp.

GEORGE RISK INDUSTRIES, INC.
G.R.I. PLAZA / KIMBALL, NEBRASKA 69145 / TEL. (308) 235-4645 / TWX 910-620-9040 / FAX (308) 235-2609

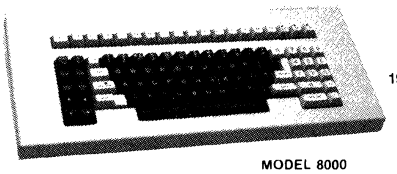
STANDARD KEYBOARDS



16.26" × 7.85"

MODEL 9062

62 keys • full 128 character ASCII encoding two-key lockout or N-key rollover • Outputs: parallel, TTL serial, RS-232, RS-422, PC-XT/AT • easy mounting provisions • non-glare double shot molded keycaps–separate cursor control keys • user defined key • auto-repeat on all keys • +5V power.

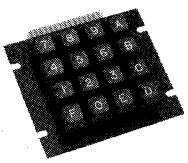


19.0" × 8"

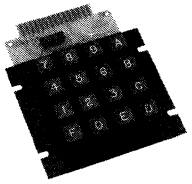
MODEL 8000

• State-of-the-art microprocessor keyboard, 95 keys, including 19 special function keys • High reliability performance • Four-wire serial interface, 300 or 1200 baud • Unique variable key rollover with phantom key lockout • High speed operation • Ergonomic design.

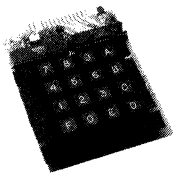
KEYPAD MODELS 10, 12 or 16 Keys



• Unencoded wiring, 1 of 16 or X-Y matrix
• One side of each keyswitch is common
• Design to be used with custom-supplied encoding.



• 4 bit hex encoded
• Full CMOS design
• Outputs compatible with LS and standard TTL logic



Serial RS-232, RS-422 or TTL output • parallel output • microcontroller keyboard encoder • full 7-bit ASCII characters.

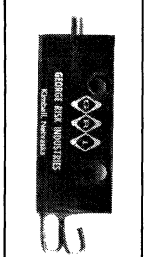
CUSTOM KEYBOARDS

GRI builds custom keyboards to your exact specifications and drawings for all types of applications—air traffic control, process control, military, etc. Our lighted keyboards are especially attractive due to their visibility and high reliability. We offer both the dry reed and mechanical contact switch technologies. We have manufactured custom keyboards for companies such as Burroughs, Eaton-AIL, FAA, Ford Aerospace, Goodyear Aerospace, Lockheed, Magnavox, Raytheon, Rockwell, Texas Instruments, and many others. Send us your specifications and drawings for a quotation today.

PUSHBUTTON SWITCHES

DRY CIRCUIT & LOGIC SWITCHING

"B" SWITCH
1.125 H x .420 W



"G" SWITCH
1.745 H x .625 dia



"D" SWITCH
1.470 H x .350 dia



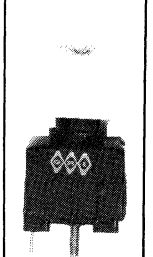
"V" SWITCH
1.320 H x .590 case dia - .675 bezel dia



"KB" SERIES
1.550 H x .705 dia

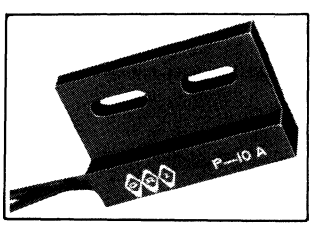


"KBLP" SERIES
1.125 H x .750 sq

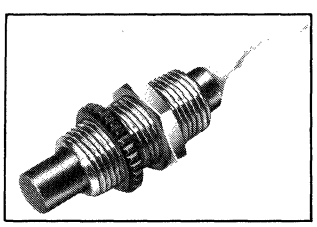


SPST-NO, NC; DPST-NO, NC-Available in 4 form A or B-Illuminated and non-illuminated Hi-rel-50 million operations-Mounting collars and buttons available-Mercury wetted reed switches available

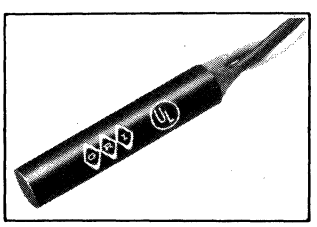
PROXIMITY SWITCHES & VANE SENSORS



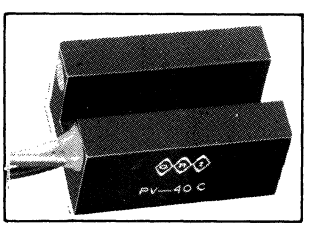
P-10



P-20



P-30

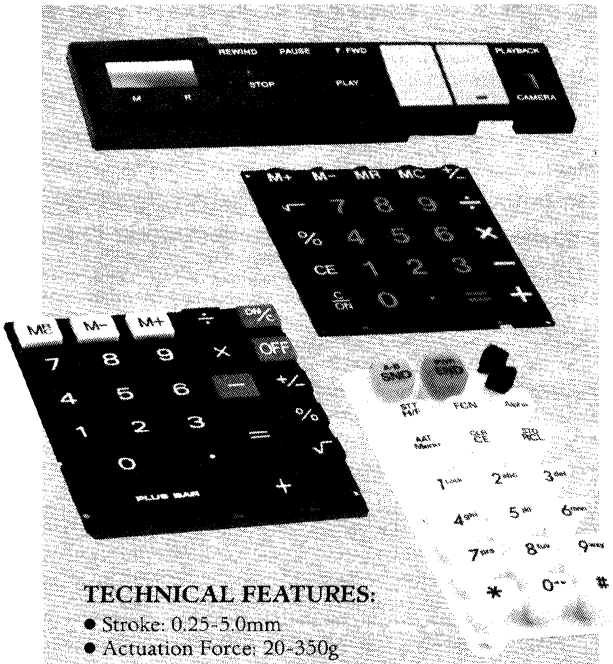


PV-40

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
Microwave Components, Product Selection Guide **A**•1746
Military Qualified Products List **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide **B**•1233
Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
Relays, Product Selection Guide **B**•1397
Resistor Color Codes **A**•1924
Resistors, Product Selection Guide **A**•1835
Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
Solenoids, Product Selection Guide **B**•1614
Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864



CONDUCTIVE RUBBER KEYPADS

MAIN PRODUCT FEATURES

● Versatility ● Long Life ● Competitive Price ● Tactile/Nontactile Feel ● High/Low Profile Keytops ● Multiple Color Keytops ● Translucent Keytops ● Multiple Color Legends ● Positive/Negative Image Graphics

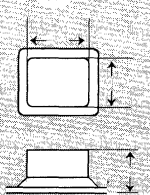
QUOTATION REQUIREMENTS

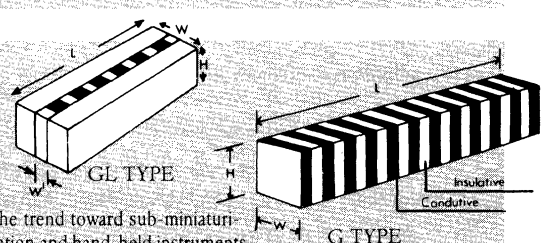
Budgetary pricing available within 24-48 hours of receipt of minimum information listed below:

1. Estimated Annual Usage _____
2. Technical Specs:
   - A. Pad Durometer (hardness) _____
   - B. Keytop Durometer (hardness) _____
   - C. Number of Keys _____
   - D. Number of Keytop Colors _____
   - E. Number of Legend Colors _____
   - F. Legend Type (screen/diffused) _____
   - G. Actuation Force _____
   - H. Overall Pad Size (length/width) _____
   - I. Keytop Size (Drawing A) _____
   - J. Keytop Height (Drawing B) _____

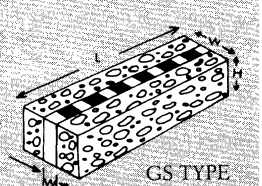
TECHNICAL FEATURES:

- Stroke: 0.25-5.0mm
- Actuation Force: 20-350g
- Life: 250,000-5,000,000 actuations
- Operating Temp: −30 + 180°C
- Contact Resistance: <200 ohms
- Contact Rating: 30mA @ 12VDC .5 sec.
- UL Flammability Rating: 94HB





The trend toward sub-miniaturization and hand-held instruments has created a need for reliable, low profile interconnection devices. Glowlite's Elastomeric Connectors provide such a connection and are easy to install. Fine pitch connectors allow for highly reliable interconnection even in most exacting applications.



TECHNICAL FEATURES:

- Length: 1.0-280mm
- Height: 0.5-25mm
- Width: 0.4-5.0mm
- Pitch: 0.03-0.40mm
- Volume Resistivity: ≤5 ohm-cm
- Hardness: (conductor 65±5 (insulator) 20-40±5
- Insulative Resistance: 10^{14} ohms
- Temp. Range: −20° = 180°C
- Conductive Width (typ.): 0.4mm

ELASTOMERIC CONNECTORS

MAIN PRODUCT FEATURES

● Versatility ● Reliability ● Long Life ● Competitive Price ● Solder Free Installation ● Corrosion Resistance ● Fine Pitch Interconnection ● Low Profile Interconnection

QUOTATION REQUIREMENTS

Budgetary pricing available within 24-48 hours of receipt of minimum information listed below:

1. Estimated Annual Usage _____
2. TechnicalSpecs:
   - A Length _____ C. Width _____
   - B Height _____ D. Pitch _____

See drawing to the right for illustration of dimensions to be supplied.

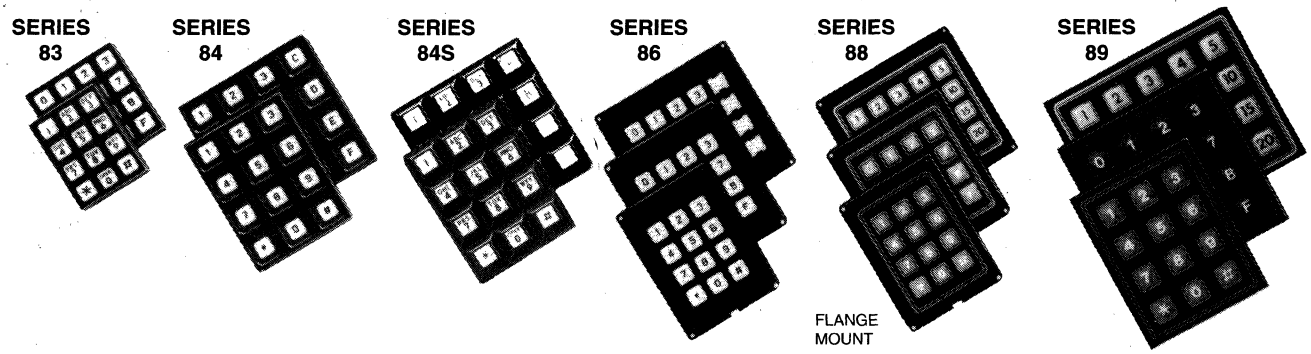
DESIGN GUIDE AVAILABLE

Glowlite

P.O. Box 688 • Hwy 77 South
Pauls Valley, Oklahoma 73075
(405) 238-5541 • (800) 654-3662 FAX (405) 238-3029

Grayhill INC. 12, 16, & 20 Button Keypads

561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE; (708) 354-1040



Features	Legend	Series	Btn. Cntrs.	Mounting	Ht.	Length	Overall Width 3x4	4x4	5x4
Very Small Size	2-shot	83	.50"	Post*	.35"	2.1"	1.6"	2.1"	—
Wide Spacing	2-shot	84	.75"	Post*	.35"	2.1"	1.6"	2.1"	—
Environmentally Sealed	Printed	84S	.75"	Stud	.50"	3.1"	2.4"	3.1"	—
Top or Subpanel Flange Mounting	2-shot	86	.50"	Screw	.36"	3.0"	2.2"	2.7"	3.2"
Top/S Flange Mount, Top Sealed	Graphic	88	.50"	Screw	.36"	3.0"	2.2"	2.7"	3.2"
Very Thin, Wide Spacing	Graphic	89	.75"	Adhesive	.10"	3.5"	2.8"	3.5"	4.3"

*POSTS ARE HEAT UPSETTING PLASTIC STUDS

SEALED KEYPADS

Series 84S: Nitrile rubber housing seals keypad and panel; a metalic back plane provides EMI/RFI shielding. Series 88: Contact area is sealed by graphic overlay; order separate gasket, either subpanel or topside mounting style, to seal keypad to your panel.

SPECIFICATIONS

Rated for 3 million operations at 10 mA 24 Vdc, -40°C to +80°C. Contact resistance is logic compatible; bounce, less than 4 mS at make, 10 mS at break. Housings (except 84S and 89) and molded buttons are ABS plastic; graphics (88 and 89) are polyester. Snap on caps are polycarbonate.

CUSTOM LEGENDS

Assorted printed inserts and labels let you create your own prototype. For Series 83, 84, and 86, legends -101, -201, -001 have snap-on caps for preprinted inserts. For Series 84S, removable ABS buttons can be re-arranged. For buttonless 84S keypads and stock printed or blank white and colored buttons for your own printing; contact Grayhill. For Series 89, adhesive backed printed labels (2 sheets) fit blank buttons. For Series 88 legendable keypads, contact Grayhill.

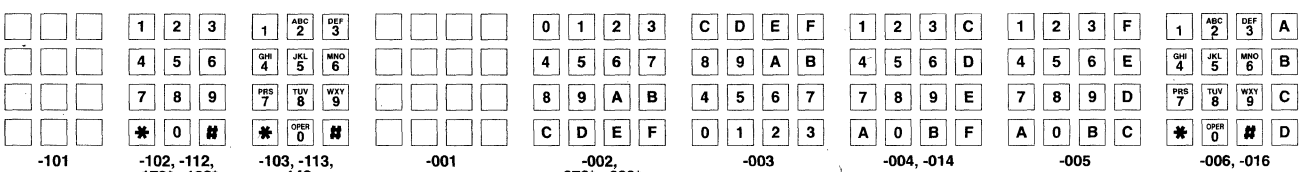
STANDARD LEGENDS

Legends for 83, 84, and 86 are molded (b/w); for 84S, epoxy ink printed (b/w). Series 88/89 have 2nd surface printed graphics with blue, orange, or silver, accents.

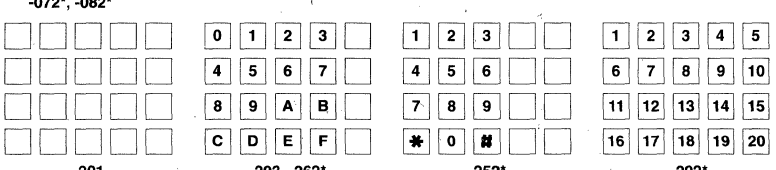
Size	Keypads By Circuit Code: 2 of 7 (8)	Matrix	SP/Common	Legend Dash Number* (Completes Part Number)
3x4	—	84SAB1-	84SAC1-	-112, or -113
	83AA1- 84AA1- 86AA2-	83AB1- 84AB1- 86AB2-	83AC1- 84AC1- 86AC2-	-101, -102, or -103
	88AA2-	88AB2-	88AC2-	-143, -172, or -182
	—	89AB2-	89AC2-	-172-A, or -182-A
4x4	—	84SBB1-	84SBC1-	-014, or -016
	83BA1- 84BA1- 86BA2-	83BB1- 84BB1- 86BB2-	83BC1- 84BC1- 86BC2-	-001, -002, -003, -004, -005, or -006
	88BA2-	88BB2-	88BC2-	-072 or -082
	—	89BB2-	89BC2-	-072-A, or -082-A
5x4	—	86JB2-	86JC2-	-201, or -203
	—	88JB2-	88JC2-	-252, -262, or -292
	—	89JB2-	89JC2-	-252-A, -262-A, or -292-A

Accessories	Series	3x4	4x4	5x4
Sub Pn'l Gasket	All 88	88M2001-2	88M2009-2	88M2019-1
Topside Gasket	All 88	88M2012-1	88M2015-1	88M2018-1
Legend Inserts	83,84,86	All Sizes: 87AC2046		
Legend Labels	89	All Sizes: 89AC3038-1 and -2		

*Sample part number, completed: 86AA2-102.



* Graphic accent for -072, -172, and -262 is blue; for -082, -182, & -252, orange; for -292, silver.



For prices and discounts, contact a Sales Office, an authorized Distributor, or GRAYHILL.

Available from GRAYHILL Distributors

Grayhill INC.
561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE; (708) 354-1040

Keyboard Modules

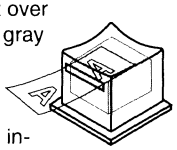
CREATE YOUR OWN CONFIGURATION AND MAINTAIN BUTTON DISTANCES

SERIES 82 MODULES

- .683" Button Centers
- Long Stroke, Wiping Contacts
- 4 Sizes In 1 to 4 Poles
- Lightable Buttons/Legends
- Insertable Printed Legends
- Invisible Deadfront Option

STANDARD LEGENDS OR INSTANT CUSTOM LEGENDS

Telephone modules have molded-in legends. Others have slotted caps for printed inserts. Lightable styles fit over your T-1 lamp or LEDs (not supplied). Lightable gray styles show light thru entire button. Lightable black styles, have legend-only lighting with a choice of 2 legends: Clear thru-lit legend, or deadfront legend (invisible until lit). Insert sheets include letters, numbers 0-19, phone legends, and common sysmbols and terms.



CIRCUITRY AND SPECIFICATIONS

Momentary switches in Single Pole/ Single Throw, and in 2P, and 4P as charted. Additional standard and coded circuitry available. Total button travel is .130"; nominal overtravel is .080 inches. Operating force is 8 ±3 oz., depending on the number of poles. Switches are rated at 100 mA, 5 Vdc for 1,000,000 operations. Contact bounce is 10 mS or less. Voltage breakdown is 250 Vac. Insulation resistance is 1000 meghoms minimum. Heat resistance to solder is tested up to 260°C for 5 seconds maximum. Careful flux cleaning is required since switches are not sealed. Lightable modules fit over T-1 size LEDs/lamps which are .250" maximum above board. Lamps are not supplied. For operating temperature, luminosity and factory legends, contact GRAYHILL.

DIMENSIONS

All modules are .750" high; 0.683" wide for 1-row strips, and 1.270" for 2 rows (6 buttons).

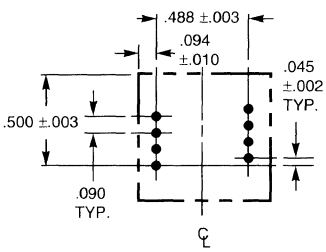
Lengths are .0683", 1.370", 2.057", and 2.057" for the 1, 2, 3, and 6 button modules respectively.

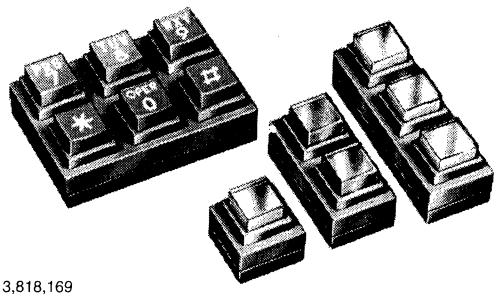
Actual pin locations depend on circuitry and style. The 4PST circuitry is shown here.

PC BOARD LAYOUT

Viewed from component side

NOTE: ALL DIMENSIONS ARE REPEATED AT .687 INCHES INTERVALS IN ALL DIRECTIONS FOR ADDITIONAL BUTTONS.





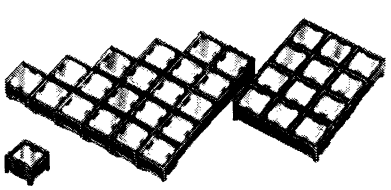
PAT. NO. 3,818,169

Series 82 Module Description & Circuitry			Part Number
Top of Phone	6 Btns.,	SP/ST	81-601-85
Legend (molded)	6 Btns.,	2P/ST	82-601-86
Bottom of Phone	6 Btns.,	SP/ST	81-601-89
Legend (molded)	6 Btns.,	2P/ST	82-601-90
Standard Gray Modules (Use White Legend Inserts)	1 Btn.,	SP/ST	82-101-71
	1 Btn.,	4P/ST	82-101-74
	2 Btns.,	SP/ST	82-201-41
	2 Btns.,	4P/ST	82-201-44
	3 Btns.,	SP/ST	82-301-61
	3 Btns.,	4P/ST	82-301-64
	6 Btns.,	SP/ST	82-601-81
	6 Btns.,	4P/ST	82-601-84
Lightable Gray Modules (Use Black Legend Inserts)	1 Btn.,	SP/ST	82-150-38
	1 Btn.,	4P/ST	82-150-16
	3 Btns.,	SP/ST	82-350-12
	3 Btns.,	4P/ST	82-350-9
	6 Btns.,	SP/ST	82-650-19
	6 Btns.,	4P/ST	82-650-9
Lightable Black (Clear or DdFrnt)	1 Btn.,	SP/ST	82-150-211
	1 Btn.,	4P/ST	82-150-213
Legend Insert Sheets	Series 82	White	82AC2017-1
	Series 82	Black	82AC2050-1
	Series 82	Clear	82AC2055
	Series 82	Deadfront	82AC2060

For prices, contact a sales, an authorized Distributor or GRAYHILL.
Available From Your Local GRAYHILL Distributor

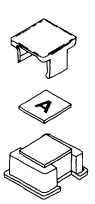
SERIES 87 MODULES

- Low Profile
- Audible Dome Contacts
- 1/2" Button Centers
- Custom Legend Inserts



LEGEND INSERTS

Self adhesive printed inserts are die-cut to fit buttons. Sheet includes common symbols, terms, letters, and 0-99, printed in black on clear film. Blank inserts are included for use with dry transfer lettering. Dry transfer lettering in 3 sizes are also available. Clear button cap snaps off and on.



SPECIFICATIONS

Logic compatible contact risistance, rated at 10 mA, 24 Vdc for 3 million operations. Voltage breakdown is 250 Vac. Contact bounce is less than 4 mS at make, 10 mS at break. Travel is 0.15"; operating force is 300 grams; operating temperature is -40°C to +80°C.

ORDERING INFORMATION

Series 87 Module, Circuitry, and Size			Part Number
1 Button	SP/ST	0.5 x 0.5	87CC3-201
2 Btn. Strip	SP/Com Bus	0.5 x 1.0	87DC3-201
3 Btn. Strip	SP/Com Bus	0.5 x 1.5	87EC3-201
4 Btn. Strip	SP/Com Bus	0.5 x 2.0	87FC3-201
5 Btn. Strip	SP/Com Bus	0.5 x 2.5	87GC3-201
6 Btn. Strip	SP/Com Bus	0.5 x 3.0	87HC3-201
12 Btn. Keypad	Matrix	1.5 x 2.0	87AB3-201
16 Btn. Keypad	Matrix	2.0 x 2.0	87BB3-201
Legend Inserts	Die-Cut		87AC2046
Dry Transfer	Small Type		87-DT-2096-088
Dry Transfer	Med. Type		87-DT-2096-125
Dry Transfer	Large Type		87-DT-2096-187

For prices, contact a sales, an authorized Distributor or GRAYHILL.
Available From Your Local GRAYHILL Distributor

IEE PPD
MILITARY PRODUCTS GROUP

Keypads, Keyboards, Switches & Displays

IEE Planar Products Division, Military Products Group specializes in standard and custom keypads, keyboards, displays, front panel assemblies and control display units for both military and industrial applications.

Keyboards and Keypads
PPD designs and manufactures a variety of keyboards and keypads. They incorporate such features as gold-plated snap domes or carbon contacts, illuminated (MIL-P-7788) or nonilluminated keys, EMI/RFI shielding, environmental sealing and low-profile bezels. Keypads are also molded of silicone and other specially compounded elastomers. Together, these products comprise one of the most comprehensive high reliability keyboard and keypad selections available.

Full-Travel Military Keyboard
PPD designs and manufactures a unique Full-Travel Military Keyboard (FTMK™) to the most exacting military specifications. A full-travel stroke (similar to standard data-entry PC keyboards) is provided while meeting severe operational specifications such as TEMPEST, nuclear hardening, 3-foot submersion, shock, vibration and wide-temperature (MIL-Std-810). A tactile "snap" is also offered as an optional feature as well as a wide selection of standard and custom interfaces.

The modular configuration of the individual FTMK key positions permits the ready design and manufacture of custom keyboards.

Rear-Projection Readouts
PPD designs and manufactures rear-projection readouts which display up to 48 discrete custom legends and/or graphics in color in an area as small as .37 square inches. These displays are available with or without an interactive touch switch feature. Rear-projection readouts are currently being used in a variety of applications from automotive instrumentation to Trident submarine sonar systems.

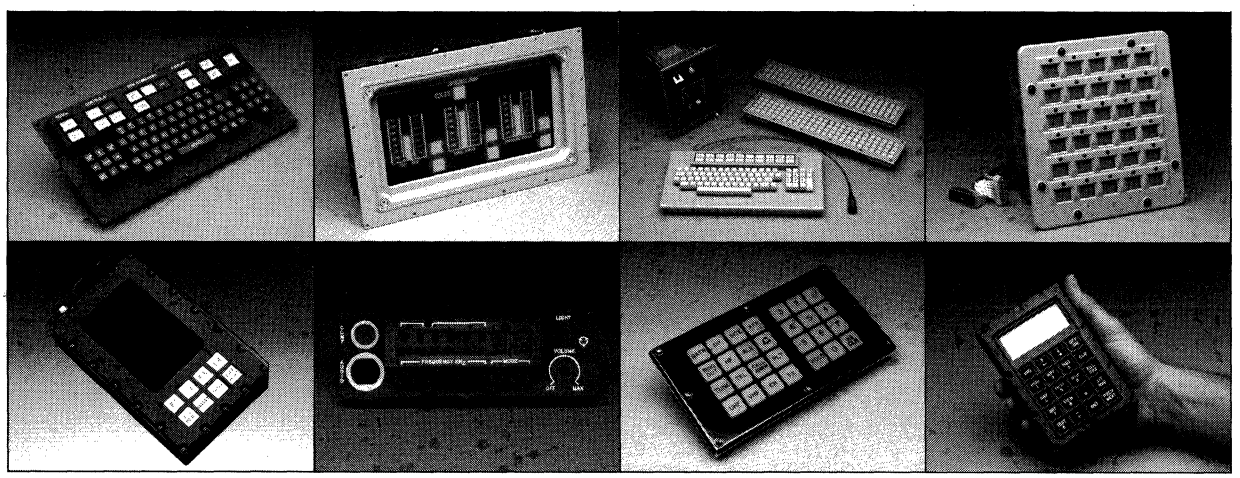
Displays
PPD designs and manufactures full military and ruggedized thin film electroluminescent (TFEL) flat panel displays with or without interactive touch switch capabilities. These rugged, low-power EL displays are currently available in 3"×5" and 4"×8" configurations. A variety of interfaces are available, and the displays are provided complete with power supplies, and optical filters.

In addition to the above, PPD also designs and manufactures full military custom LCD, VF, LED and DC Plasma displays.

Front Panel Assemblies and CDUs
PPD's custom engineering capabilities include the design and manufacture of front panel assemblies and handheld, portable and desktop control display units (CDU). These custom assemblies integrate our standard and custom keyboards and displays into environmentally rugged man-machine interface devices that meet the most rigid military specifications. PPD also produces ruggedized assemblies to meet severe industrial requirements.

Contracts and Program Coordination
To ensure meeting contractual and schedule commitments, PPD maintains a Contracts and Program Coordination group dedicated to closely monitoring the progress of in-house programs and serving as the primary liaison with PPD customers for work-in-progress.

Quality
PPD Military Products Group maintains a MIL-Q-9858 quality program and high reliability solder process controls to Weapon Standard WS6536 specification levels. PPD is committed to high-quality standards in attitude, workmanship and final products.



Custom FTMK
Full-Travel
Military Keyboard

PORTABLE CDU
Full Military
with 3×5 EL Display
and 8 position Sealedswitch

4×8 EL
Electroluminescent Display Module
with IR Touch Switch Matrix

FRONT PANEL ASSEMBLY
Full Military
with segmented LCD Display,
Sealed Switches and ANVIS Backlighting

Custom FTMK,
Custom Illuminated Sealed Switch
Panels and Power Control Panel

Illuminated, Sealed,
Relampable Keypad

PROJECTION DISPLAY MATRIX
Full Military Assembly

HANDHELD CDU
Full Military
with Dot Matrix LCD Display
Sealed Keypad and ANVIS Backlighting

IEE
INDUSTRIAL ELECTRONIC ENGINEERS, INC.
7740 Lemona Avenue
Van Nuys, California 91409-9234
Tel.: (818) 787-0311 • FAX: (818) 781-9795

- **Membrane Switches**
- **PCB Switching Assemblies**
- **Elastomer Keypads**
- **Transparent Membrane Touch Screens**
- **Electroluminescent Panels**

VERTICALLY INTEGRATED MANUFACTURING

Pre-tested, ready-to-install key panels reduce your assembly costs.

- Custom Design and Graphics
- Color Filter Windows
- Multiple Hard Coat Finishes
- 100% Functionally Tested
- Installation-ready

PROCESS-CONTROLLED PRODUCTION

- Computerized quotation, order entry and production tracking through final shipment
- CAD Engineering
- On-site Tool & Die facility
- Laser-based art generation
- Spectrophotometer color analysis and match
- Class 1000 Clean Room print stations
- 100% testing for continuity, resistance, dielectric strength and actuation force
- Documented QA to MIL-I-45208A
- Prototype service

PRODUCT SUPPORT SYSTEM

- Trained, nationwide sales force
- Experienced design/manufacturing team
- Follow up assistance after product delivery
- One account manager tracks each job from quote through shipment, coordinating manufacture to meet your production schedule.

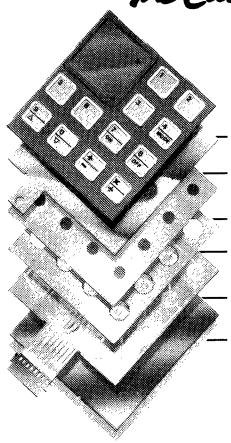
INTAQ® Key panels are designed and manufactured by GM Nameplate. We have been producing key panels for over a decade, and supplying product identification components to major manufacturers world wide since 1954. The INTAQ design team is housed in the 97,000 sq. ft. headquarters/ manufacturing facility.

GM NAMEPLATE CUSTOM PRODUCT IDENTIFICATION COMPONENTS
- nameplates
- roll and computer imprintable labels
- cosmetic front panels and overlays
- fabricated subassemblies
- fleet graphics and signage

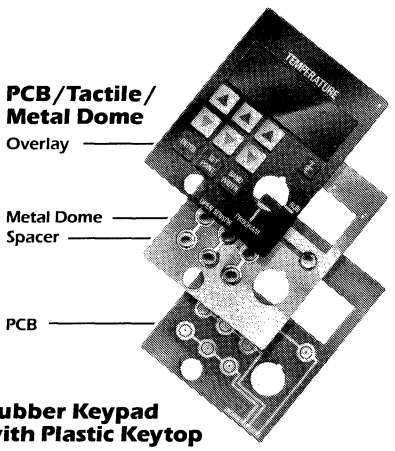
Call Customer Service **206-284-2200** for information, samples or price quotation.

INTAQ® The Custom Touch℠

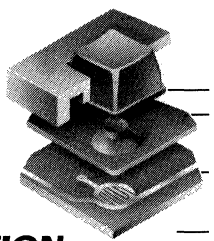
GM NAMEPLATE, INC. FLAT AND SHORT TRAVEL KEY PANELS



Membrane/ Non Tactile
- Overlay
- EMI/ESD Shield (optional)
- Top Membrane
- Spacer
- Bottom Membrane
- Subpanel (optional)



PCB/Tactile/ Metal Dome
- Overlay
- Metal Dome
- Spacer
- PCB



Rubber Keypad with Plastic Keytop
- Overlay/bezel
- Plastic Keytop
- Rubber Keypad (with carbon pill)
- PCB

CONSTRUCTION

GRAPHIC OVERLAY Subsurface printed polyester. No limit to perfectly matched colors. Surface protected from chemical attack and abrasion with hard coat finishes. Can include transparent, deadfront or colored display windows; selective texturing; embossed, die-cut and/or relegendable areas.

SWITCH Normally open, single pole, single throw momentary contact device, activated by light, direct pressure. Standard encoding xy or common bus.

MEMBRANE Layers of thin, flexible film (printed circuit patterns, insulators and spacers), die cut and laminated with high strength adhesive to form low profile switches. Can be installed to a subpanel, complete with mounting hardware, or fit within a bezel or housing. **Non Tactile** Conductive patterns are printed on the facing, inner surfaces of the two outermost layers, separated, except at the contact pad, by a spacer. **Tactile** Substitutes metal domes (or polyester dome layer) for the top circuitry, as a shorting pad.

PCB Similar to membrane construction, but meets broader electrical requirements and permits board mounted components. Substitutes a PCB for the bottom membrane layer, forming its own subpanel. **Accessory PCB** used to mount components and for accessory circuitry. Mounts directly below the PCB key panel using standoffs.

ELASTOMERIC KEYPAD Used over a membrane or PCB construction. For extended switch life, uses silicon rubber/carbon pills (over a PCB) as the shorting device. Sealed construction ideal for harsh environments. Silent feedback available in progressive feel or positive snap. Under a **plastic keytop,** snap-action metal domes also can be used.

EMI & ESD SHIELDING (optional) Printed or fabricated from copper, aluminum or other alloys.

TERMINATION Unterminated (with terminal pads), solder tabs, male/female connectors; PCB headers or terminal pads.

TRANSPARENT MEMBRANE TOUCH SCREENS xy or analog coding. Construction details and specifications sent by FAX or mail- CALL 206-284-5475

SWITCH SPECIFICATIONS

	MEMBRANE AND PCB KEY PANELS			ELASTOMER KEY PANELS				
	Non-tactile	Tactile Metal Dome	Tactile Polydome	Rubber Keypad/ Membrane	Rubber Keypad/ PCB Switch	Rubber Keypad/ Shorting Pad/ PCB Switch	Plastic Keytop/Rubber Keypad/Shorting Pad/ PCB Switch	Plastic Keytop/Metal Dome/PCB Switch
ELECTRICAL								
Contact rating (Membrane)	30 VDC, 100mA, 1 Watt	30 VDC, 100mA, 1 Watt	30 VDC, 100mA, 1 Watt	30 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt
Contact rating (PCB)	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt					
Contact resistance	<100 ohms	<100 ohms	<100 ohms	<100 ohms	<20 ohms	<20 ohms	<20 ohms	<20 ohms
Contact bounce	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms
Capacitance	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf
MECHANICAL								
Actuation force	3 - 10 oz.	10 - 16 oz.	4 - 18 oz.	4 - 12 oz.	3 - 10 oz.	4 - 12 oz.	4 - 12 oz.	10 - 16 oz.
Life cycle*	5,000,000	5,000,000	1,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Key travel	.007 - .011 in.	.015 - .025 in.	.010 - .030 in.	.045 - .075 in.	.040 - .075 in.	.045 - .075 in.	.040 - .075 in.	.015 - .025 in.
ENVIRONMENTAL								
Operating temp.	-30° - +65° C	-30° - +65° C	-20° - +55° C	-30° - +65° C	-30° - +65° C	-30° - +65° C	-30° - +65° C	-30° - +65° C
Storage temp.	-40° - +80° C	-40° - +80° C	-40° - +80° C	-40° - +70° C	-40° - +70° C	-40° - +70° C	-40° - +70° C	-40° - +70° C

* Life cycle may decrease approaching upper and lower extremes of operating range.

THE CUSTOM TOUCH

From simple, thin profile membranes to complex, multi board PCB assemblies with surface mounted components, GM Nameplate custom engineers each INTAQ keypanel design to meet your unique requirements.

For more information, samples or price quotation, contact

GM Nameplate
INTAQ® Key Panels
2040 15th Avenue West, Seattle, Washington 98119
206-284-5475 ▸ FAX 206-284-3705

CALL OR WRITE FOR INFO ON ANTI-ROCK™ ELASTOMER KEY PANELS

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

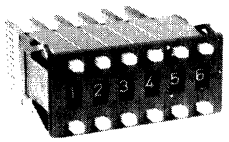
Z
ZIF zero insertion force

INTERSWITCH
ONE OF THE PURDY GROUP OF COMPANIES

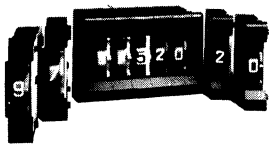
RDS Rotary DIP Code Switch, Thumbwheel Switches & Immersion Proof Key Pad

770 AIRPORT BLVD., BURLINGAME, CA 94010 • TEL (415) 347-8217 • FAX (415) 340-1670 • MCI/TLX 677-1439 (PURDY UW)

Thumbwheel Switches



Type D&Z Pushbutton

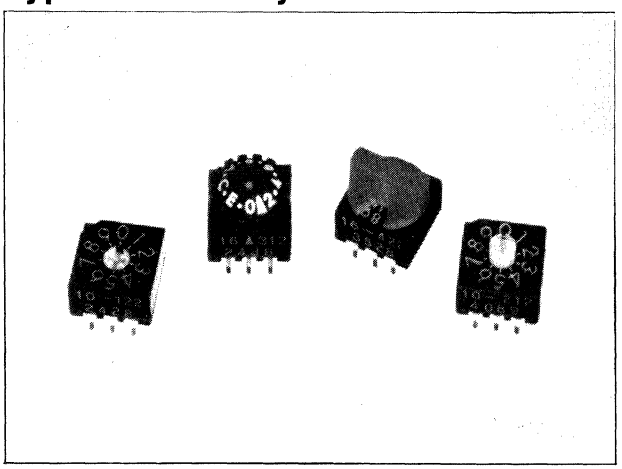


Type U

Available Switches (dimensions in millimeters)

Series A	B	D	E	G	H	L	M	N	P	R	S	U	V	Z
Front Mounting	•	•		•	•		•			•	•	•	•	•
Rear Mounting	•		•			•		•	•					
Width	11	12.5	7.62	16	20	10	8	8	7	10	20	10	8	8	7.62
Height	39	58	24	18	76	33	18	33	18	24.2	33	33	33	26.5	15
Mounting Depth	63.6	67.1	33.5	31.5	79	38	31.5	38	31.5	38.25	38	38	40	32.5	24
Spacer 2.54 mm			•												
Spacer 2.7 mm						•				•		•			

Type RDS Rotary DIP Code Switch



DESCRIPTION

The new INTERSWITCH RDS rotary DIP switches embody many new improved features and at a reduced cost! This new model features molded-in contacts ultrasonic welded body to base and an "O" ring around the rotor shaft. These features insure an absolute seal to fluxes, flux gasses and cleaners. (Acceptable solvents are isopropyl alcohol, ethyl alcohol, toluene, benzine, tricylene, clorocene, freon; acetone and methanol solvents are not acceptable.) Detent action is positive and firm assuring reliable settings.

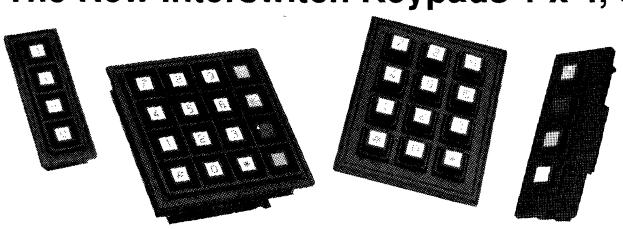
SPECIFICATIONS

Current rating and voltage: Non switching 125 mA at 30 VDC; Switching 125 mA at 30 VDC **Contact resistance:** 100 milliohms maximum **Insulation resistance:** 1000 megohms at 250 VDC for 1 minute minimum. **Durability:** 20,000 actuations. **Positions:** 10 and 16. **Temperature rating:** – 25°C (– 13°F) to 85°C (185°F). **Body:** Glass-filled polyamide (UL94V-0). **Contacts:** Copper alloy, selective gold plating over nickel. **Rotor control:** Polyacetal. **Rotor switch element:** Glass epoxy, gold over nickel plated circuits.

Order Number	Description	No. of Pos.
Flat Type		
RDS10-112	BCD Real Code	10
RDS10-122	BCD Complement	10
RDS10-132	EECO-BCD Real Code	10
RDS10-142	EECO-BCD Complement	10
RDS16-112	Hexadecimal Real	16
RDS16-122	Hexadecimal Complement	16
RDS16-132	EECO-Hexadecimal Real	16
RDS16-142	EECO-Hexadecimal Complement	16
Shaft Type		
RDS10-212	BCD Real Code	10
RDS10-222	BCD Complement	10
RDS10-232	EECO-BCD Real Code	10
RDS10-242	EECO-BCD Complement	10
RDS16-212	Hexadecimal Real	16
RDS16-222	Hexadecimal Complement	16
RDS16-232	EECO-Hexadecimal Real	16
RDS16-242	EECO-Hexadecimal Complement	16

Order Number	Description	No. of Pos.
Indicator Type		
RDS10-312	BCD Real Code	10
RDS10-322	BCD Complement	10
RDS10-332	EECO-BCD Real Code	10
RDS10-342	EECO-BCD Complement	10
RDS16-312	Hexadecimal Real	16
RDS16-322	Hexadecimal Complement	16
RDS16-332	EECO-Hexadecimal Real	16
RDS16-342	EECO-Hexadecimal Complement	16
RDS16-372	EECO-Hexadecimal Real	16
RDS16-382	EECO-Hexadecimal Complement	16
Knob Type		
RDS10-412	BCD Real Code	10
RDS10-422	BCD Complement	10
RDS10-432	EECO-BCD Real Code	10
RDS10-442	EECO-BCD Complement	10
RDS16-412	Hexadecimal Real	16
RDS16-422	Hexadecimal Complement	16
RDS16-432	EECO-Hexadecimal Real	16
RDS16-442	EECO-Hexadecimal Complement	16

The New Interswitch Keypads 1 x 4, 3 x 4 and 4 x 4



KNM 2 *Series KNM 2, Immersion Proof (IP 67 Protection) with Flush Keys 1 x 4, 3 x 4, and 4 x 4 Keypads*

KNM 3 *Series KNM 3, Immersion Proof (IP 67 Protection) with Raised Keys 1 x 4, 3 x 4 and 4 x 4 Keypads*

FEATURES

• immersion proof, IP 67 rated • superb tactile feel • long life, 5,000,000 operations • magnetic return (no springs, no domes, no membranes) • dual gold plated contacts • individual addressable keytops • contact resistance (0.15 Ω)

APPLICATIONS:

• shipboard/naval • remote outdoor communication systems (telephones, etc.) • geophysical • wherever extreme, rugged, environmental conditions are encountered.

TECHNICAL DATA

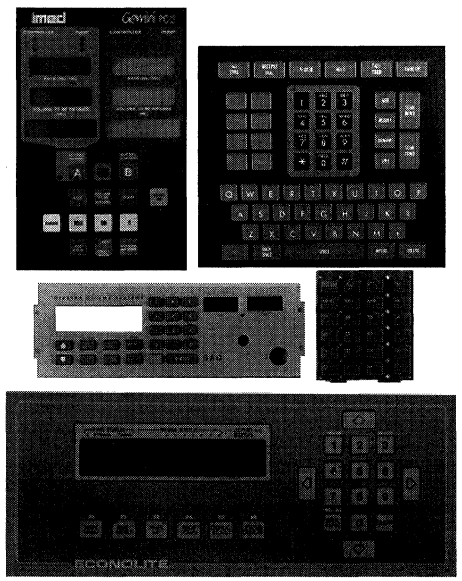
Mechanical: *Housing:* Crastin/silicon rubber
Key Travel: 1.35 mm *Actuating Force:* 2.2 N ± 0.4 N
Termination: Solder pins
Service Life (at nominal load): 5×10^6 operations

Electrical: *Contact:* n.o. contact (5μ Ni/2μ Au)
Operating Voltage: max. 50 ≅ *Test Voltage:* 500 V≅
Nominal Current (resistive load): max. 125 mA≅
Contact Rating: max. 2 W *Contact Resistance:* < 150 mΩ
Insulation Resistance: $> 10^2$ MΩ *Bouncing Time:* < 5 ms

Environmental: *Application Class (DIN 40040):* GSF
Operating Temperature Range: – 40°C to + 70°C
Storage Temperature Range: – 40°C to + 70°C
Relative Humidity: 75% annual average, 95% 30 days
Protection Type: IP 67

JAYCO

MEMBRANE SWITCHES
HYBRID SWITCH ASSEMBLIES
LEADERS IN FRONT



Jayco specializes in front panel switches & sub-assemblies. Our products are consistently chosen by hardware designers for their performance, superior standards, and visual appeal.

MEETING YOUR NEEDS

Customer satisfaction is our primary business concern. Our unique approach to customer satisfaction guarantees product reliability. At Jayco, quality begins with a complete analysis and planning of your machine interface requirements, before any material selection, design or construction methods are determined.

Our pre-engineering design reviews, testing and inspection to MIL-I-45208A insures that all processes and procedures are in place to anticipate and prevent any and all manufacturing problems. To further maximize customer benefits, Jayco maintains a policy of open communication throughout the design, engineering and manufacturing cycle, as a priority and a critical link in our system. Jayco breaks through the traditional customer–vendor relationships and enters into customer–supplier partnerships where together, we become committed to perfecting your project.

MEMBRANE SWITCHES

Our reliable membranes are thin, light weight, space saving and have a low assembly cost making them ideal for medical devices, process control, test and measurement, diagnostic, telecommunications, security, hand held equipment, and other applications. Membrane Switches are simple to use, offer design flexibility, and they are rugged and durable. They facilitate easy design integration to include displays, bargraphs, CRT windows, and speaker grilles. Many options are also available. (see design options).

HYBRID SWITCH ASSEMBLIES

Hybrid's are a combination of membranes and PCB technology built onto circuit boards. HSA's have the design advantages of membranes and are versatile enough for most applications. In addition, hybrid switch assemblies are a rigid assembly allowing component integration and conventional mounting without separate backplates. HSA's often eliminate another PCB from your product because display components and related circuitry are mounted to the same board used for the switch circuitry. Complete, fully tested sub-assemblies save you money. You have fewer components to order and track, lower assembly costs, and Jayco completes all of the testing for you.

SILICONE RUBBER KEYPADS AND ASSEMBLIES

The ideal choice for applications when a sensitive tactile feedback is required. Silicone keypads can be conductive or non-conductive, with integral or separate keytops, supplied as components or built into membrane or hybrid switch assemblies to produce a totally integrated front panel. Our sub-assemblies include keypads, PCB's, bezels, overlays, displays and other electronic components. This is an excellent money and labor saving alternative to building your own assembly with different components from multiple vendors.

Tailored to your requirements, Jayco's SRK's are molded in a wide variety of operating forces and switch travels. Select SRK's for any design application where positive feedback, low user fatigue, low cost and high reliability are prime requirements. SRK benefits also include: Long life (durability); excellent thermal stability and chemical resistance, light weight, low assembly cost, design flexibility, ESD protection and multi color arrays.

KEYBOARDS AND KEYPADS

Jayco manufactures custom keyboards and pads to your precise design requirements. These switches have few limitations regarding size, layout, number of switches, circuitry or graphic design. Custom keypads eliminate the compromise of off the shelf components which more than offsets the tooling costs in many applications.

DESIGN OPTIONS

EMBOSSING

Jayco embosses all overlays in-house. Proprietary techniques provide exceptional results, lower tooling costs, and a perfect match between printing and embossing. Any part of the front panel can be embossed to add a third dimension.

Embossing is usually pad or rim type. With pad embossing, the entire switch area is raised like a top hat. Rim embossing raises the outline of the switch like a crater. Rim and padding can be combined for special effects.

Pad embossing gives a more conventional keyboard appearance and is generally used with tactile switches. Rim

SILICONE RUBBER KEYPADS
KEYBOARDS AND KEYPADS
PANEL TECHNOLOGY

JAYCO

embossing assures better switch location, vital in non-tactile applications.

TACTILE FEEDBACK

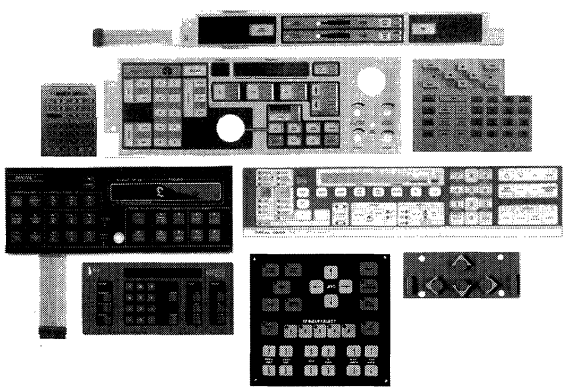
Tactile feedback is the snap action felt at switch closure and is achieved by the oil can effect of a stainless steel or polyester dome. Positive feedback of closure is important in applications utilizing unskilled operators or where other forms of feedback are impractical.

Jayco's tease-resistant tactile feedback mechanisms guarantee simultaneous contact and snap with both metal and plastic dome systems.

Metal (stainless steel) domes offer greater consistency of operation and reliability. Plastic (polyester) domes are more economical and make tactile feedback a practical feature for low cost applications.

SHIELDING

Jayco gives you the option to specify panels with EMI/RFI or ESD shielding. For maximum protection, the shielding is applied between the overlay and the switch layer. Shielding materials include metalized polyester, transparent ITO for windows and printed thick film.



SELECTIVE TEXTURES

Textures are used to optimize display visibility and legend clarity, selective (multi) textures allow the use of optically clear, anti-glare and matt texture coatings on Jayco panels. This technique is also used for aesthetic reasons. An added benefit is that Jayco's hard-coated textures typically have significantly better chemical and scratch resistance than the base materials.

INSERTABLE LEGENDS

Jayco responds to your visual needs with easy to change legends and graphics. An ideal feature for user definable keys, different model options, foreign language versions or prototyping.

INTEGRATED DISPLAYS

Through proprietary processes, Jayco offers one piece or laminated display windows for almost any kind of display device. With windows that are transparent or filtered. Standard filters are available in red, green or gray, with other colors available upon request.

In addition, fully interactive front panels can be made combining thin film LCD's and membrane switches in an assembly less than 0.060" thick. Call Jayco for more details.

DEADFRONT PANELS

Jayco's deadfront panel makes a complex instrument easier to use and the displays more effective.

Deadfront or secret-til-lit panels are invisible or blank until their displays are lit from behind. This effect is typically used for warning displays, or where strong impact of the hidden message is required.

TECHNICAL SPECIFICATIONS

Typical Values	
Current Rating	50mA at 30VDC
Circuit Resistance	Less than 100 Ohms
Contact Bounce	Less than 5 Milliseconds (non-tactile) Less than 20 Milliseconds (tactile)
Insulation Resistance	1 Gohm Min at 100VDC
Dielectric Strength	250VRMS Min
Capacitance	27 pf Max Between Any Two Traces
Actuation Force	Variable from 3oz and up
Operating Temperature	40°C to +80°C
Operational Life	Greater than 5 Million Operation (non-tactile) Greater than 1 Million Operations (tactile)
Termination	Dupont "Clincher" Offered as Standard
Tolerances	+ or -0.010" as Standard
Emboss Height	0.010-0.015"

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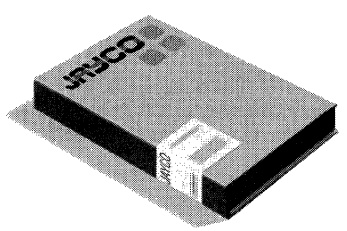

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low key

THERE IS NO GREATER PRIORITY AT LOW KEY THAN THE COMMITMENT TO QUALITY & DESIGN EXCELLENCE

A FULL SERVICE MEMBRANE SWITCH MANUFACTURER FEATURING COMPLETE DESIGN, PROTOTYPING AND PRODUCTION OF CUSTOM SWITCHES/KEYBOARDS, PC ENCODERS AND ASSEMBLY SERVICES

INTRODUCING 1st KEY SERVICE FROM "LOW KEY CORP."

A comprehensive package that translates your prototype design into production ready systems in 15 working days or less.

1st KEY SERVICE is more than just the proven reliability of membrane keyboard technology. 1st KEY SERVICE is the state-of-the-art in producing prototype, brass board, or pre-production keyboards, in as little as 2 weeks! With over 25 years of combined hands-on design knowledge and CAD/CAE support, your prototype is an investment in quality.

Think what the advantages of 1st KEY SERVICE can do to eliminate the work/time loss and bottlenecks created through confusion and the world of parading would-be keyboard suppliers flooding your lobbies today.



CAD/CAE ANALYSIS AND CORRECTION

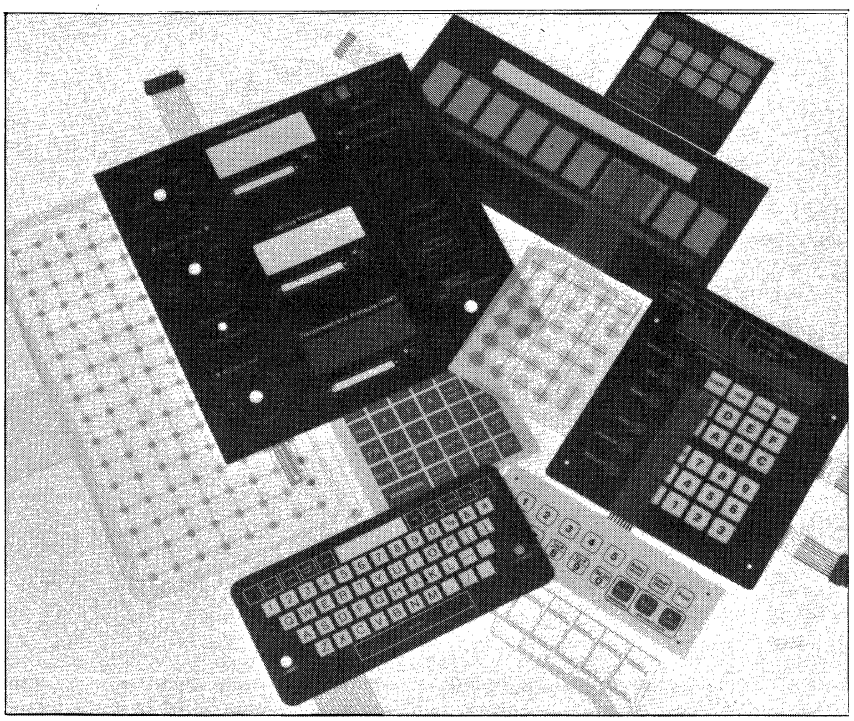
With 1st KEY SERVICE your design documentation must stand the "test." It will undergo CAD/CAE Analysis as the 1st step in validating your design. If conflicts exist, you will be notified immediately by phone and provided with options and solutions.

Most importantly 1st KEY SERVICE ensure conformance to the most rigid of mechanical and electrical standards. We can't afford to give you anything less than outstanding quality.

If you've got a hot project that needs 1st key treatment call us.

BACKLIGHTING

Low Key offers a wide variety of options and configurations. Utilizing both electroluminescent panels, liquid crystal reflective displays and surface mount L.E.D.'s.



CUSTOM SWITCHES/ KEYBOARDS

Low Key membrane products represent the ultimate in state of the art materials, design options and operational stability over a wide range of User environments. Low Key design options, include both polyester film and printed circuit board substrates, offering a wider range of current, temperature and mounting geometries.

GRAPHICALLY APPEALING

Low Key graphics are more than, just so much decorative "window dressing." Utilizing its years of experience, Low Keys graphic arts department has met the most enduring standards of excellence developed over the widest possible range of photographic imaging requirements; And end User environments. The graphic standards today, are what sells "your products" tomorrow.

UNIVERSAL MEMBRANE SWITCH/KEYBOARD ENCODERS

Low Key introduces the USE-144 universal encoder series, providing a pure PC encoding interface for Low Keys custom membrane switch/keyboard designs. The USE-144 is software configurable which can be used with any contact type keyboard with a switching matrix up to $12 \times 12 = 144$ keys.

ASSEMBLY SERVICES

Low Key provides turn-key assembly and testing of display, driver and controller boards, in conjunction with specific switch/keyboard related applications. One stop shopping lessens the USER exposure to costly delays and confusion with multiple sources.

LOW KEY CORP. 105 MAPLEWOOD AVE. / GLOUCESTER, MA 01930-1195 / (508) 281-0448 FAX (508) 281-6321

low key

THERE IS NO GREATER PRIORITY AT LOW KEY THAN THE COMMITMENT TO QUALITY & DESIGN EXCELLENCE

MEMBRANE SWITCHES

A Low Key membrane switch consists of a decorative, silk screened graphic overlay combined with conductive inks on a polyester carrier which, when assembled, forms a low voltage switching device.

Low Key membrane keyboards are sealed from the environment. This protects them from gross chemical and atmospheric contamination. Having no moving mechanical parts to fail, the membrane keyboard is highly reliable, cost effective, and environmentally efficient.

OPERATING CHARACTERISTICS

- Operating Voltage 30Vdc
- Operating Current 20ma Typical
- Contact Resistance 2-50 Milliohms
- Circuit Resistance 20-30 Ohms*
- Life Cycles (MTBF) 5,000,000
- Activation Forces Ounces 3-12 oz
- Travel Inches 0.006 Typical
- Bounce, Milliseconds 20 Typical
- Operating Temperature 0 to 150°F** −18 to 65°C**

Normal range forces can be varied to meet your specifications.

* Depending on size and configuration of circuit.

** Selected lamination materials are available for high temperature applications.

DESIGN OPTIONS TO CONSIDER

A. Transparent lens for LCD display (UV-hardcoated—clear glossy)
B. Frosted windows for LEDs
C. Membrane switch contact with embossed locating ring
D. Die-cut keyways for pushbuttons
E. Electroluminescent lighting
F. Printed gas discharge display window (UV-hardcoated—transparent green)
G. UV-textured velvet finish
H. Membrane switch contact flat keypad surface
I. Printed deadfront legend for seven segment display, visible only when illuminated. A variety of colors available
J. Membrane switch contact with embossed keypad and stainless steel domes
K. Aluminum molded on machined subplates
L. Threaded studs and fasteners
M. Polycarbonate Face with UV-printed hardcoat finish
N. Embossed surface for decorative effect

Note: See Design Data Sheets for specific details on A through N.

CONSTRUCTION & FINISHING

DIE CUTTING

Low Key utilizes laser cut steel rule dies. Steel rule die cutting is carried out on all components of the keyboard. Typical tolerance levels of a steel rule die is generally ±0.010 for overall dimensions, and less for die cut holes, key ways, cut outs, and rounded corners.

EMBOSSING

Embossing of the keypad areas on membrane switch overlays is offered by Low Key, to accent key switch areas and to enhance tactile response. Embossed areas can raise circular, square, or rectangular keys more than 0.030 inches above the overlay surface.

TERMINATIONS

Low Key membrane keyboards are most commonly terminated with Dupont/Berg insulation displacement connectors. Common to all flat and flexible circuit connectors, the clincher assembly mates to 0.025 inch pins or headers on a 0.100 center to form a complete interconnection system. Low Key offers other types of interconnect systems in varying configurations and geometry.

SNAPDOMES

Low Key metal snap action domes provide positive feedback over a wide spectrum of operational conditions. Dome sizes range from 0.50 inches in diameter and smaller. Domes are fabricated from a passivated stainless steel spring material. Electrical contact is made when a snap dome is given sufficient finger pressure, causing the dome to snap over into a flattened shape. This forces the dimple to bring the top and bottom circuits into contact with each other. Snap domes are not in intimate contact with the circuit.

Typical specifications on Low Key tactile domes are:

Operational M.T.B.F.	1.0 million
Total Travel	0.015 max.
Pretravel	0.008
Overtravel Nominal	0.007
Trip Travel at Make Point gm	250 gm ±4
Tactile Range	medium

L.E.D.'S

If densities are shrinking, combine size efficient surface mounted L.E.D.'s within your next membrane switch design. Low Key's construction techniques provide unlimited SMD arrays at no increase in assembly thickness, typically 0.035″ to 0.042″.

ELECTROLUMNESCENT PANELS

The durable thin film of the EL panel offers long life, uniform lighting. They are individually addressable, and add as little as 0.011″ to your assembly.

Capacitance	.0035 ufd/in²
Phase Angle	Up to 75 degrees leading
Frequency	60-400 Hz
Voltage	115 AC

UNIVERSAL MEMBRANE SWITCH/KEYPAD . . . . . .ENCODER. . . . . .

Low Key offers the USE-144 micro-processor based encoder with its custom membrane switch and keyboard products. The USE-144 is software configurable, detecting and encoding up to 144 keys in matrices up to 12 x 12. Selectable output data provides either, PCXT/AT format or in RS232/432 formats. The USE-144 is powered from a single + 5v power supply. No + / − 12v supply is required even for true RS-232 signals. The encoder is uniquely size efficient 1.500″ x 3.500″ x 0.500″ and is easily mounted to the back of your custom membrane switch/keyboard. Complete technical data is available upon request.

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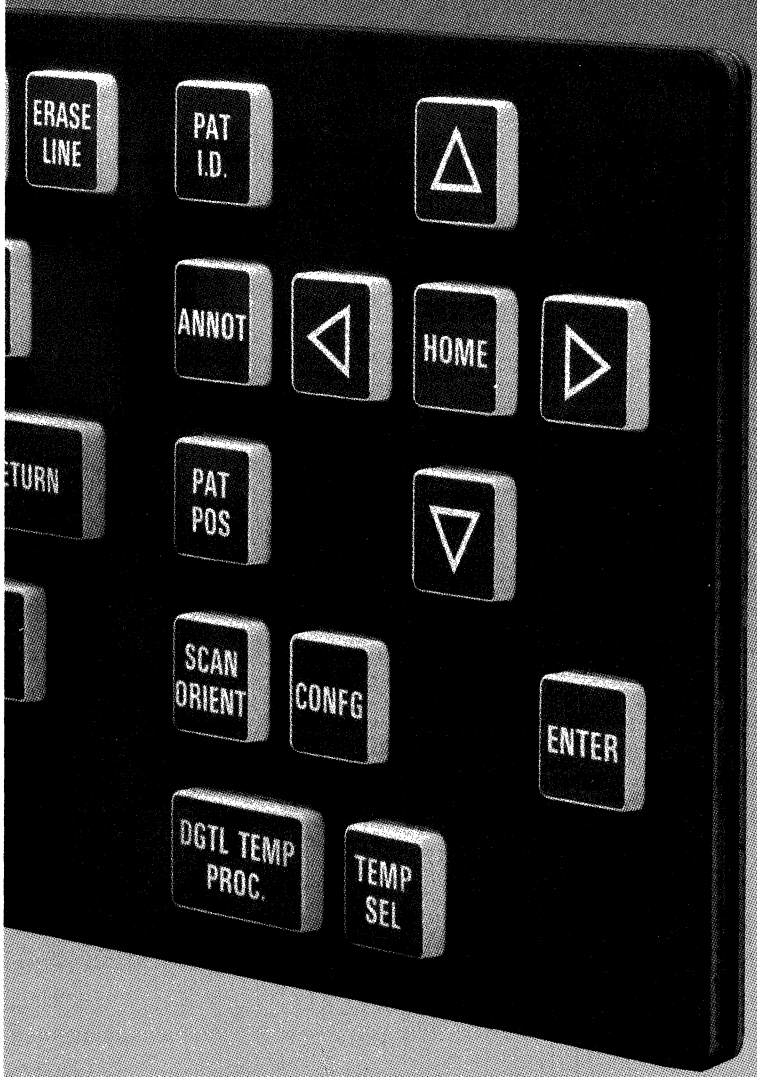
We Build More Custom Panels for More Leading Companies Than Anyone Else in the Industry...



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After nearly 50 years of leadership in the manufacture of quality graphic display panels... we keep proving ourselves on every order.

Our single source supplier approach — from design assistance, through in-house manufacturing, to on-time delivery — assures better cost, quality, and delivery control on every job.

We understand the complexities of panel assembly and can meet your most sophisticated design requirements with the widest range of materials and components.

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- ☐ PCB assemblies
- ☐ Elastikey molded silicone key arrays
- ☐ E-L lamps
- ☐ Touch screens
- ☐ Perma/TUF specialty products
- ☐ Nameplates/labels/filters

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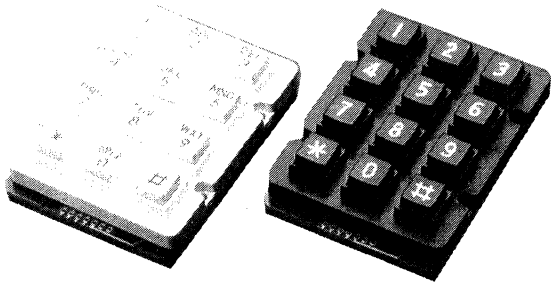
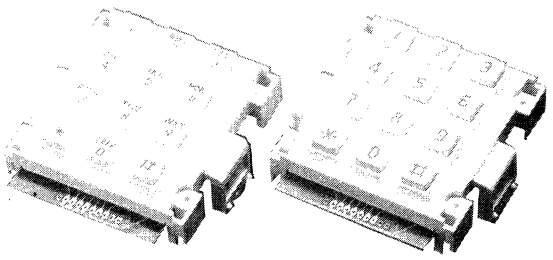
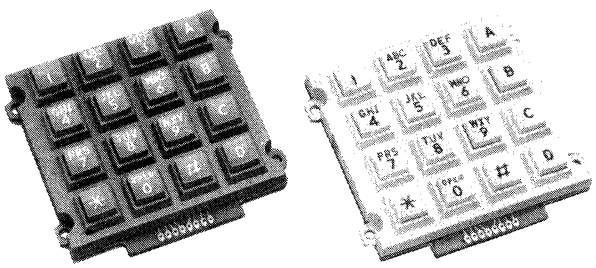


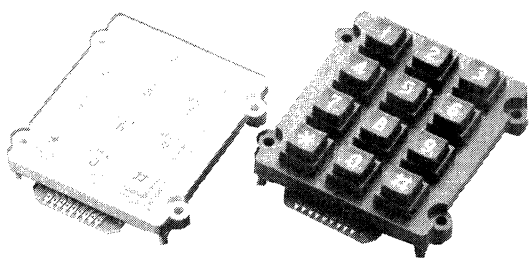
TKA2200 TKN2201



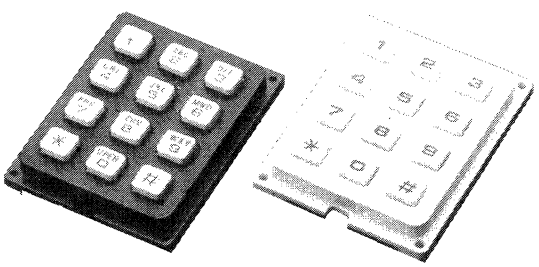
TKA2300 TKN2300



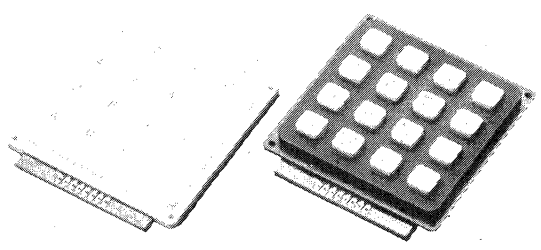
TKA8100 (NUMERIC KEYS) TKN8102



TKA2500 TKN2501



TKA2602 TKN2600



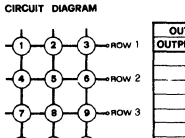
TKN6100 TKA6102

SPECIFICATIONS:

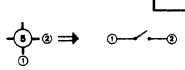
1) LZR ELECTRONICS offers a wide range of standard telephone keyboards utilizing silicone rubber as the elastic actuator and conductive silicone rubber pad as the contact element.
2) GENERAL SPECIFICATIONS:
   - Contact rating: 20mA, 24VDC
   - Contact resistance: 200 ohm max.
   - Life: 1,000,000 cycles per key
   - Operating Temperature: – 20°C to + 60°C
   - Storage Temperature: – 40°C to + 65°C
3) MATERIALS
   - Bezel: Material is ABS, or Polycarbonate: black, white or grey.
   - Double-shot keytops: Material is ABS, black or white.
   - PCB: Matrix type circuit, Grade HB or FR2 board with wire jumpers or double-layer jumpers with gold plated contacts
   - Terminal: Pin wafer.
   - Aluminum shield for ESD to be customer specified.
4) Custom designs are welcome. Minimum quantity 5K pcs.

CIRCUIT DIAGRAM

3 x 4

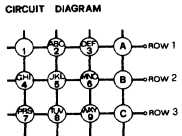


OUTPUT PIN NO.	SYMBOL
1	
2	COL 2
3	ROW 1
4	COL 1
5	ROW 4
6	COL 3
7	ROW 3
8	ROW 2
9	
10	

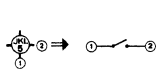


CIRCUIT DIAGRAM

4 x 4



OUTPUT PIN NO.	SYMBOL
1	ROW 2
2	ROW 3
3	COL 1
4	ROW 4
5	COL 2
6	COL 3
7	COL 4
8	ROW 1



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MEMBRANE SWITCHES



WHEN YOU NEED ASSURANCE, WE'LL BE IN TOUCH.

Over the years, many membrane switch manufacturers have come and gone, but at MEMTRON, we're stubborn, we've stuck to our guns. And now, when it comes to **quality, research and development, product warranties,** and **service,** we're

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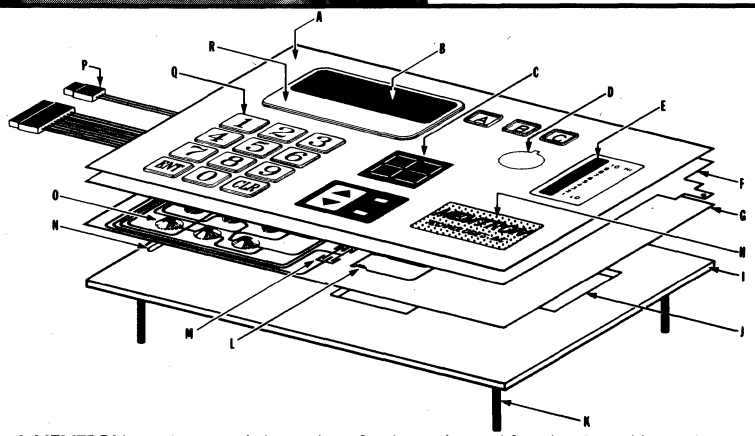

A MEMTRON membrane switch consists of a decorative and functional graphic overlay combined with conductive inks on a polyester carrier which, when assembled, form a low-voltage switching device.

MEMTRON membrane switches are completely sealed from the environment, making them extremely impervious to chemical and solvent attack. With no mechanical parts to fail, the panel is highly reliable and efficient.

SPECIFICATIONS OF SNAP DOMES

Life Expectancy, cycles	2,000,000
Total Travel, nominal inches	0.015
Pretravel, nominal inches	0.012
Overtravel, nominal inches	0.003
Trip Force at Operating Point, grams	300
Tactile Feel	high

STANDARD OPERATING CHARACTERISTICS:

Operating Voltage, volts dc	30
Operating Current, milliamps	30
Contact Resistance, ohms	2 to 10
Circuit Resistance, ohms*	20 to 100
Life Expectancy, cycles	5,000,000
Activation Force, ounces†	5 to 8
Travel, inches	0.006
Bounce, milliseconds	1 to 10
Operating Temperature, °F (°C)**	0 to 150 (-18 to 65)

*Depending on size and configuration of circuit.
†Normal range. Any force can be obtained to meet your specifications.
**Special laminations and materials are available for high-temperature applications.
Note: Contact Memtron engineering for special operating requirements.

DESIGN OPTIONS

A. **The Membrane Switch Overlay:** To meet special environmental and design conditions. May consist of polycarbonates, polyesters, or special-composition plastics.

B. **Transparent Display Windows:** Used primarily for viewing LCD displays. May consist of the clear, glossy overlay material, with or without U.V. hardcoating. Inserted lenses are also available.

C. **Tinted or Deadfront Display Windows:** Used primarily with LED or gas-discharged displays. May be printed or inserted lenses.

D. **Die-Cut Holes With Keyways:** For application of mechanical switches, in conjunction with the membrane switch, in higher voltage applications.

E. **Gloss UV Hardcoat on Textured Overlay:** Used to create an inexpensive transparency when using a pre-textured overlay material such as velvet polycarbonate.

F. **Shielding Layer:** May consist of solid foil or plastic layer printed with conductive inks. May be designed to guard against EMI, ESD, and RFI conditions.

G.-1 **Membrane Switch Composite:** Consists of layers of heat-stabilized plastics with printed circuitry and spacer layer. Assembled with special adhesives.

G.-2 **Printed Circuit Board Construction:** Consists of tin-lead reflowed copper-etched circuits on glass epoxy or other PCB substrate.

H. **Selective Texturing:** UV hardcoat textures may be applied in selected areas on gloss overlay materials to impart abrasion, chemical attack, or glare resistance.

I. **Sub-Plates:** A rigid plate used for mounting membrane switches to an enclosure. May consist of aluminum, glass epoxy, or other materials.

J. **Sub-Plate Cut-Outs:** To allow the viewing of displays mounted on a PC board behind the sub-plate.

K. **Studs and Stand-Offs:** For fastening sub-plates to enclosures or for fastening PC boards and displays to sub-plates.

L. **Surface-Mounted Embedments:** May consist of surface-mounted LEDs within the membrane switch composite and powered through the switch circuits.

M. **Standard or Micromotion Switch Design:** Consists of upper and lower circuit layers separated by a 5- to 7-mil spacer. May also consist of a single circuit layer with shorting pad separated by a spacer.

N. **Tail Cut-Out:** An opening in the sub-plate to allow connection of switch with logic board.

O. **Domed (Tactile) Switch Design:** Consists of metal or plastic snap domes for touch response when depressing a membrane switch keypad.

P. **Connector:** May consist of prong or receptacle types with or without housing. May also consist of solder tabs or exposed traces for friction-fit connection.

Q. **Embossing (Functional):** Raised or embossed keypad areas to allow room for tactile domes. Also serves as key referencing device when keypad is ring embossed.

R. **Embossing (Decorative):** Embossed areas to enhance design or draw attention to special features. May also allow space for special legend inserts behind overlay.

For the name of our nearest representative or for literature and details, call collect 1-517-652-2656 or 1-800-234-7525

Or write Memtron Technologies, 1400 Weiss Street, Frankenmuth, MI 48734

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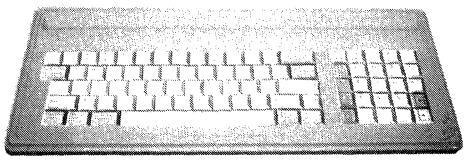
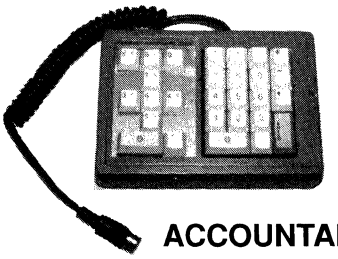
CUSTOM KEYBOARDS

WITH SEALED CONTACTS



INDUSTRIAL KEYBOARD

The NK550I combines an alpha numeric membrane key pad with a Nema 13 enclosure to produce a ruggedized keyboard product for use in demanding industrial environments. The NK505I is resistant to abrasion, water, oils, fuels and many solvents.



ACCOUNTANTS PAD

ACCOUNT PAD 900 is designed to significantly reduce the hand movements required by Numeric Data Entry Professionals in Spread Sheets, Inventory Control Accounting Systems and related applications. Use alone or side by side with your IBM™ PC, XT, AT, or compatible keyboard.

FULL TRAVEL KEYBOARDS

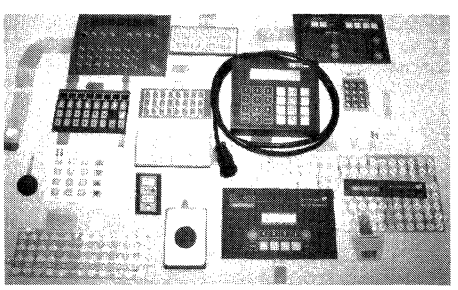
At New England Keyboard we design and manufacture keyboards according to your specific needs. Our modular design concept and computer aided robotic assembly equipment enable us to achieve short lead times and the economies of large scale production in small to medium runs.



- Linear or Tactile Feedback
- Low Profile Din Compliance
- 50,000,000 Key Life
- Customer Defined Electronics
- Military Keyboards
- Choice of Enclosure Styles
- ASCII, IBM™, Apple™ Electronics
- Many Hardware Options
- Backlighted Key Modules
- Choice of Key Colors, Legends
- Relegendable Keycaps

MEMBRANE SWITCHES

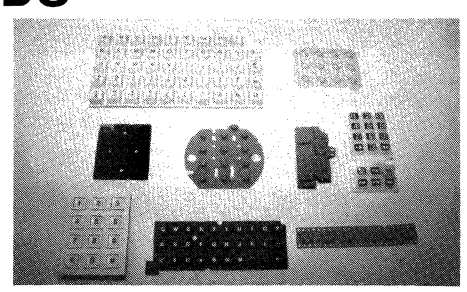
Flat panel membrane switches can be manufactured to your exact specification. Special solvent resistant textured overlays stand up to the harshest environments. NEK membranes are currently on the job in the Military, in-the-vehicle and the commercial kitchen.



- Unlimited Color Choices
- Tactile Feedback Option
- Clear and Tinted Windows
- LEDs Available
- Embossing
- Alone or with Electronics
- Choice of Connectors
- Dead Front Panels
- Integrated Displays

RUBBER KEYPADS

These rugged short stroke keypads offer substantial design flexibility. Key size, color, shape, height, legends and layout can be designed to exactly meet your requirements.



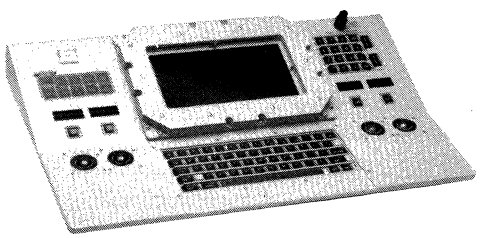
- Corrosion Resistance
- Plastic Bezels Available
- Glow in the Dark Rubber
- Sealed Contacts
- -40°C to 85°C Temp Range
- Tactile Feedback
- Choice of Key Force

RUGGEDIZED SWITCH PANEL & CUSTOM KEYBOARD DESIGNS

CORPORATE FACILITIES: 80 CABOT COURT, HAUPPAUGE, L.I., NY 11788, TELEPHONE: (516) 435-8300 • FAX (516) 435-8458
5606 CORPORATE AVENUE, CYPRESS, CA 90630, TELEPHONE: (714) 527-0561 • FAX (714) 527-7552

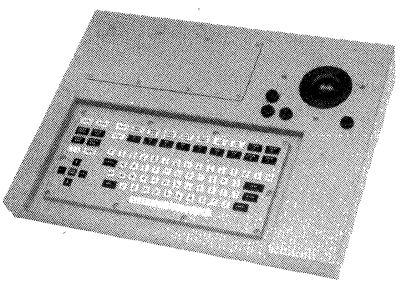
ORBIT INSTRUMENT CORP.

MILITARIZED KEYBOARD / BALL TRACKER ASSEMBLIES



OPERATOR CONTROL TRAY
KEYBOARD TRACKBALL

INSTALLED IN CONSOLES AS REMOVABLE ASSEMBLIES FOR EASY ACCESS



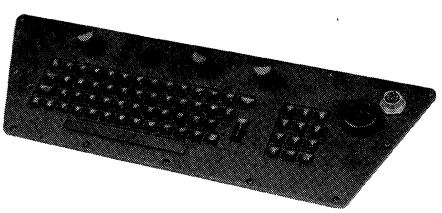
OPERATOR CONTROL TRAY
KEYBOARD TRACKBALL

MIL – E – 16400 / MIL – E – 5400

BACK LIGHTED KEYBOARDS & CUSTOM PANEL DESIGNS



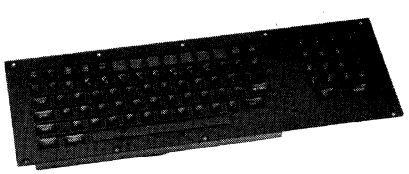
KEYBOARD



KEYBOARD OPTICAL ENCODERS, FORCE STICK

FEATURING:

- ORBIT LOW PROFILE SNAP ACTION SWITCH TECHNOLOGY
- SWITCHES CAN BE SPLIT LEGEND OR TRI SPLIT
- RUGGED DESIGN CONSTRUCTION
- RELEGENDABLE KEYCAPS
- FULL TRAVEL
- CUSTOM ENCODING
- BACKLIGHTED



KEYBOARD

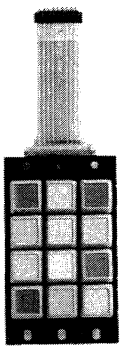


INTEGRATED SWITCH PANEL

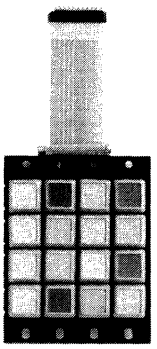
Preh Electronic Industries, Inc.
470 East Main Street, Lake Zurich, IL 60047-2578 U.S.A.
Phone (708) 438-4000 • FAX 708-438-5522

RECONFIGUREABLE KEYPADS

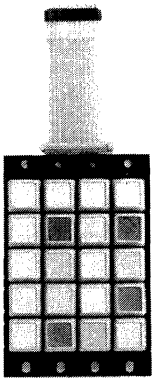
NW Series Versatility.... only from Preh



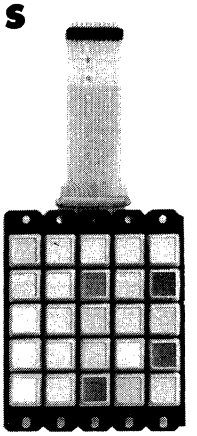
3x4 75201-081/5000



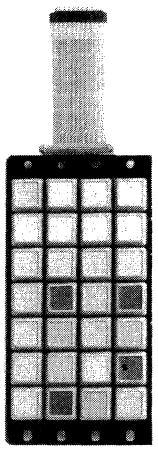
4x4 75201-082/5000



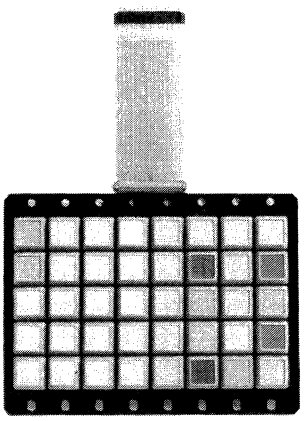
4x5 75201-083/5000



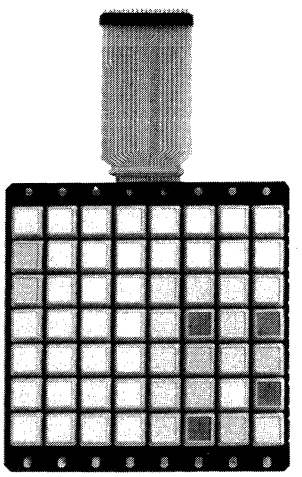
5x5 75201-089/5000



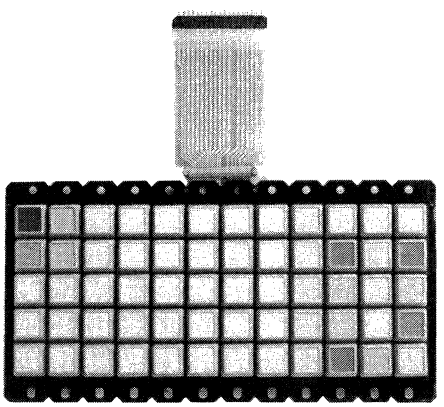
4x7 75201-084/5000



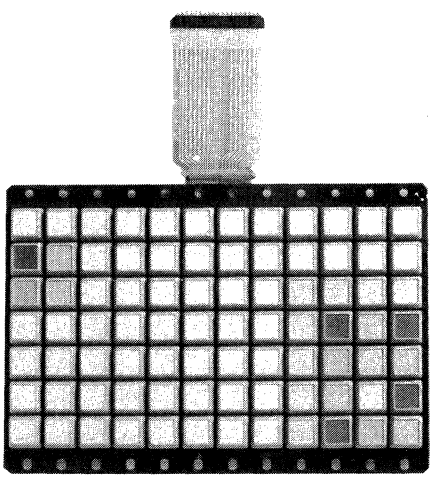
8x5 75201-090/5000



8x7 75201-091/5000



12x5 75201-085/5000



12x7 75201-063/5000

The NW Series Incorporates unique, full travel, membrane construction for high quality and reliabiiity in reconfigureable keypads that are dustproof and waterproof.

With one simple tool you can easily remove, relegend and reconfigure NW Series keypads. Universal guideframes allow use of either single, double, triple or quad keys in any orientation or location on the keypad. And, multiple switch positions covered by double, triple or quad keys can be selectively activated. Dead-key covers are available for unused key positions.

Preh patented key leveling assures full, level travel and consistent actuation with a force of only 2.1 ounces (0.6 N) regardless of key size.

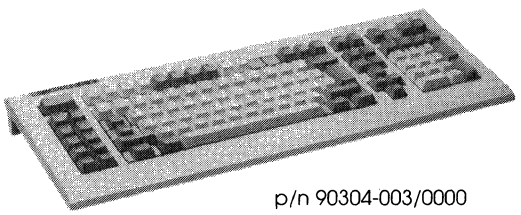
Keypads come complete with single-position grey keytops, white legend inserts, plastic lenses, key puller and keypad connector. Accessory keytops and colored inserts are also available.

Preh Electronic Industries, Inc.
470 East Main Street, Lake Zurich, IL 60047-2578 U.S.A.
Phone (708) 438-4000 • FAX 708-438-5522

COMMERCIAL KEYBOARDS

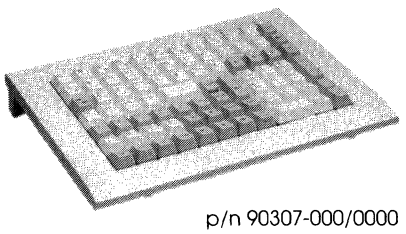
IBM PC/XT, AT and PS/2 COMPATIBLE

Preh commercial keyboards (except Series 2000) are splash proof and dust proof per IP-54 of the International Protection standards.



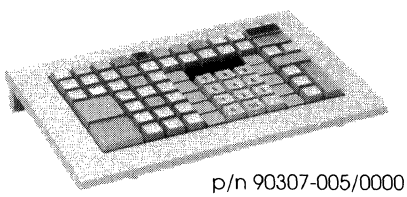
p/n 90304-003/0000

The PREH Commander AT-3 is a professional keyboard utilizing PREH's full-travel membrane technology with tactile feel to provide the most comfortable man-machine-interface for high speed, accurate data entry. The AT-3 features 114 keys including 22 function keys that can be reprogrammed and relegended using the PREH programming diskette and relegendable keycap set. Key-caps are double-shot molded for legend integrity.

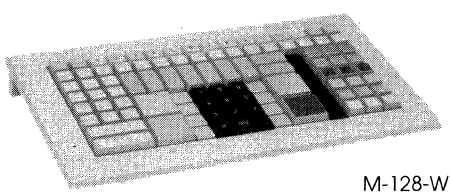


p/n 90307-000/0000

The PREH Commander M-84-F is a space saving MINI AT keyboard designed for special applications. With 79 row and column key positions it contains all the important functions of other IBM compatible keyboards. It measures only 7.6" x 11.4". Applications include banking, restaurants, hotels, process controls, etc. The full travel membrane technology keyboard has an IP rating of 54 and features positive tactile feel.

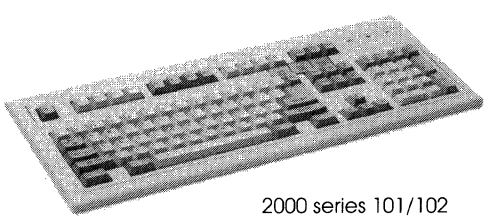


p/n 90307-005/0000



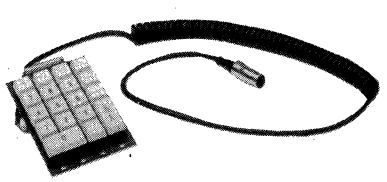
M-128-W

REPROGRAMMABLE KEYBOARDS PREH offers two models of reprogrammable keyboards, the 84 key M-84-W and the 128 key M-128-W. In addition to being reprogrammable, both are relegendable and reconfigureable. Complete with software, these models enable the user to program and legend the keyboard to satisfy a broad spectrum of specific applications in the POS area. Programming is easily accomplished through the use of the PREH programming diskette. Up to 120 characters can be programmed on a single key, including control functions. All keytop sizes (1x1, 1x2, 1x3, and 2x2) are interchangeable and easily relegendable. Positive tactile feel and an IP rating of 54 are achieved through PREH's unique full-travel membrane switching technology. In their enclosures, the M-84-W measures 7.6"x 11.4" and the M-128-W measures 8.5"x 14.5".



2000 series 101/102

LOW COST KEYBOARDS The Series 2000 101/102 Keyboards have combined an aesthetically appealing design with conductive rubber switching technology to provide a reliable high quality keyboard at a reasonable price. Features include switch selectable AT/XT operation, relocation of 16 keys, small footprint (134 sq in), 2x or 4x repeat rate for any key or keys, positive tactile feel and double shot keycaps for legend integrity.

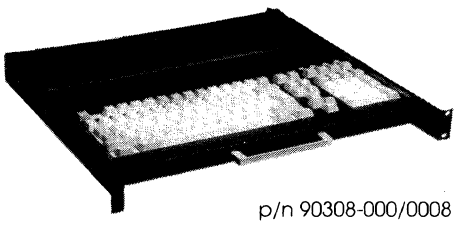


NW Series keypads for IBM/AT applications The full range of Preh NW Series keypads are available with integrated electronics (including 5 pin DIN connector and coil cord) for direct connection to IBM/AT processors. NW Series keypads are reconfigureable and relegendable, and have programable function keys.These keypads offer easy/economical numeric input for control devices interfacing with IBM/AT systems.

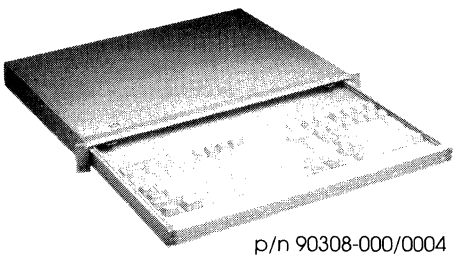
Preh Electronic Industries, Inc.
470 East Main Street, Lake Zurich, IL 60047-2578 U.S.A.
Phone (708) 438-4000 • FAX 708-438-5522

INDUSTRIAL KEYBOARDS

IBM PC/XT, AT and PS/2 COMPATIBLE
For Harsh Environmental Conditions

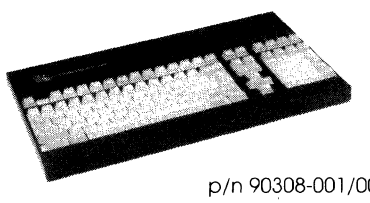


p/n 90308-000/0008

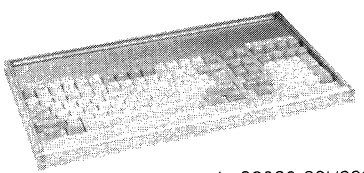


p/n 90308-000/0004

RACK MOUNT VERSIONS These full-travel keyboards are specifically designed for 19" rack mounting. With an IP Rating of 54, they are impervious to dust and liquid spills that are often found in industrial installations. The IP 54 Rating is achieved by PREH'S unique full-travel membrane technology combined with sealed electronics (IP 65). Available in either steel with industrial black finish or brushed aluminum. The aluminum version is completely enclosed when in the closed rack position. The steel version has friction lock-in and positive detent lockout features. Each keyboard requires only one unit of rack space. Other standard features include 12 reprogrammable function keys, separate cursor keys, positive tactile feel and three year warranty.

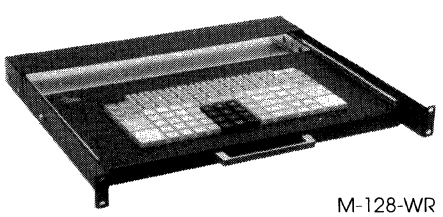


p/n 90308-001/0005

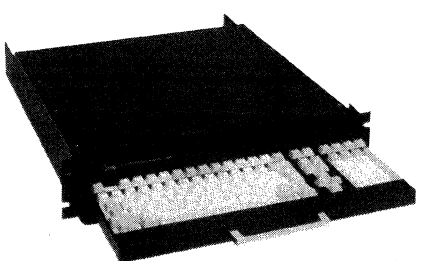


p/n 90308-001/0002

DESK TOP VERSIONS These full-travel keyboards have all the basic technical specifications and qualifications of the rack mount keyboards described above, except they are designed to be used with industrial computer installations requiring a detached or desk top orientation. They are available in either steel with industrial black finish or brushed aluminum. The aluminum version has adjustable feet for angle determination and has a 6' straight cord. The steel version has fixed rubber feet to provide the appropriate 11° tilt and comes equipped with a coil cord. Standard features include 12 reprogrammable function keys, separate cursor keys, positive tactile feel and three year warranty.



M-128-WR



p/n 90308-000/0011

REPROGRAMMABLE RACK MOUNT The PREH MODEL M-128-WR is a reprogrammable, reconfigureable, relegendable keyboard in a rack mount for industrial applications . Up to 120 characters can be programmed on any single key, including control functions (programming diskette provided). All keytop sizes (1x1, 1x2, 1x3, and 2x2) are interchangeable and easily relegendable. The full-travel membrane technology keyboard has an IP rating of 54 and features positive tactile feel. The M-128-WR requires only one unit of rack space.

KEYBOARD IN NEMA-4 ENCLOSURE The PREH Commander 1 9RN Rackmount keyboard is specifically designed for extremely hostile environments. The keyboard itself has an IP rating of 54 (equiv. to NEMA -12). The all steel, gasketed NEMA-4 enclosure features a hinged, water-tight door, and rear extension rails for secure mounting. Standard features include 12 reprogrammable function keys, separate cursor keys, full-travel positive tactile feel and 3 year keyboard warranty. Requires only 2 units of rack space.

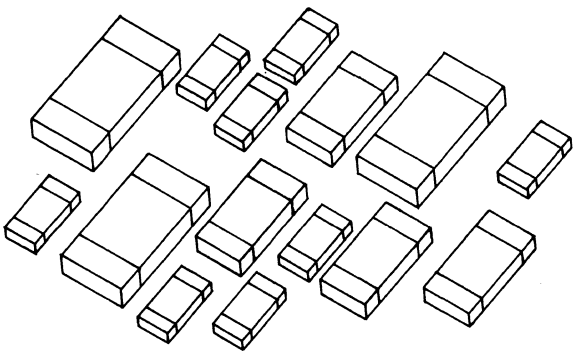
QUALITY THERMISTOR, INC.

2147 CENTURION PLACE / BOISE, ID 83709 / PHONE (208) 377-3373 FAX (208) 376-4754

PRECISION COMMERCIAL AND MILITARY GRADE THERMISTORS

NTC SERFACE MOUNT THERMISTOR

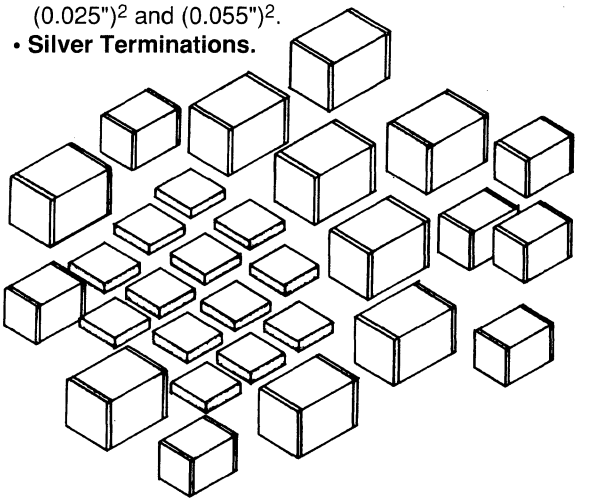
- **Standard Package Sizes:** 0805, 1005 and 1206.
- **Solder Leach Resistant Pads.**



- **R25C Values:** 1.0K to 10.0MEG
- **Tolerances:** F (1%) to K (10%)
- **Meets or Exceeds MIL-T-23648 Where Applicable.**
- **Ideal for Pick and Place**
- **Packaging:** 8MM Tape and Reel or Waffle Package (ESD Available).

NTC AND PTC THERMISTOR DIE

- **Standard Package Sizes:** $(0.025")^2$ and $(0.055")^2$.
- **Silver Terminations.**



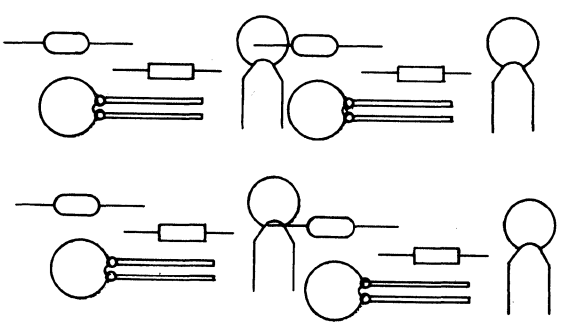
- **R25C Values:** 10 Ohm to 10.0MEG
- **Tolerances:** J (5%) and K (10%)

PTC DIE

- **Gold Terminations.**
- **Standard Size:** $(0.032")^2$ X 0.050".
- **R25C Values:** 10 to 10.0K Ohm.
- **Tolerances:** J (5%) and K (10%)

NTC

- **MIL-T-23648:** RTH44 (/20), RTH16 (/6)
- **Commercial:** ±0.2C Precision Curve Tracking Tolerance to ±0.1C Point Match.
- **Features:** Glass Hermetic Sealed D035 and D07 Packages. Epoxy and Phenolic Coated Packages (Radial). High Negative TCR.



PTC

- **MIL-T-23648:** RTH22 (/9), RTH42 (/19)
- **Commercial:** From ± 1% to ± 10% At 25 Degree Celcius.
- **Features:** Glass Hermetic Sealed D035 and D07 Packages. Linear Resistance vs. Tempco +0.7% Delta "R" per Degree Celcius.

FOR ASSISTANCE CALL

(208) 377-3373

THERMISTORS, THERMOCOUPLES, & SENSORS

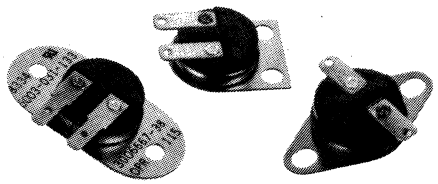
Manufacturer	Starting EEM Page No.	NTC	PTC	Leaded Chip	Bar	Cube	Disc	Hybrid Chip	Inter-changeable	Switches, Temperature Sensing	Sensors, Temperature	Inrush Current Suppressors	Thermo-couple	Other Features
Airpax/Frederick Div.	B•1832	√	√								√			
Best Technology Inc.	B•1833													RMS current measurement
Beta Therm	B•1834	√		√					√		√			
Dale Electronics	B•1839	√		√			√	√	√		√			
Elmwood Sensors	B•1842									√	√			
Fenwal Electronics	B•1845	√	√	√			√		√		√	√		
Ketema Rodan Div.	B•1846	√	√	√	√	√	√	√	√	√	√	√		
Keystone Carbon Co.	B•1849	√	√				√			√	√	√		
Murata Erie, N. A.	B•1853	√	√								√	√	√	
Omega Engineering	B•1854									√	√		√	Platinum RTDs
Philips Components	B•1856	√	√								√	√		Varistors
Quality Thermistor Inc.	B•1858	√	√	√				√	√		√		√	
Selco Products	B•1861						√			√	√			
Sensor Scientific Inc.	B•1862	√		√			√	√	√		√			
Therm-O-Disc (Emerson)	B•1865	√	√	√			√			√	√	√		
Therm-O-Disc (Midwest)	B•1866	√	√	√			√			√	√	√		
U.S. Sensor	B•1871	√	√	√	√	√	√	√	√		√	√		SMD, Networks
Warren GV	B•1870									√	√			Air flow sensors

THERMOSTATS

Manufacturer	Starting EEM Page No.	Low Profile	Grounded	Sealed (Immersion)	Isolated Contact	Isolated Case	Hermetic Seal	Disc
Airpax Corp.	B•1832	√	√	√	√	√	√	√
Elmwood Sensors	B•1842	√		√			√	√
Quality Thermistor	B•1858			√		√	√	
Selco Products Co.	B•1861	√						√
Therm-O-Disc (Emerson)	B•1865							√
Therm-O-Disc (Midwest)	B•1866							√
Warren GV	B•1870	√		√	√	√	√	

THERMOSTATS

Accurate. Reliable. In standard and custom design. Contact Airpax, Husky Park, Frederick MD 21701. (301)663-5141. Fax (301)698-0624. A North American Philips Company.

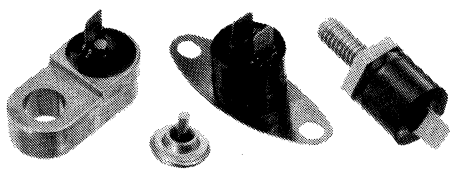


Series 5003—Low-Profile Thermostat

Extremely thin, lightweight, wafer-type thermal switch that provides fast, positive response, excellent repeat reliability, good shock and vibration resistance over a wide operating range.

Features:

- Overall depth is only .250".
- Operating temperature range from 15°F to 355°F.
- OPR or CLR contacts are available.
- 120 VAC 5 amp, 240 VAC 3 amp.
- Weight 2.3 grams.
- Variety of mountings and terminations available.
- Environmental sealing available.
- Approval: CSA UL

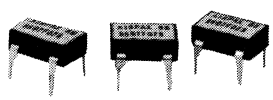


Series 5011—Low-Cost, Grounded Thermostat

A very low-cost thermostat that will meet a number of exacting requirements for shock and vibration resistance. It is hermetically sealed and offers fast response. Plug, wire-lead, isolated base and 1/4-20 bossmountings are available.

Features:

- Low-cost, grounded unit .
- Operating temperature range from 15°F to 525°F.
- Many mounting packages available: 120 VAC, 32 VDC, 3 amp.

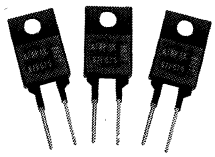


Series 6600—PC Board-Mountable Thermostat

A miniature bimetallic snap-acting thermostat in an 8-pin N8A Dual In-Line Package. Single pole/single throw switch assembly available in either normally closed, open on rising temperature or normally open, close on rising temperature configurations. Compatible with auto-insertion equipment, the Series 6600 will withstand wave soldering and board washing operations. Typical uses include turning on an indicator light, changing the speed of a fan or switching on a control circuit.

Features:

- Operating temperature range 40°C to 120°C.
- 1 amp 48 VDC switching capability.
- Standard 8-pin N8A Dual In-Line Package for auto-insertion compatibility.
- OPR or CLR contacts available.
- Sealed to withstand wave solder and board washing.

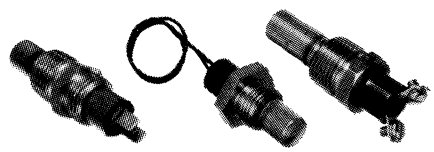


Series 6700—Surface Sensing Thermostat

This miniature, bimetallic, snap-acting thermostat conforms to the International product package standard Y220/10220. Included are gold plated silver cross bar contacts rated for 100,000 cycles at 5 VDC, 1mA resistive and 30,000 cycles at 48 VDC/120 VAC, 1 amp resistive. Excellent repeatability over an operating temperature range of 40°C to 110°C.

Features:

- Operatingtemperature range. 40°C to 110°C.
- T0-220 packaging—compatible with hiqh-speed automated assembly equipment.
- Epoxy sealed for wave soldering and cleaning.
- Approval: VDE pending, CSA UL

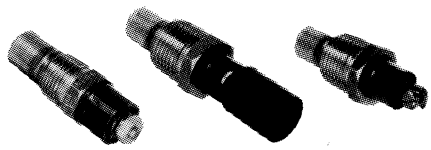


Series 5100—Isolated Case Thermostat

This two-terminal, immersion-type hermetically sealed thermostat can be used on water-cooled engines, hydraulic systems, degreasers, industrial air compressors and tanks where liquids are heated. Its isolated contact is designed to switch 110 VAC within your control circuitry. It offers rapid response to liquid or air temperature.

Features:

- Hermetically sealed.
- All stainless T.I.G. construction.
- Operating temperature range from 15°F to 525°F.
- 120 VAC 3 amp and 240 VAC 1.5 amp models available.
- Approval: CSA UL

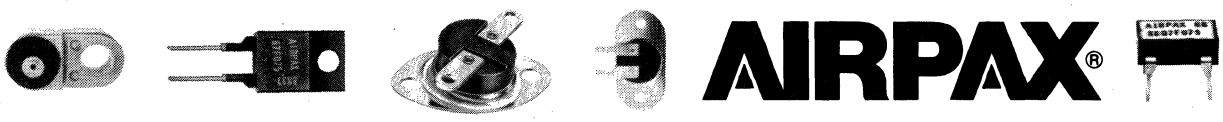


Series 5020—Hermetically Sealed Thermostat

This snap-action hermetically sealed temperature control is designed for use wherever a sealed unit and high vibration resistance are required. Protects engines from damage from overheating by sensing high water or oil temperatures. Snap-action disc located in the very tip of the probe assures rapid and true response to liquid temperature. The all-welded construction (and grounded case) of this sealed thermostat ensures meeting Thermal Shock Specifications of MIL-STD-202, Method 107, Test Condition B. The tube will withstand a Pressure Exposure Limit of 1500 PSI. Insulation Resistance of 50 megohms minimum at 500 VDC.

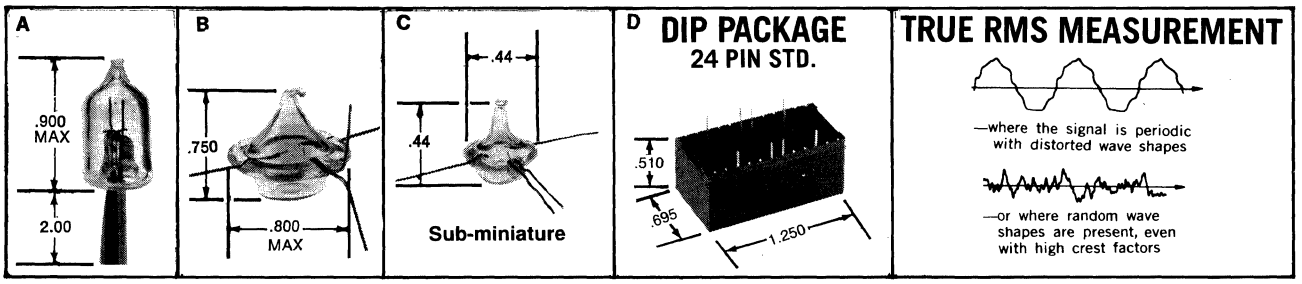
Features:

- Hermetically sealed.
- Grounded case.
- Operating temperature range from 15°F to 525°F.
- 32 VDC, 3 amp.
- 5020 13 Conforms to MIL-12285/1.



BEST TECHNOLOGY INC.
400 Boren Ave. N., Seattle, WA 98109 206/382-1300 FAX 206/382-0186

VACUUM THERMAL CONVERTERS



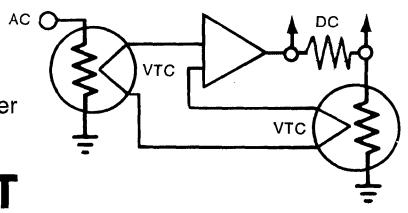
Vacuum Thermal Converters (VTC) provide a simple solution to a difficult design problem. That problem is, economically measuring the true RMS value of a current independently of waveform and frequency.

While VTCs have been in existence for many years, their work is often not understood. The basic structure looks like a simple incandescent light bulb. The outer shell is clear glass. There is a near total vacuum inside. The active elements are a heater wire with a thermocouple suspended at midpoint.

Current flows through the heater wire and the thermocouple measures the temperature at midpoint. This midpoint temperature is proportional to the true RMS current through the heater wire. The ability to calibrate at DC and measure AC accurately is inherent.

Operating range is from 0 to 65 MHz for standard pattern models, up to 300 MHz for UHF pattern and up to 1 GHz for miniature UHF pattern models. Sub-miniature models are supplied in a low profile glass shell.

D package will house one or two sub-miniature units. Ideal for T.C. Control, Spare or Matched Pairs.



Typical application.
RMS — DC Converter
Using two VTCs

APPLICATIONS CHART

VTCs are used as basic AC-DC transfer standards as well as other instrumentation applications including vacuum measurement.

VTC Type	Current mA	Freq MHz	R/E %*	Applications
UHF	2.5-1000	0-300	.04	General purpose
UHF Matched Pairs	2.5-1000	0-300	.005	Voltmeters
Sub-Min. UHF	2.5-1000	0-1GHz	.08	Artificial squibs
Sub-Min. UHF Matched Pairs	5	0-1GHz	.005	Voltmeters
Std. Pattern	1-1000	0-65	.005	Low current models available
Std. Pattern Matched Pairs	1-1000	0-65	.005	Voltmeters
Low AC-DC Transfer error	5-100	0-65	.005	AC-DC transfer std.
Vacuum Gages	1-1000	NA	NA	Vacuum measurement
Open Heaters	1k-50k	0-300	.20	High current RF

* Best reversal error, standard is 0.2%

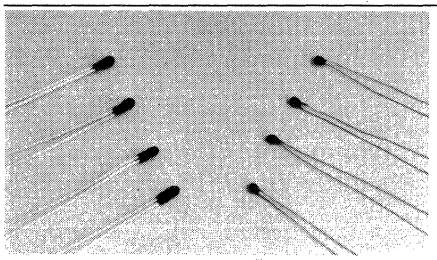
POPULAR MODELS

Model No.	Range mA	Heater Resis. Ohms ±10%	Couple Resis. Ohms ±10%	O/C EMF ±12% mV	Max. Overload %	See Fig.
S1	1.0	1750	13	7	250	A
S4	2.0	800	12	7	250	A
S7	5.0	90	8	7	250	A
S9	10.0	25	8	7	250	A
S48	5.0	180	8	20	200	A
S50	10.0	125	8	20	200	A
S102	5.0	125	8	10	200	A
S104	10.0	40	4	10	200	A
U1	5.0	90	8	7	250	B
SUB MIN U1	5.0	90	8	7	250	C or D
U2	10.0	25	8	7	250	B
U27	2.5	200	8	7	250	B

Hundreds of other models available. Thermocouple vacuum gauges to custom order. Write or call for application assistance.

BetaTHERM NTC Thermistor Devices

INTERCHANGEABLE ***BetaCURVE*** *THERMISTOR DEVICES*



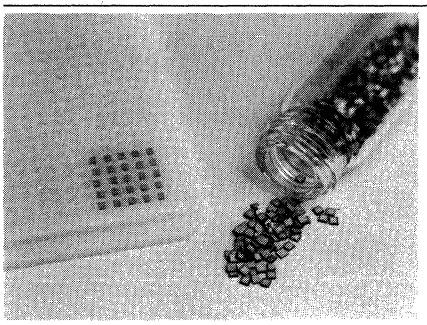
FEATURES
- Available in all Chip & Probe styles, insulated & non-insulated leads
- Superior Temp. Accuracy & Interchangeability
- Rugged—Reliable—Cost Efficient
- Proven Stability and Life Capability
- Rapid Time Response
- Rated from −55 to 150°C.
- 1.0 mW/°C Dissipation Constant
- 10 sec. Maximum Time Constant

BetaCURVE THERMISTOR DEVICES
(±0.2°C 0 to 70°C.)

Nominal R @ 25°C. (ohms)	Part Number	R-T Curve #	0–50°C. Beta Value (K.)	α @ 25°C. (%/°C.)
100	0.1K1A1	1	3108	−3.5
300	0.3K1A1	1	3108	−3.5
1,000	1K2A1	2	3263	−3.7
1,000	1K7A1	7	3422	−3.9
2,252	2.2K3A1	3	3892	−4.4
5,000	5K3A1	3	3892	−4.4
10,000	10K3A1	3	3892	−4.4
10,000	10K4A1	4	3749	−4.0
30,000	30K5A1	5	3811	−4.3
50,000	50K6A1	6	4143	−4.7
100,000	100K6A1	6	4143	−4.7

+ *BetaCURVE* devices have ±0.2%C. curve track tolerance capability over the recommended use temperature span. Products with tighter deviation or extended temperature range can be factory ordered.
+ + Interchangeable *BetaCURVE* products with ±0.2 to 1.0 deg. C curve-track tolerance capability over 0–70°C are available. Products with tighter dT deviation or extended temperature can be factory ordered.

LEADLESS ***BetaCHIP*** *THERMISTOR*



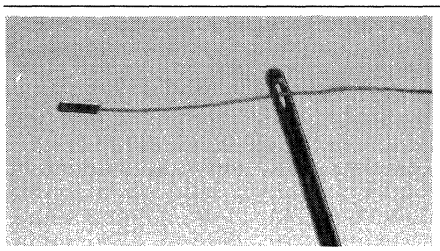
FEATURES
- Available with either Silver or Gold Terminations
- Top and Bottom Metallization
- Rapid Time Response
- Rated from −55 to 150°C.
- Surface Mount Capability
- Uniformly Sized for Pick & Place Assembly
- 1.0 mW/°C. Dissipation Constant
- 10 sec. Maximum Time Constant

LEADLESS *BetaCHIP* THERMISTOR
(±10% Tolerance @ 25°C.)

Nominal R @ 25°C. (ohms)	"Chip" Part Number	R-T Curve #	0–50°C. Beta Value (K.)	α @ 25°C. (%/°C.)
100	0.1K1C2	1	3108	−3.5
300	0.3K1C2	1	3108	−3.5
1,000	1K2C2	2	3263	−3.7
1,000	1K7C2	7	3422	−3.9
2,252	2.2K3C2	3	3892	−4.4
3,000	3K3C2	3	3892	−4.4
5,000	5K3C2	3	3892	−4.4
10,000	10K3C2	3	3892	−4.4
10,000	10K4C2	4	3749	−4.0
30,000	30K5C2	5	3811	−4.3
30,000	30K6C2	6	4143	−4.7
50,000	50K6C2	6	4143	−4.7
100,000	100K6C2	6	4143	−4.7

Standard *BetaCHIP* Leadless Thermistor Elements available in other R_{25} tolerance limits.
BetaCHIP Products with tighter R_{25} tolerance or sorted at T other than 25°C can be factory ordered.

microCHIP *THERMISTOR PROBES*



FEATURES
- High Stability Probe (Industrial & Medical Applications Typically)
- Temperature Accuracy +0.1 C.
- Extremely small profile diameter
- Rapid Time Response Design
- Time Constant — <1.0 sec.*

microCHIP THERMISTOR PROBE
CHARACTERISTICS DEVICE AVAILABILITY

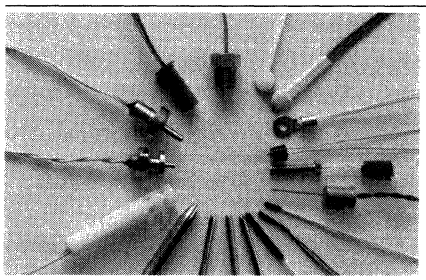
Part No.	Material No.	Ro @ 25°C (ohms)	Temp. Tol. (°C)	Max Exposure Temp. (°C)	Typical Application Use
2K7MCD1	7	2,000	0.2	150	Laboratory Instrument Probe
10K3MCD1	3	10,000	0.1	150	Medical Probe
22K7MCD5	7	22,000	0.1	150	Catheter Probe
100K6MCD1	6	100,000	0.2	150	Fast Response Probe

Other Styles, Resistance Values and Tolerances Available.
Contact BetaTHERM Application Engineering for details.

BetaTHERM Corporation • 910 Turnpike Road, Shrewsbury, Massachusetts 01545 • 508-842-0516 Fax: 508-842-0748
BetaTHERM Ireland Ltd. • Ballybrit Industrial Estate, Galway, Ireland • 353-091-53238 Fax: 353-091-53615

BetaTHERM **NTC Thermistor Devices**

CUSTOMIZED PROBE ASSEMBLY CONSTRUCTIONS (TYPICAL)

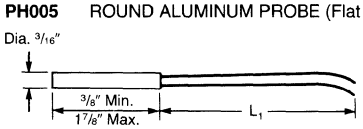


FEATURES

- Customized for Each Application
- Cost-Effective Designs to Performance Specs
- Prompt Betatherm Design/Build Execution
- Rugged—Reliable—Stable—Constructions
- Surface, Immersion and Gas Sensing Designs
- Customized Sense Element for Each Application

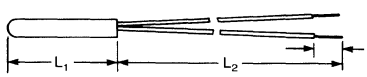
CONFIGURATIONS

PH005 ROUND ALUMINUM PROBE (Flat End)



Available with Individual (Teflon or PVC) Insulated Wire or (Teflon or PVC) Insulated Cables.

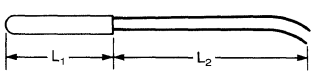
PH006 ROUND GLASS PROBE (Spherical End)



Standard Glass Dia.
.107" ± .005" O.D.
.090" ± .005" O.D.
.057" ± .002" O.D.

Available with Individual (Teflon, PVC or Varnish) Insulated Wire.

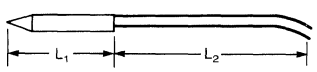
PH008 ROUND T304 T316 STAINLESS STEEL PROBE (Spherical End)



Available with Individual Lead Wires or Cable. Teflon or PVC Insulation.

(Probe Diameters Available in Hypodermic Gage Sizes 6.5 to 22.5 and Fractional Sizes 1/16" to 3/8".)

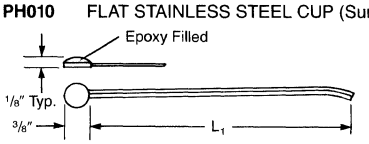
PH009 ROUND T304 T316 STAINLESS STEEL PROBE (Pointed End)



Available with Individual Lead Wires or Cable. Teflon or PVC Insulation.

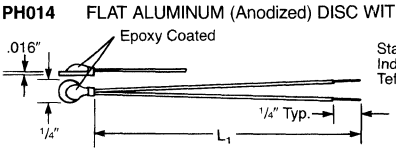
(Probe Diameters Available in Hypodermic Gage Sizes 6.5 to 22.5 and Fractional Sizes 1/16" to 3/8".)

PH010 FLAT STAINLESS STEEL CUP (Surface Sensing)



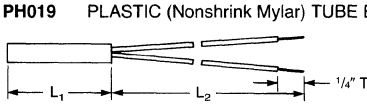
Available with Dual Cond Zip Cable, Individual Leads and or Cable. Teflon or PVC Insulation.

PH014 FLAT ALUMINUM (Anodized) DISC WITH CRIMP (Surface Sensing)



Standard with 30 AWG Stranded Individual Leads with Teflon Insulation.

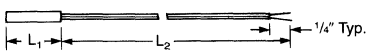
PH019 PLASTIC (Nonshrink Mylar) TUBE EPOXY FILLED



Standard Outside Dia.
.070" O.D.
.078" O.D.
.095" O.D.

Standard with 28 AWG to 34 AWG Individual Leads. Teflon PVC or Uninsulated Leads.

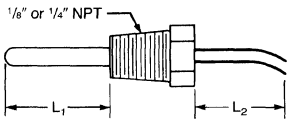
PH020 PLASTIC (Polyimide) MICROTUBE EPOXY FILLED



Standard Outside Dia.
.017" Max O.D.
.018" Max O.D.
.040" ± .002" O.D.

Standard with 40 AWG Bifilar Nickel Leads with Isomid Insulation.

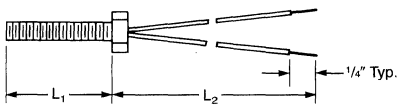
PH025 STAINLESS STEEL PIPE THREAD PROBE



Standard Probe Dia.
1/8" S.S.
3/16" S.S.
1/4" S.S.

Available with Individual Leads or Jacketed Cable Teflon or PVC.

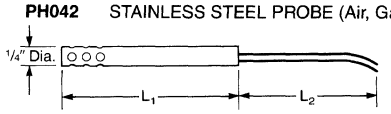
PH032 BRASS OR STAINLESS STEEL HEX HEAD SCREW



Standard Thread Size
10–32
1/4–20
3/8–16

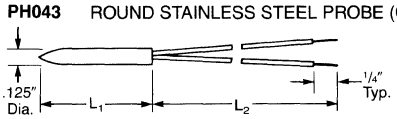
Standard with Individual Leads, Teflon or PVC Insulation.

PH042 STAINLESS STEEL PROBE (Air, Gas Sensing)



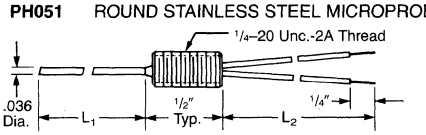
Available with Individual Leads or Jacketed Cable, Teflon or PVC Insulation.

PH043 ROUND STAINLESS STEEL PROBE (Conical End)



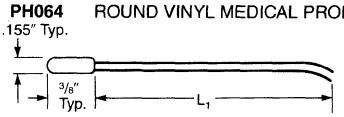
Standard with Individual Leads, Teflon or PVC Insulation

PH051 ROUND STAINLESS STEEL MICROPROBE (Round End)



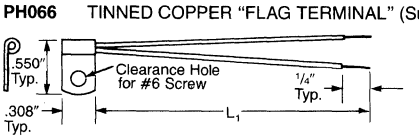
Standard with Individual Leads, 28 to 34 AWG, Teflon or PVC Insulation

PH064 ROUND VINYL MEDICAL PROBE (Round End)



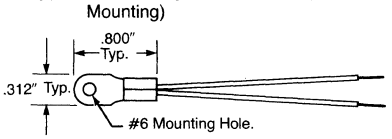
Standard with White or Gray PVC Jacketed Cable Only.

PH066 TINNED COPPER "FLAG TERMINAL" (Surface Mounting)



Available with Individual Leads, 24 to 30 AWG, Teflon or PVC Insulation.

PH080 TINNED COPPER "RING TONGUE TERMINAL" (Surface Mounting)



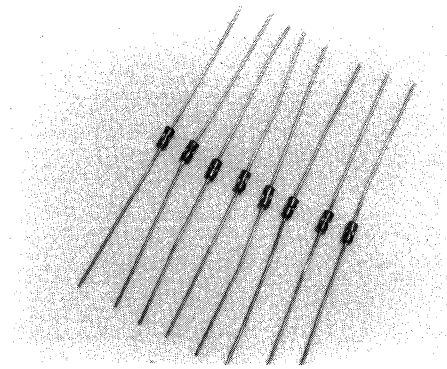
Standard with Individual Leads 22 AWG to 24 AWG, Teflon or PVC Insulation.

Interchangeable BetaCURVE and BetaCHIP devices are available in most probe assembly configurations. For more information please contact BetaTHERM Application Engineering Department.

BetaTHERM Corporation • 910 Turnpike Road, Shrewsbury, Massachusetts 01545 • 508-842-0516 Fax: 508-842-0748
BetaTHERM Ireland Ltd. • Ballybrit Industrial Estate, Galway, Ireland • 353-091-53238 Fax: 353-091-53615

BetaTHERM **NTC Thermistor Devices**

DO35 PACKAGE ***BetaCHIP & BetaCURVE*** *THERMISTOR*



DO-35 packaged Thermistor are made from the same high quality and high stability **BetaCHIP** and **BetaCURVE** Thermistor Chip Elements that are manufactured for all of **BetaTHERM's** product family.

The rugged construction of the DO-35 package is ideally suited for applications which cover the temp. range of −60°C to 300°C with leads that are solderable or weldable.

FEATURES

- High Temperature Device (300°C)
- Glass to Metal Hermetic Seal
- Low Cost, High Reliability
- T.C. 8 Sec. in Air
- D.C. 2 mW/°C in Air
- Values from 1K Ω to 5 Meg Ω
- Dumet Leads Tin Plated for 200°C Max Operation or Gold Plated Leads for 300°C Max Operation
- Axial Leads

STANDARD (± 10% @ 25°C) THERMISTOR DEVICES

Part Number	RT Curve	Part Number	RT Curve	Part Number	RT Curve
1K2PD2	2	10K3PD2	3	200K6PD2	6
2K7PD2	7	20K3PD2	3	500K6PD2	6
3K7PD2	7	30K3PD2	3	1M6PD2	6
5K7PD2	7	50K3PD2	3	5MPD2	12
10K7PD2	7	100K3PD2	3		

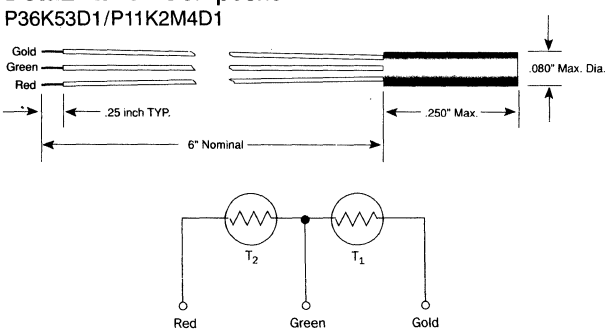
Custom Specification: For Resistance Values and or Tolerances not listed above, contact **BetaTHERM** Applications Engineering for details.

BetaLINEAR *THERMISTOR/RESISTOR NETWORKS*

BetaLINEAR Thermistor/Resistor Networks produce precision linear output for both Linear Voltage versus Temperature or Linear Resistance versus Temperature. Wiring schematics are as shown below.

BetaLINEAR Composite

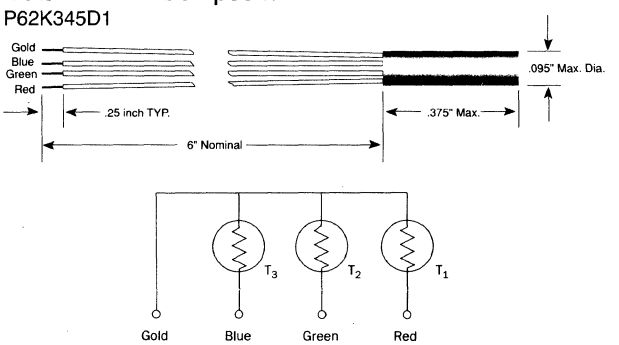
P36K53D1/P11K2M4D1



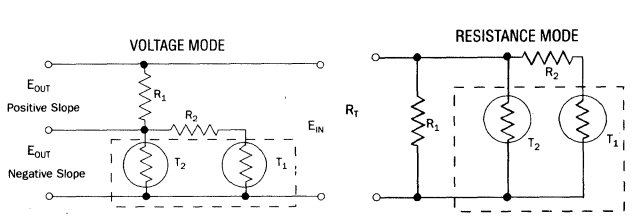
NOTE: Use P36K53D1 and P11K2M4D1 composite in the above schematics only. R1 and R2 resistors are supplied in resistor sets. Their values are dependent on the temperature range to be used.

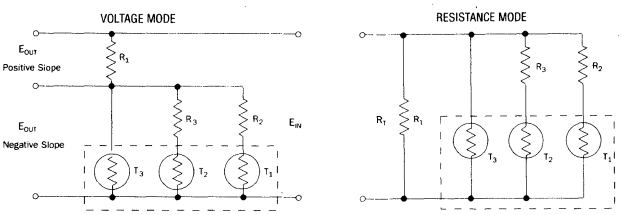
BetaLINEAR Composite

P62K345D1



NOTE: Use P62K345D1 composite in the above schematics only. R1, R2, and R3 resistors are supplied in resistor sets.





To simplify and accommodate various assembly configurations, **BetaTHERM** supplies precision resistor sets as a separate item or in kit form with **BetaLINEAR** Thermistor Composites.

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BetaTHERM NTC Thermistor Devices

BetaTHERM RESISTANCE RATIO—TEMPERATURE AND DEVIATION TOLERANCE TABLES

TEMP °F	TEMP °C	Material (Curve) #1 Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	(Curve) #2 Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	(Curve) #3 Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	(Curve) #4 Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	(Curve) #5 Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	(Curve) #6 Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	(Curve) #7 Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE
-112	-80	**169.20**	-6.72	12.5	1.82	**233.5**	-7.16	12.0	1.68	**729.68**	-8.90	13.0	1.46																	
-103	-75	**121.59**				**163.5**				**471.37**																				
-94	-70	**88.34**	6.28	10.0	1.55	**115.9**	-6.69	9.0	1.34	**309.56**	-8.29	9.5	1.15																	
-85	-65	**64.87**				**83.17**				**206.49**																				
-76	-60	**48.12**	-5.88	7.8	1.31	**60.39**	-6.26	7.0	1.12	**139.79**	-7.69	7.5	0.98																	
-67	-55	**36.04**				**44.33**				**95.978**				**60.86**				**79.36**				**121.63**				**54.14**				
-58	-50	**27.24**	-5.51	6.3	1.13	**32.89**	-5.85	5.0	0.85	**66.782**	-7.14	5.5	0.87	**44.17**	-6.30	4.3	0.68	**56.43**	-6.67	4.70	0.70	**83.38**	-7.40	7.0	0.95	**39.49**	-6.67	5.7	0.85
-49	-45	**20.778**				**24.64**				**47.061**				**32.39**				**40.57**				**57.89**				**29.11**			
-40	-40	**15.983**	-5.16	5.3	1.00	**18.641**	-5.47	3.8	0.58	**33.5668**	-6.61	4.3	0.79	**23.983**	-5.92	3.6	0.61	**29.47**	-6.26	3.61	0.58	**40.672**	-6.83	5.1	0.74	**21.68**	-5.55	4.3	0.77
-31	-35	**12.395**				**14.231**				**24.2193**				**17.928**				**21.63**				**28.909**				**16.31**			
-22	-30	**9.689**	-4.85	4.3	0.88	**10.960**	-5.12	3.0	0.48	**17.6682**	-6.21	3.5	0.68	**13.523**	-5.56	2.9	0.53	**16.02**	-5.91	2.92	0.49	**20.774**	-6.45	4.1	0.64	**12.38**	-5.43	3.5	0.64
-13	-25	**7.630**				**8.511**				**13.0242**				**10.289**				**11.98**				**15.085**				**9.485**			
-4	-20	**6.053**	-4.56	3.3	0.73	**6.662**	-4.82	2.3	0.39	**9.6973**	-5.81	2.7	0.56	**7.893**	-5.23	2.3	0.44	**9.032**	-5.57	2.29	0.41	**11.065**	-6.08	3.2	0.53	**7.329**	-5.08	2.7	0.53
5	-15	**4.835**				**5.255**				**7.2894**				**6.1030**				**6.869**				**8.1938**				**5.709**			
14	-10	**3.888**	-4.29	2.5	0.58	**4.175**	-4.54	1.6	0.29	**5.5297**	-5.51	2.0	0.45	**4.7549**	-4.94	1.7	0.35	**5.266**	-5.25	1.71	0.33	**6.1237**	5.74	2.4	0.42	**4.482**	-4.76	2.0	0.45
23	-5	**3.147**				**3.341**				**4.2314**				**3.7316**				**4.068**				**4.6169**				**3.546**			
32	0	**2.563**	-4.04	1.7	0.42	**2.691**	-4.25	1.1	0.21	**3.2651**	-5.20	1.4	0.33	**2.9490**	-4.65	1.2	0.25	**3.166**	-4.94	1.17	0.24	**3.5102**	-5.40	1.6	0.30	**2.825**	-4.48	1.4	0.30
41	5	**2.100**				**2.182**				**2.5395**				**2.3462**				**2.481**				**2.6904**				**2.266**			
50	10	**1.730**	-3.82	1.0	0.26	**1.780**	-4.02	0.6	0.13	**1.9903**	-4.80	0.8	0.20	**1.8787**	-4.40	0.7	0.15	**1.958**	-4.67	0.68	0.15	**2.0781**	-5.10	1.0	0.19	**1.830**	-4.21	0.8	0.19
59	15	**1.434**				**1.460**				**1.5714**				**1.5136**				**1.556**				**1.6170**				**1.487**			
68	20	**1.194**	-3.60	0.3	0.09	**1.205**	-3.78	0.2	0.04	**1.2494**	-4.52	0.3	0.07	**1.2268**	-4.16	0.2	0.05	**1.243**	-4.41	0.22	0.05	**1.2673**	-4.81	0.3	0.06	**1.216**	-3.99	0.3	0.07
77	25	**1.0000**	-3.50	0.0	0.00	**1.0000**	-3.68	0.0	0.00	**1.0000**	-4.39	0.0	0.00	**1.00000**	-4.04	0.0	0.00	**1.0000**	-4.30	0.00	0.00	**1.00000**	-4.68	0.0	0.00	**1.0000**	-3.87	0.0	0.00
86	30	**0.8414**	-3.41	0.3	0.09	**0.8342**	-3.57	0.2	0.05	**0.80560**	-4.26	0.3	0.07	**0.81966**	-3.92	0.2	0.05	**0.8089**	-4.18	0.21	0.05	**0.79428**	-4.55	0.3	0.06	**0.8270**	-3.76	0.3	0.07
95	35	**0.7114**				**0.6993**				**0.65301**				**0.67539**				**0.6580**				**0.63489**				**0.6876**			
104	40	**0.6043**	-3.22	0.9	0.27	**0.5892**	-3.39	0.6	0.15	**0.53249**	-4.03	0.7	0.21	**0.55937**	-3.73	0.6	0.16	**0.5382**	-3.96	0.61	0.15	**0.51058**	-4.30	0.9	0.20	**0.5747**	-3.56	0.7	0.20
113	45	**0.5155**				**0.4987**				**0.43669**				**0.46557**				**0.4425**				**0.41301**				**0.4827**			
122	50	**0.4417**	-3.05	1.4	0.46	**0.4240**	-3.21	1.0	0.25	**0.36010**	-3.80	1.2	0.36	**0.38933**	-3.53	1.0	0.28	**0.3656**	-3.77	0.98	0.26	**0.33598**	-4.08	1.4	0.33	**0.4074**	-3.36	1.2	0.35
131	55	**0.3800**				**0.3620**				**0.29851**				**0.32707**				**0.3036**				**0.27480**				**0.3454**			
140	60	**0.3283**	-2.89	1.9	0.65	**0.3104**	-3.04	1.3	0.37	**0.24871**	-3.61	1.6	0.52	**0.27599**	-3.36	1.3	0.40	**0.2332**	-3.58	1.33	0.37	**0.22593**	-3.87	1.9	0.48	**0.2941**	-3.17	1.6	0.50
149	65	**0.2846**				**0.2673**				**0.20823**				**0.23387**				**0.2122**				**0.18669**				**0.2515**			
158	70	**0.2477**	-2.74	2.4	0.85	**0.2310**	-2.88	1.7	0.49	**0.17516**	-3.42	2.0	0.68	**0.19900**	-3.19	1.7	0.52	**0.1786**	-3.42	1.66	0.49	**0.15502**	-3.68	2.3	0.63	**0.2160**	-2.99	2.0	0.66
167	75	**0.2164**				**0.2004**				**0.14801**				**0.17000**				**0.1509**				**0.12932**				**0.1862**			
176	80	**0.1897**	-2.60	2.8	1.02	**0.1745**	-2.73	2.0	0.62	**0.12562**	-3.25	2.3	0.85	**0.14579**	-3.05	2.0	0.65	**0.1281**	-3.25	1.97	0.60	**0.10837**	-3.49	2.7	0.78	**0.1612**	-2.84	2.3	0.82
185	85	**0.1668**				**0.1524**				**0.10706**				**0.125483**				**0.1091**				**0.091215**				**0.1400**			
194	90	**0.1472**	-2.47	3.2	1.19	**0.1336**	-2.58	2.3	0.75	**0.091610**	-3.07	2.7	1.03	**0.108395**	-2.91	2.3	0.78	**0.09333**	-3.10	2.26	0.73	**0.077097**	-3.33	3.1	0.94	**0.1220**	-2.69	2.7	0.99
203	95	**0.1302**				**0.1175**				**0.078698**				**0.093960**				**0.08011**				**0.065428**				**0.1067**			
212	100	**0.1156**	-2.35	3.7	1.43	**0.1037**	-2.49	2.7	0.91	**0.067863**	-2.92	3.0	1.20	**0.081719**	-2.78	2.5	0.91	**0.06900**	-2.95	2.53	0.86	**0.055744**	-3.17	3.5	1.11	**0.0937**	-2.54	3.0	1.18
221	105					**0.0917**				**0.058730**				**0.071303**				**0.05964**				**0.047674**				**0.0825**			
230	110					**0.0814**	-2.40	3.0	1.09	**0.051006**	-2.77	3.3	1.37	**0.062409**	-2.65	2.8	1.05	**0.05173**	-2.81	2.79	0.99	**0.040921**	-3.04	3.9	1.27	**0.0728**	-2.36	3.3	1.39
239	115					**0.0725**				**0.044448**				**0.054792**				**0.04500**				**0.035251**				**0.0645**			
248	120					**0.0647**	-2.25	3.4	1.27	**0.038859**	-2.64	3.6	1.59	**0.048246**	-2.52	3.0	1.20	**0.03928**	-2.68	3.03	1.13	**0.030469**	-2.91	4.2	1.45	**0.0573**	-2.31	3.6	1.55
257	125					**0.0579**				**0.034082**				**0.042603**				**0.03438**				**0.026424**				**0.0510**			
266	130					**0.0519**	-2.23	3.7	1.47	**0.029982**	-2.51	3.9	1.73	**0.037723**	-2.42	3.3	1.33	**0.03019**	-2.59	3.26	1.26	**0.022990**	-2.87	4.5	1.67	**0.0456**	-2.12	3.9	1.82
275	135					**0.0467**				**0.026454**				**0.033492**				**0.02658**				**0.020064**				**0.0408**			
284	140					**0.0421**	-2.03	4.0	1.67	**0.023408**	-2.41	4.1	1.91	**0.029812**	-2.32	3.5	1.50	**0.02346**	-2.49	3.48	1.40	**0.017563**	-2.74	4.8	1.96	**0.0366**	-2.00	4.1	2.06
293	145					**0.0380**				**0.020770**				**0.026604**				**0.02077**				**0.015419**				**0.0330**			
302	150					**0.0344**	-2.01	4.3	1.85	**0.018478**	-2.31	4.4	2.17	**0.023798**	-2.23	3.7	1.66	**0.01843**	-2.39	3.69	1.55	**0.013575**	-2.6	5.1	2.16	**0.0298**	-1.88	4.4	2.33

BetaTHERM MATERIALS R-T SLOPE SPECIFICATIONS

TYPICAL "CHIP" ELEMENT Resistance Range (Ohms @ 25°C.)		Material (Curve) #1: 50 to 500	(Curve) #2: 100 to 1,000	(Curve) #3: 2,000 to 20,000	(Curve) #4: 5,000 to 30,000	(Curve) #5: 10,000 to 50,000	(Curve) #6: 50,000 to 1,000K	(Curve) #7: 100 to 10,000
		BETA Value / Max % Dev. BetaCHIP / BetaCURVE	BETA Value / Max % Dev. BetaCHIP / BetaCURVE	BETA Value / Max % Dev. BetaCHIP / BetaCURVE	BETA Value / Max % Dev. BetaCHIP / BetaCURVE	BETA Value / Max % Dev. BetaCHIP / BetaCURVE	BETA Value / Max % Dev. BetaCHIP / BetaCURVE	BETA Value / Max % Dev. BetaCHIP / BetaCURVE
BETA Value & Max. Beta Deviation for 0/50°C. Ro Ratio		3108 / 1.7 / 0.40	3263 / 0.92 / 0.38	3892 / 1.4 / 0.32	3575 / 1.0 / 0.30	3811 / 0.94 / 0.30	4143 / 1.3 / 0.30	3422 / 1.0 / 0.36
		R Ratio Value	R Ratio Value	R Ratio Value	R Ratio Value	R Ratio Value	R Ratio Value	R Ratio Value
Nominal R Ratio &	**0/50**	5.80 / 3.2 / 0.9	6.35 / 2.1 / 0.7	9.06 / 2.5 / 0.7	7.58 / 2.2 / 0.9	8.65 / 2.2 / 0.9	10.45 / 3.1 / 0.9	6.95 / 2.5 / 0.7
Max. Deviations for	**0/70**	10.35 / 4.2 / 1.1	11.65 / 2.8 / 1.0	18.65 / 3.4 / 1.0	14.82 / 2.9 / 1.1	17.73 / 2.9 / 1.1	22.65 / 4.1 / 1.1	13.08 / 3.4 / 1.1
Temperature Span (°C.)	**25/125**	15.22 / NA / NA	17.33 / 3.7 / 1.5	29.27 / 3.9 / 1.4	23.51 / 3.3 / 1.3	29.15 / 3.3 / 1.3	38.07 / 4.6 / 1.3	19.05 / 3.9 / 0.7

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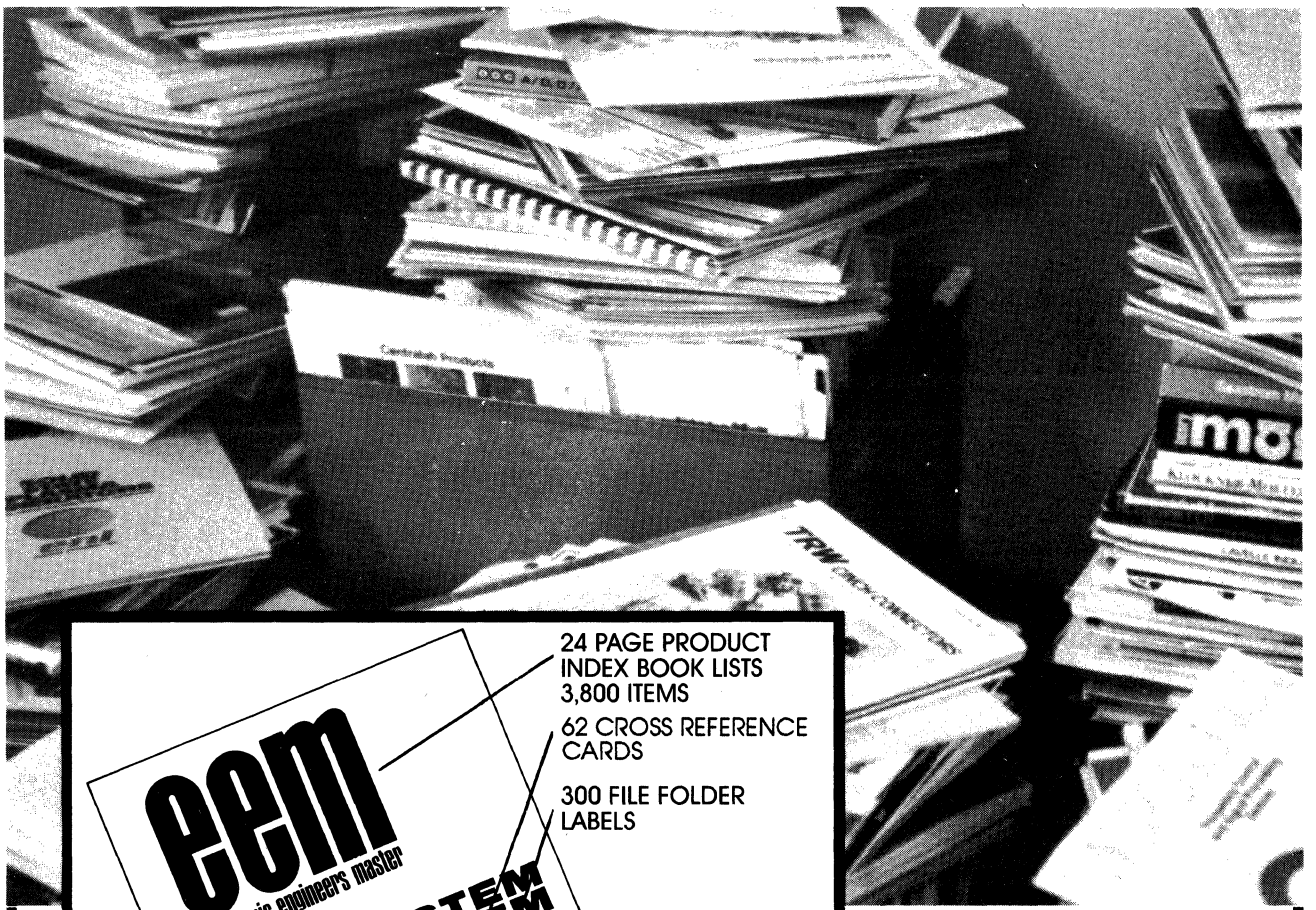

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SURFACE MOUNTED
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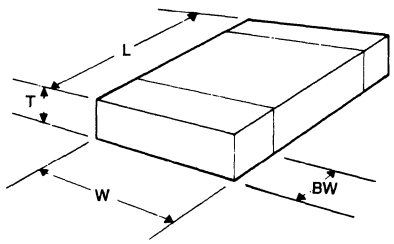
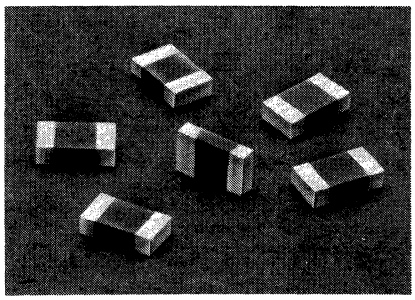
J Thermistors – Hybrid Chip

FEATURES

- Wraparound terminations
- Allows design flexibility for use with hybrid circuitry
- High-density monolithic ceramic construction
- Available in 8mm tape and reel





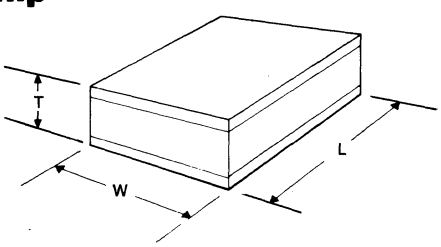
J Style chips are thermistor dies with wraparound terminations for mounting directly to the bonding pads of a hybrid substrate. The use of low temperature 2% to 5% silver bearing solder paste, or a suitable conductive epoxy is suggested for mounting.

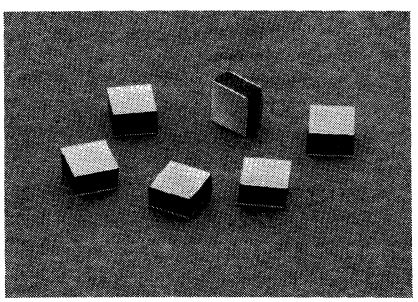
Style J = Platinum Palladium Silver

W Style Thermistors – Chip

FEATURES

- Top and bottom surface terminations
- High-density monolithic ceramic construction
- Allows design flexibility for use with hybrid circuitry





W style is a thermistor die with silver conductors fired on the top and bottom surfaces. The bottom surface can be reflow soldered or conductive epoxied directly to a substrate bonding pad, and the top surface wire bonded to complete the circuit connection.

W STYLE ±10%, ±5% R_{25} tolerance Value range is 50Ω to 1Meg Ω

RESISTANCE vs. TEMPERATURE CONVERSION TABLES (Ratio = $R_T \div R_{25}$)

TEMP. °C	CURVE 1			CURVE 2			CURVE 4			CURVE 7			CURVE 9		
	Ratio	MT±%	NTC	Ratio	MT±%	NTC	Ratio	MT±%	NTC	Ratio	MT±%	NTC	Ratio	MT±%	NTC
−55	96.44	4.5	7.4	53.40	6.3					132.15	6.0				
−50	67.06	3.9	7.2	38.99	6.1	6.2				90.49	5.0	7.5	44.13	3.9	
−40	33.66	3.3	6.7	21.45	5.5	5.8	40.16	5.3		43.92	4.2	7.0	23.98	3.3	5.9
−30	17.70	2.6	6.2	12.27	4.8	5.4	20.64	4.3	6.5	22.26	2.9	6.7	13.52	2.6	5.6
−20	9.712	2.1	5.8	7.278	4.0	5.1	11.03	3.5	6.1	11.73	2.7	6.2	7.891	2.1	5.2
−10	5.534	1.5	5.5	4.459	3.2	4.7	6.119	2.6	5.7	6.418	2.1	5.9	4.754	1.5	4.9
0	3.266	1.1	5.1	2.815	2.3	4.5	3.510	1.8	5.4	3.632	1.4	5.5	2.949	1.1	4.6
10	1.990	0.6	4.8	1.826	1.4	4.2	2.078	1.0	5.1	2.121	0.9	5.2	1.879	0.6	4.4
20	1.249	0.1	4.5	1.215	0.5	4.0	1.267	0.2	4.8	1.276	0.2	5.0	1.226	0.1	4.2
25	1.000	0.0	4.4	1.000	0.0	3.8	1.000	0.0	4.7	1.000	0.0	4.8	1.000	0.0	4.0
30	.8058	0.2	4.3	.8276	0.5	3.7	.7942	0.4	4.6	.7889	0.4	4.7	.8194	0.2	3.9
37	.6016	0.6	4.1				.5814	1.0	4.4				.6258	0.6	3.8
40	.5326	0.7	4.0	.5758	1.4	3.5	.5105	1.1	4.3	.5003	0.9	4.4	.5592	0.7	3.7
50	.3602	1.1	3.8	.4086	2.3	3.3	.3359	1.8	4.1	.3249	1.5	4.2	.3893	1.1	3.5
60	.2488	1.3	3.6	.2954	3.1	3.2	.2259	2.4	3.9	.2147	1.9	4.1	.2760	1.3	3.4
70	.1751	1.8	3.4	.2172	4.1	3.0	.1550	2.9	3.7	.1447	2.4	3.8	.1990	1.8	3.2
80	.1256	2.1	3.3	.1622	5.1	2.8	.1084	3.4	3.5	.09941	2.7	3.7	.1458	2.1	3.1
90	.09164	2.3	3.1	.1229	5.5	2.7	.0771	3.9	3.3	.06949	3.2	3.5	.1084	2.3	2.9
100	.06792	2.6	2.9	.09446	6.7	2.6	.0557	4.4	3.2	.04938	3.6	3.3	.08168	2.6	2.8
110	.05108	2.7	2.8	.07350	7.4	2.4	.0408	4.9	3.0	.03564	4.0	3.2	.06235	2.7	2.6
120	.03894	3.2	2.7	.05788	8.5	2.3	.0303	5.3	2.9	.02610	4.4	3.0	.04818	3.2	2.5
125	.03416	3.3	2.6	.05158	8.7	2.3	.0263	5.5	2.9	.02246	4.5	3.0	.04253	3.3	
130	.03006	3.4	2.5	.04609	8.9	2.2	.0228	5.7	2.8	.01939	4.7	2.9	.03764	3.4	2.4
140	.02348	3.7	2.4	.03708	9.7	2.1	.0173	6.0	2.7	.01459	5.0	2.8	.02972	3.7	2.3
150	.01854			.03012			.0133			.0111			.02370		

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A COMPANY OF VISHAY DALE®

NTC THERMISTOR

B - Series Thermistors
2.5 to 500 Ω

D - Series Thermistors
25 to 5,000 Ω

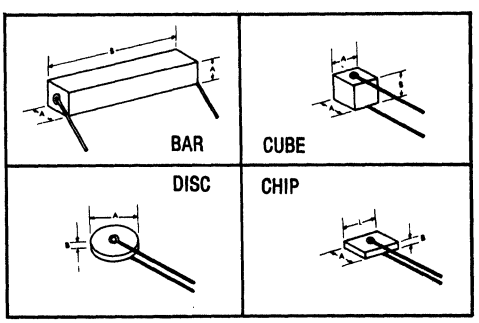
J - Series Thermistors
200 to 30,000 Ω

Techno Components thermistors conform to AQL and confidence levels specified in MIL-T-23648, tables V and VI.

Coatings, markings, special leads, probes, resistor/thermistor networks, resistance values from 1 ohm to 150 K Ω, and other product variations are produced to meet your design requirements.

Resistance tolerance of ± 1% through ± 20% are available and may be specified at 25°C or any temperature within the operating range. Maximum operating temperature with leads is 150°C.

CURVE B	Ratio $\frac{R\ @\ 25°C}{R\ @\ 125°C}$ = 12.95% ±10%
CURVE D	Ratio $\frac{R\ @\ 25°C}{R\ @\ 125°C}$ = 19.8% ±10%
CURVE J	Ratio $\frac{R\ @\ 25°C}{R\ @\ 125°C}$ = 29.85% ±10%



THERMISTOR SPECIFICATIONS

R @ 25°C Ω ±10%	Part Number	NTC %/°C @ 25°C	Nominal D.C.*	Nominal T.C.**	Max. Dimensions A	Max. Dimensions B	Leads AWG#	Type
100,000	2J05	−4.4	3	10	.06	.26	30	Bar
75,000	2J06	−4.4	3	8	.06	.20	30	Bar
50,000	2J07	−4.4	3	7	.06	.15	30	Bar
30,000	2J08	−4.4	2	6	.06	.08	30	Bar
25,000	2J09	−4.4	2	5	.06	.07	30	Bar
20,000	2J10	−4.4	2	5	.06	.06	30	Chip
15,000	2J11	−4.4	2	4	.06	.05	30	Chip
10,000	2J12	−4.4	2	4	.06	.04	30	Chip
10,000	1J112	−4.4	2	4	.08	.05	30	Disc
10,000	1J13	−4.4	4	12	.11	.10	28	Disc
8,000	1J14	−4.4	4	10	.11	.08	28	Disc
7,000	1J145	−4.4	4	10	.11	.07	28	Disc
6,000	1J147	−4.4	3	9	.11	.06	28	Disc
5,000	1J15	−4.4	3	8	.11	.05	28	Disc
5,000	2J15	−4.4	3	8	.10	.04	28	Chip
4,000	1J154	−4.4	5	23	.16	.10	28	Disc
4,000	2J165	−4.4	3	8	.10	.04	28	Chip
3,000	2J16	−4.4	3	—	.12	.04	28	Chip
3,000	1J155	−4.4	6	20	.16	.08	28	Disc
2,500	1J158	−4.4	5	19	.16	.07	28	Disc
2,000	2J17	−4.4	3	5	.10	.03	28	Chip
2,000	1J20	−4.4	7	25	.22	.09	24	Disc
2,000	1D10	−3.9	2	3	.06	.04	30	Disc
2,000	2D10	−3.9	2	4	.06	.04	30	Chip
1,500	1D111	−3.9	2	3	.08	.06	30	Disc
1,000	2J21	−4.4	6	15	.18	.04	24	Chip
1,000	1J24	−4.4	9	48	.32	.09	24	Disc
1,000	1D112	−3.9	2	4	.08	.04	30	Disc
1,000	1D13	−3.9	4	10	.11	.08	28	Disc
1,000	2D13	−3.9	2	3	.08	.04	28	Chip
800	1D14	−3.9	3	8	.11	.06	28	Disc
700	1D145	−3.9	3	7	.11	.06	28	Disc
600	1D147	−3.9	3	7	.11	.04	28	Disc
500	1D15	−3.9	3	6	.11	.04	28	Disc
500	2D15	−3.9	2	4	.10	.04	28	Chip
500	1D153	−3.9	7	20	.16	.08	28	Disc
400	2D165	−3.9	2	4	.11	.04	28	Chip
300	2D16	−3.9	3	5	.10	.03	28	Chip
300	1D19	−3.9	7	25	.22	.09	24	Disc
200	2D20	−3.9	6	—	.15	.04	—	Chip
100	2D21	−3.9	6	—	.18	.04	24	Chip
100	2B13	−3.3	2	4	.07	.04	28	Chip
80	2B14	−3.3	2	4	.08	.04	28	Chip
80	2D211	−3.9	5	—	.20	.04	24	Chip
50	2D24	−3.9	6	—	.32	.04	24	Chip
50	2B15	−3.3	2	4	.10	.04	28	Chip
30	2D31	−3.9	7	—	.35	.04	24	Chip
30	2B16	−3.3	2	4	.10	.03	28	Chip
25	2D33	−3.9	7	—	.36	.04	24	Chip
20	2D34	−3.9	7	—	.36	.04	24	Chip
20	2B17	−3.3	3	4	.16	.04	28	Chip
10	2B21	−3.3	5	—	.18	.04	28	Chip
5	2B24	−3.3	6	—	.30	.04	24	Chip

***DISSIPATION CONSTANT**
Dissipation Constant expressed in mw/°C, represents the amount of power required to raise the temperature of a thermistor 1°C.

****TIME CONSTANT**
Time Constant, expressed in seconds, is the time required for a thermistor dissipating zero power to change 63% of the difference between its initial temperature value and that of a new temperature environment.

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A COMPANY OF VISHAY DALE

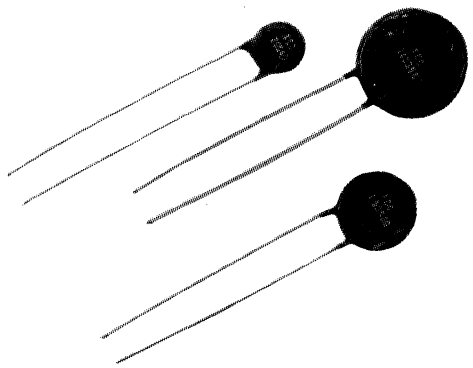
"SOFT START"
INRUSH CURRENT SUPPRESSING DEVICES

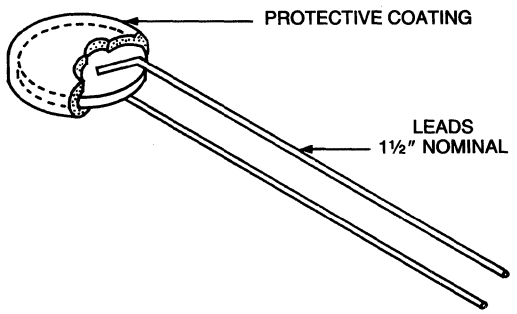
"Soft-Start" devices display relatively high resistance to starting currents in a variety of electronic circuits. Having a negative temperature coefficient of resistance, these devices exhibit a large decrease in resistance when an AC or DC current is applied.

Unlike circuit breakers and fuses, "Soft-Starts" prevent dangerous, short-duration, peak inrush currents present at turn-on. Especiallly useful in power supplies where charging capacitors initially present extrememly low impedance, "Soft-Starts" actually limit inrush currents thereby extending the life of other critical components.

Part Number	Imax. (Amperes)	R_o°25C (Ohms)	R @ Imax. (Ohms)	Max. Diameter (Inches)	Max. Thickness (Inches)	Lead Diameter (Inches)
25SS25	25	1	.01	1.10	.35	.040
20SS20	20	1	.015	.90	.30	.040
18SS36	18	2	.03	.90	.35	.040
15SS38	15	2.5	.03	.90	.30	.040
14SS56	14	4	.05	.90	.35	.040
12SS60	12	5	.06	.90	.50	.040
12SS30	12	2.5	.04	.90	.35	.040
10SS50	10	5	.06	.90	.35	.040
10SS25	10	2.5	.04	.90	.25	.040
9SS45	9	5	.06	.90	.25	.040
9SS23	9	2.5	.04	.90	.25	.040
8SS40	8	5	.05	.60	.25	.040
8SS32	8	4	.07	.60	.25	.040
7SS35	7	5	.07	.60	.25	.032
7SS18	7	2.5	.05	.60	.25	.032
6SS60	6	10	.15	.60	.35	.040
6SS42	6	7	.15	.60	.30	.040
6SS30	6	5	.07	.60	.25	.032
5SS50	5	10	.20	.60	.35	.040
5SS35	5	7	.15	.60	.30	.040
5SS20	5	4	.15	.60	.25	.032
4SS48	4	12	.22	.50	.30	.040
4SS28	4	7	.15	.60	.30	.040
4SS20	4	5	.15	.60	.25	.032
3SS30	3	10	.20	.50	.30	.032
3SS21	3	7	.14	.60	.25	.032
3SS15	3	5	.17	.60	.25	.032
3SS08	3	2.5	.15	.60	.25	.032
2SS80	2	40	.60	.70	.25	.032
2SS40	2	20	.28	.60	.25	.032
2SS20	2	10	.20	.60	.25	.032
2SS10	2	5	.40	.60	.25	.032
1.5SS90	1.5	60	1.00	.60	.25	.032
1.5SS60	1.5	25	.80	.60	.25	.032
1.5SS38	1.5	40	.60	.50	.30	.032
1.5SS15	1.5	10	.25	.50	.25	.032

- Standard Ro25°C tolerance is ± 20%. Closer tolerances are available upon request.
- Protective silicone coating is standard and has a nominal thickness of .02 inches. Other coatings are available upon request.
- Standard lead materials is tinned copper-clad steel. Nickel or copper leads are available upon request.
- Special marking is available upon request.





DEFINITIONS

I max
Represents the maximum rated steady state DC or RMS current and is expressed in amperes.

R o 25°C
Represents the zero power resistance of the device at +25°C and is expressed in ohms.

R@Imax
Represents the approximate resistance at maximum steady state current conditions and is expressed in ohms.

Ambient Temp.
Full rated current may be applied in the ambient temperature range of +25°C to +65°C and must be derated in accordance with Imax derating curve.

I op
Represents the actual operating current applied.

Cool-Down Time
Is the amount of time needed for a "Soft-Start" device to cool enough to cause the necessary amount of resistance to limit inrush current.

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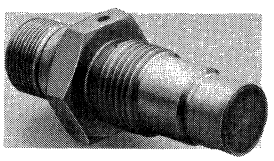
ELMWOOD SENSORS

WHERE RELIABILITY IS BUILT IN.

PRECISION THERMOSTATS



When applications call for precise specifications, Elmwood has a full line of Precision Thermostats with a variety of mounting and package configurations available. For narrow or wide differentials. When accuracy and reliability is serious business, you can count on these high quality thermostats.

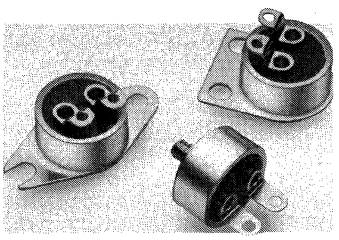
APPLICATIONS:

- Aerospace & Avionics
- Medical Equipment
- Power Supplies
- Data Processing Equipment

FEATURES:

- 1/2" and 3/4" Sizes
- Internal and External Design Options
- Variable Probe Lengths and Connecting Methods Available

AEROSPACE/ MILITARY THERMOSTATS



Designed to meet the requirements of the aerospace industry and exceed the criteria of MIL-S-24236. Elmwood's Aerospace/Military Thermostats are capable of optimum performance in rigid environmental conditions such as extreme temperature, shock and vibration.

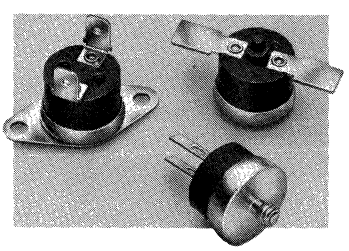
APPLICATIONS:

- Satellites
- Aircraft
- Missiles
- Instrumentation

FEATURES:

- QPL Listed
- Small Size and Weight
- Variety of Mounting & Package Configurations Available

1/2" THERMOSTATS



Designed to open or close on temperature rise, 1/2" Thermostats operate in an ambient temperature range up to 550°F (287°C). Devices are thermally and mechanically inspected at the factory. Cost-efficient for commerical applications.

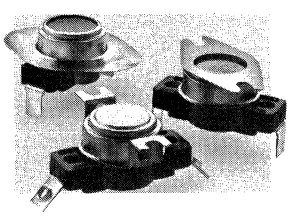
APPLICATIONS:

- Small Appliances
- Fire and Smoke Alarms
- Data Processing Equipment

FEATURES:

- Cost Efficient
- Set to Specifications
- UL Recognized, CSA Certified & European Approved

3/4" THERMOSTATS



Designed to open and close on temperature rise, 3/4" Thermostats are specifically designed to meet the demanding temperature control requirements of a wide range of major appliances and equipment. Thermostats are rated up to 25 Amps-240 Volts and meet UL Standard 353.

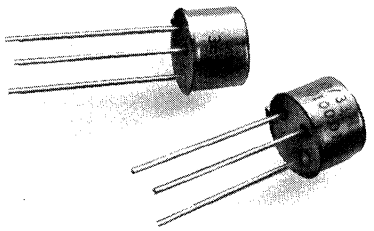
APPLICATIONS:

- Major Appliances
- Commerial Appliances
- Data Processing Equipment
- Spa and Hot Tub Equipment

FEATURES:

- 25 Amp Capacity
- Narrow Temp Differential
- Tight Temp Tolerances
- Rugged Construction
- Recognized by UL, CSA and European Approval Agencies

THE WORLD'S FIRST TO-5 THERMAL SWITCH

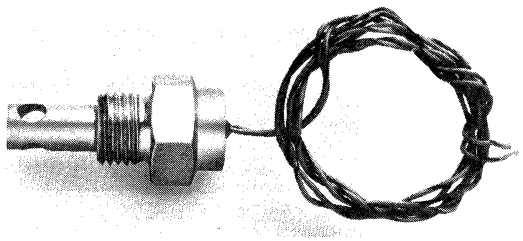


Elmwood's 3600 Series TO-5 Thermostat provides reliable protetion against damage caused by hazardous temperatures on your printed circuit board. Customized configurations are available.

APPLICATIONS:
- Power Supplies
- Logic Boards
- Medical Electronics
- Telecommunications
- Personal Computers

FEATURES:
- Hermetically Sealed/ Wave Solderable
- Switches Up To 1 Amp
- 100% Temperature Tested
- Heat Sink Mounting Brackets Available

THERMISTOR ASSEMBLIES

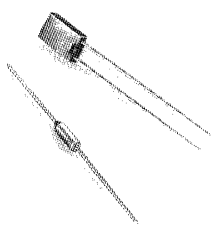


Elmwood's Accumistor Series of thermistor assemblies are available with PTC's and NTC's to meet your needs. Thermistors can be combined for reliable multi-purpose sensing capabilities and as self-regulating heaters in electronics, process control and automative applications.

APPLICATIONS:
- Temperature Setting
- Level & Flow Sensing
- Precision Heating
- Over-Current Protection

FEATURES:
- Packaged Assemblies
- Range: –40°C to 200°C
- Solid State Technology
- Customized Assemblies

THERMAL FUSES AND MOTOR & TRANSFORMER PROTECTORS

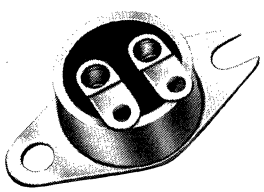


Miniature, heat-sensitive devices designed for over temperature protection of electrical appliances and equipment or transformers and fractional horsepower motors. Thermal Fuses are rated to 15 Amps and can be configured to your specifications. Motor and Transformer Protectors have a patented, non-eutectic design, feature an isolated and sealed cap and are rated to 5 Amps. Both are UL Recognized, CSA Certified and meet major international approvals. Immediate off-the-shelf availability in a variety of standard temperatures and leads.

APPLICATIONS:
- Small Appliances
- HVAC
- Major Applicance
- Motor & Transformer

FEATURES:
- Popular Temp Range
- Insulated Case (MTP)
- Customized Assemblies Available

CUSTOMER SERVICE PROGRAMS



REDI-TEMP

At Elmwood, our commitment to customer service goes beyond product quality. Our customer service programs are designed to fit your specific needs:

- Redi-Temp—An off-the-shelf program with a one week delivery schedule.
- Elmwood Express—A priority delivery service that puts your rush order on the fast track.
- Design Assistance—Pre-packaged assemblies made to fit your requirements complete with custom brackets, terminals, wiring, connectors, overmolds, etc.
- Lead Time Programs—Production and sample lead times that others try to beat.

And our customers service representatives are trained professionals assigned to you from order entry to order shipment.

No one puts more into thermal sensing than Elmwood. Don't accept anything less.

CALL TOLL FREE: 1-800-ELMWOOD

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A Subsidiary of FASCO Industries
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Thermal Sensing Technologies...Worldwide



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- Clarostat
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- Microtran
- Sola
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- Eimac
- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

TUBING
- Alpha
- Electrovert
- Heli-Tube
- Panduit

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NTC and PTC

THERMISTORS

FREE Technical State-of-the-Art Thermistor Literature

CHIP SERIES • BEAD SERIES • THERMISTOR PROBE ASSEMBLIES DISC SERIES • PTC THERMISTORS

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Chip Series

- Surface Mounted, End-Banded
- Without Leads
- Uninsulated Leads
- Insulated Leads
- Series I Glass Encapsulated
- Series II Glass Encapsulated, Interchangeable
- MINI-CHIP Glass Encapsulated Series
- UNI-CURVE® Interchangeable, R-T Curve-Matched
- LTN® Linear Thermistor Networks
- MICRO-MINI CHIP
- MICRO-MINI CHIP Medical Grade, Interchangeable
- OTHER AVAILABLE Chip Thermistors
- "MELF" Glass Encapsulated Chip

Bead Series

- SMALL BEADS
- E-I MATCHED BEADS
- STANDARD BEADS
- GLASS PROBES
- ISO-CURVE® Interchangeable Glass Probes & Beads
- OTHER AVAILABLE BEAD THERMISTORS
- MID-TEMP. (200°C TO 600°C)
- MICRO-MINI PROBES
- SUB-MINI PROBES
- CRYOGENIC GLASS ENCAPSULATED PARALLEL MATCHED

Disc Series

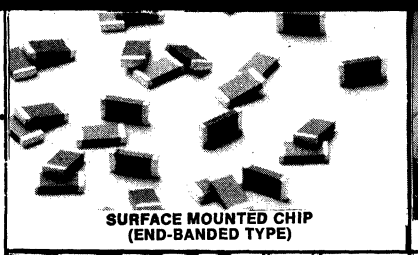
- DISCS 0.1 TO 0.3" DIA.
- OTHER AVAILABLE DISC THERMISTORS 0.4" DIA. DISCS
- INRUSH CURRENT LIMITING (ICL)

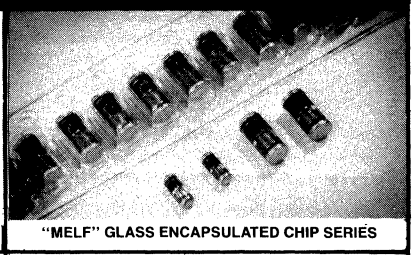
PTC Thermistors

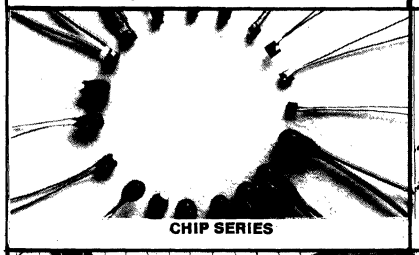
- STD. and MINI-POSI-CHIP SERIES, Glass Encapsulated, Silicon Based
- CERAMIC BASED PTC THERMISTORS for Switching, Current Limiting, Heating and Measurement and Control Applications
- PTC/VARISTOR
- SURFACE MOUNTED POLYMERE ENCAPSULATED

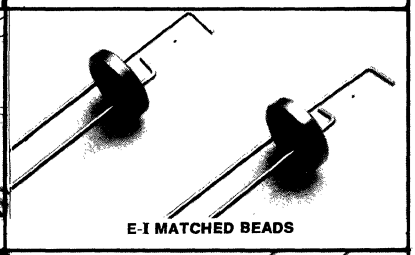
Thermistor Probe Assemblies

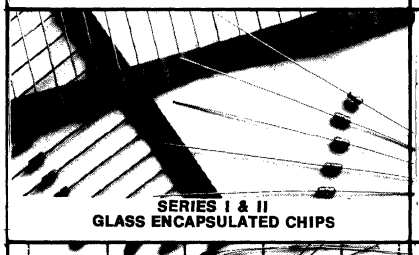
SURFACE, IMMERSION, GAS/AIR, OVEN PROBES, GENERAL PURPOSE AND SPECIAL MEDICAL SENSORS.

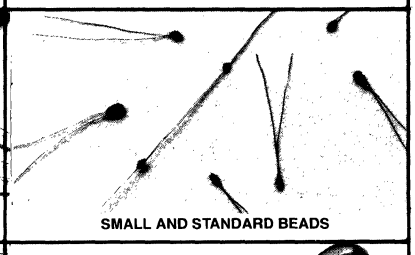

SURFACE MOUNTED CHIP (END-BANDED TYPE)

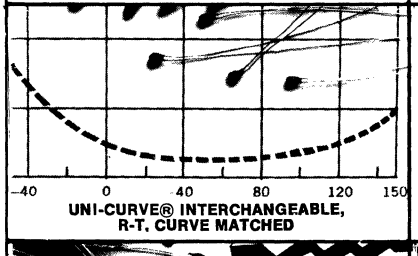

"MELF" GLASS ENCAPSULATED CHIP SERIES


CHIP SERIES

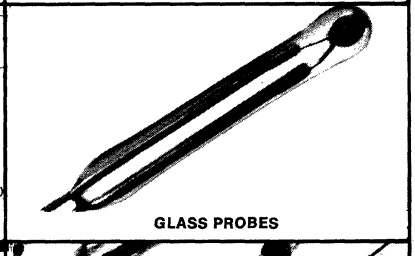

E-I MATCHED BEADS

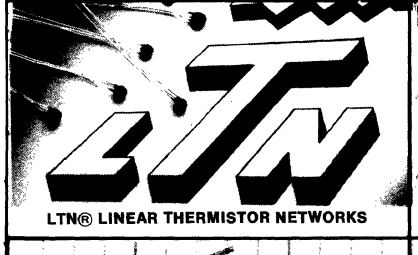

SERIES I & II GLASS ENCAPSULATED CHIPS


SMALL AND STANDARD BEADS

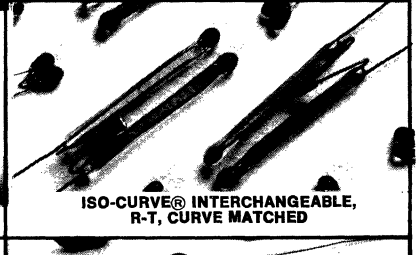


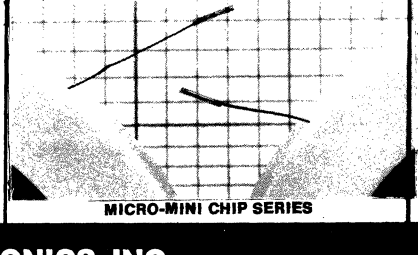
UNI-CURVE® INTERCHANGEABLE, R-T, CURVE MATCHED


GLASS PROBES



LTN® LINEAR THERMISTOR NETWORKS


ISO-CURVE® INTERCHANGEABLE, R-T, CURVE MATCHED


MICRO-MINI CHIP SERIES


DISC SERIES

Fenwal® Electronics INC

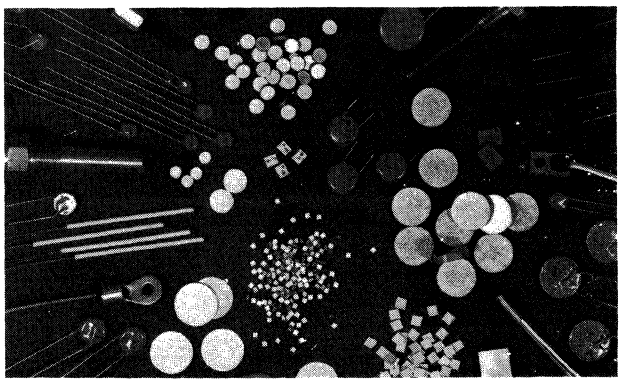
FENWAL ELECTRONICS, INC.
450 Fortune Boulevard, Milford, MA 01757

- TELEPHONE (508) 478-5255
- TELEX 299550
- FAX (508) 473-6035

KETEMA RODAN DIVISION 2900 Blue Star Street, Anaheim, CA 92806 • (714) 630-0081 • FAX: 714-630-4131

INTRODUCTION

Thermistors are temperature sensitive passive semiconductors which exhibit a large change in electrical resistance when subjected to a relatively minute change in body temperature. Negative temperature coefficient (NTC) thermistors decrease in resistance when subjected to an increase in body temperature. Conversely positive temperature coefficient thermistors (PTC) increase in resistance when subjected to an increase in body temperature. Ketema-Rodan Division manufactures NTC thermistors as well as two basic types of PTC thermistors. The silicon PTC offers a nearly linear positive temperature coefficient of approximately +.7%°/C and the switching PTC thermistor which exhibits a very large increase in resistance (several powers of 10) over a designated temperature range. Their extreme sensitivity to minute temperature changes enables them to perform many unique functions heretofore impossible with standard electronic components.



NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

The NTC devices are available in resistance values from less than 1 ohm to 1 megohm, and in sizes ranging from 0.010 inch cubes to 1 inch diameter discs. Available configurations include: discs, chips, rods, bars, probes, and resistor/thermistor networks. Units can be molded, dip coated, or encapsulated to your specifications, using packaging materials such as epoxy, glass, or high temperature silicon resin.

SURGE-GARD™ INRUSH CURRENT LIMITING DEVICES

DESCRIPTION

Rodan® SURGE-GARD devices are manufactured of a specially-formulated metal oxide ceramic material which is capable of suppressing high inrush current surges. They are especially useful in power supplies (See Fig A) where, due to the extremely low impedance of the capacitor being charged, the bridge is subjected to an exceedingly high current surge at turn-on. The SURGE-GARD, being of relatively high resistance, limits the current for 1 to 2 seconds during which time the device decreases in resistance substantially to a point where its voltage drop is negligible.

SPECIFICATIONS

Part Number	Ro @ 25°C ±15% (OHMS)	I_{max} Max Steady State Current (AMPS)	* R_{Imax} Resistance At Max Current (OHMS)	"D" (Diameter max over coating)	"T" (Thickness max over coating)	"L" Lead Diameter ±.003"
SG260	.5	30	.01	1.25	.200	.040
SG100	1	20	.015	.900	.300	.040
SG110	2	18	.03	.900	.350	.040
SG120	2.5	3	.15	.600	.250	.032
SG130	2.5	7	.05	.600	.250	.032
SG140	2.5	9	.04	.600	.250	.032
SG150	2.5	10	.04	.900	.300	.040
SG160	2.5	15	.03	.900	.300	.040
SG170	4	8	.07	.600	.250	.040
SG180	5	2	.40	.600	.250	.032
SG190	5	4	.15	.600	.250	.032
SG200	5	7	.07	.600	.250	.032
SG26	5	12	.06	.900	.500	.040
SG210	7	4	.20	.600	.300	.040
SG64	7	10	.08	.950	.500	.040
SG220	10	3	.20	.450	.300	.032
SG40	10	8	.1	.900	.350	.040
SG230	20	1.75	.6	.500	.300	.032
SG240	40	2	.6	.625	.250	.032
SG250	120	3	.9	.925	.250	.040

1 Other resistance values available upon request.

2 I_{max} = The maximum steady state DC or RMS AC current.

3 * RI_{max} = The approximate resistance under maximum steady state current conditions.

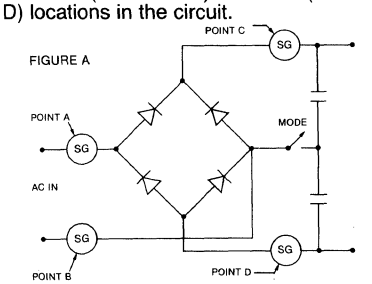
4 **Max Operating Temp** = All Rodan Surge-Gard devices are rated for operation to a maximum ambient temperature of 65°C. If your application requires operation above 65°C ambient, please consult Rodan's applications engineering department.

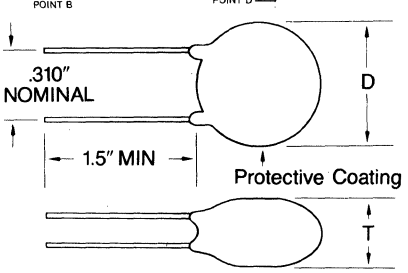
5 **Recovery Time** = Since Rodan Surge-Gards self-heat due to current flow, which in turn causes a reduction in their resistance, the devices require cool-down time after power is removed. The cool-down time allows the resistance to increase sufficiently to provide the required inrush current limiting. This time varies with the particular device, mounting method and ambient temperature. Usually, a one minute cool-down period is adequate. Selection of capacitor bleeder resistors which will provide a one minute or so bleed down time can eliminate the cool down time requirement.

APPLICATIONS

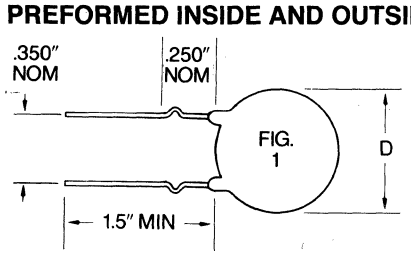
If the resistance of one Surge-Gard does not provide sufficient inrush current limiting for your application, two or more may be used in series or in separate legs of the supply circuit. Surge-Gards cannot be used in parallel since one unit will tend to conduct nearly all the current available. Surge-Gards may be used in the AC (Point A or B) or the DC (Point C or D) locations in the circuit.

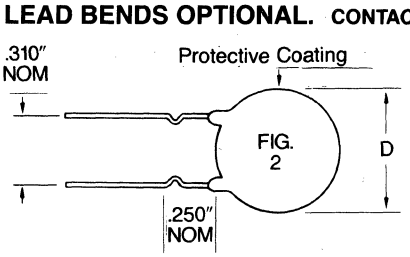
FIGURE A

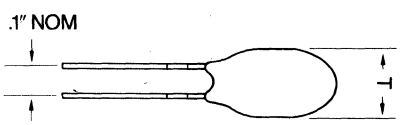




PREFORMED INSIDE AND OUTSIDE LEAD BENDS OPTIONAL. CONTACT FACTORY FOR PART NUMBERS.







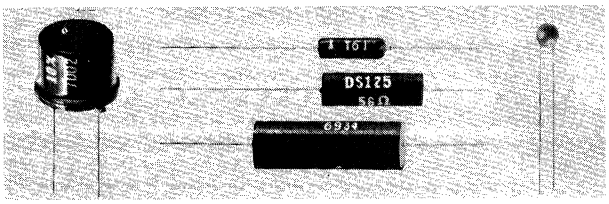
Shorter leads can be supplied upon request

KETEMA 2900 Blue Star Street, Anaheim, CA 92806 • (714) 630-0081 • FAX: 714-630-4131
RODAN DIVISION

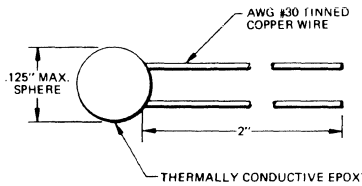
SILICON PTC THERMISTORS

DESCRIPTION

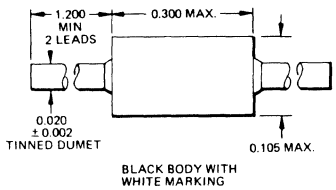
The positive temperature coefficient of resistance is very large: approximately 0.7%/°C, making these units ideal for use in temperature-compensating and sensing applications. Just a few such applications include amplifiers, power supplies, transducers, telemetry, computers, magnetic amplifiers, thermometry, meteorology, temperature regulation and overtemperature protection. Lead material other than standard, such as weldable nickel or gold plated, is available on request.



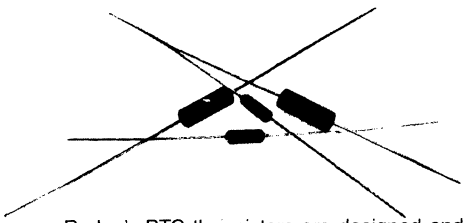
MINIATURE PROBE—DU100



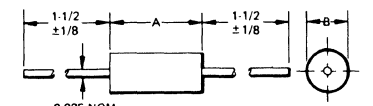
GLASS TYPE—DG125



MIL-APPROVED SERIES

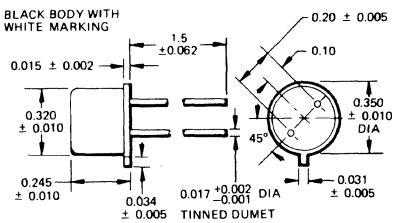


MOLDED TYPES—DS125, DS200, DS250



TYPE	A	B
DS125	0.406 ±0.015	0.140 ±0.015
DS200	0.406 ±0.015	0.140 ±0.015
DS250	0.585 ±0.015	0.200 ±0.015

TRANSISTOR TYPE—DC125



Rodan's PTC thermistors are designed and built to withstand all environmental conditions required by the most stringent Mil specs. They meet or exceed all requirements of MIL-T-23648A for Positive TC Thermistors.

RTH 42 Per MIL-T-23648A/19. Glass, hermetically-sealed type, similar to DG 125 series above.

RTH 22 Per MIL-T-23648/9. Molded style, similar to DS 200 series above.

ELECTRICAL SPECIFICATIONS

PART NUMBER	WATTAGE RATING @ 100°C	STD RESISTANCE RANGE	THERMAL TIME CONSTANT	OPERATIONAL AMBIENT TEMPERATURE RANGE
DS 125	0.125	10 to 39,000	34.8	−65 to +150
DS 200	0.250	10 to 39,000	34.8	−65 to +150
(RTH22)	0.250	10 to 10,000	34.8	−65 to +150
DS 250	0.250	10 to 39,000	54.0	−65 to +150
DG 125 (RTH42)	0.125	10 to 10,000	60.0	−65 to +125
DC 125	0.125	10 to 10,000	54.0	−65 to +125
DU 100	0.125	10 to 10,000	9.0	−65 to +125
UNIT	WATTS	Ohms	Sec. Max	°C

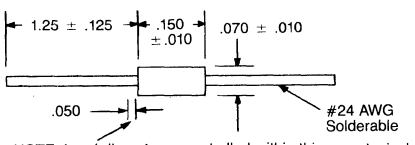
STANDARD RESISTANCE VALUES

10	27	56	150	390	820	2200	5000
12	33	68	180	470	1000	2700	5600
15	39	82	220	500	1200	3300	6800
18	47	100	270	560	1500	3900	8200
22	50	120	330	680	1800	4700	10,000

Matched pairs or other resistance values available as special devices.

MINI-SENSOR™ HERMETICALLY SEALED

NTC THERMISTORS



NOTE: Lead diameter uncontrolled within this area, typical.

DESCRIPTION:

Rodan® Mini Sensor thermistors are small, rugged, hermetically sealed, glass encapsulated (DO-35) devices which are especially useful in applications where extreme temperatures and severe environmental conditions are encountered.

Their high sensitivity makes them especially useful in applications such as temperature measurement, temperature control, liquid level indication, flow measurement and temperature compensation.

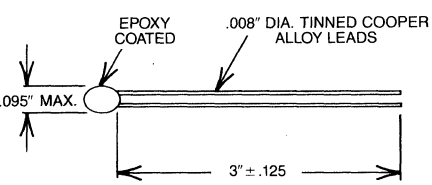
These low cost devices exhibit excellent long term stability and repeatability.

Please contact the factory for additional information.

ACCU-CURVE™ INTERCHANGEABLE THERMISTORS R-T CURVE MATCHED

DESCRIPTION

Rodan's Accu-Curve thermistors are small, high quality, low cost, epoxy encapsulated, precision curve matched devices which are available in a variety of electrical parameters. They offer true interchangeability over wide temperature ranges and eliminate the need for individual circuit adjustments or padding. These thermistors provide highly accurate and stable temperature sensing capability for applications such as temperature measurement or compensation.



SPECIFICATIONS

Part Number	Resistance* @ 25°C	Temp. Tolerance Over Temp. Range (±°C)	Temp. Range °C	D.C.* Min.	T.C.**
ACC-001	2,252	±0.2	0-70°C	1	10
ACC-002	3,000	±0.2	0-70°C	1	10
ACC-003	5,000	±0.2	0-70°C	1	10
ACC-004	10,000	±0.2	0-70°C	1	10
ACW-005	30,000	±0.2	0-70°C	1	10
ACW-006	50,000	±0.2	0-70°C	1	10
ACW-007	100,000	±0.2	0-70°C	1	10

The above device can be supplied to a wider range of specifications. Please contact the factory for requirements not listed.

***DISSIPATION CONSTANT** represents the amount of power required to raise the temperature of a thermistor 1°C above its ambient, expressed in milliwatts.

****TIME CONSTANT**, expressed in seconds, is the time required for a thermistor dissipating zero power to change 63% of the difference between its initial temperature value and that of a new impressed temperature environment.

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STANDARD PTC THERMISTORS

TYPICAL APPLICATIONS

- Over-temperature Protection • Temperature Compensation
- Arc Suppression • Time Delay • Liquid Level Sensing
- Air Flow Sensing • Automatic Color TV Degaussing
- Non-Destructive Fusing • Self-Regulating Heaters
- Single Phase Motor Starting

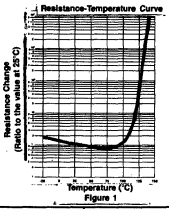
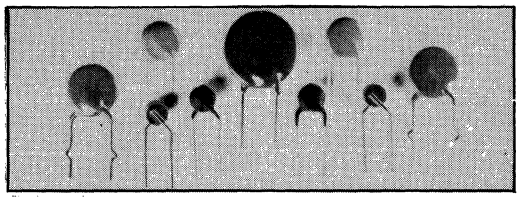
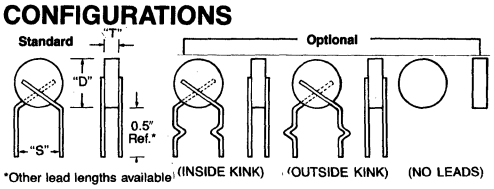


Figure 1



Part Number	Base Resistance R_0 @ 25°C (Ω) ±30%	Switch Temp. Ts (°C)	Maximum Operating Voltage V_{max}	Dissipation Constant Dc (mW/°C)	Time Constant (Sec.)	Heat Capacity Hc (Watt-Sec./°C)	Reference Dimension (In.)			
							D	T	S	Lead Dia. (In.)
SL5003D-1R8-120	1.8	120	20	12	50	.29	0.50	0.03	0.30	0.025
SL5004D-2R0-120	2	120	25	14	50	.39	0.50	0.04	0.30	0.032
SL4005D-5R0-110	5	110	25	10	45	.31	0.40	0.05	0.30	0.025
SL3505D-7R5-120	7.5	120	50	9	40	.24	0.35	0.05	0.25	0.020
SL5510D-100-110	10	110	132	16	90	1.19	0.55	0.10	0.30	0.025
SL2505D-200-120	20	120	50	7	30	.12	0.25	0.05	0.20	0.020
SL5010D-250-065	25	65	132	15	80	.98	0.50	0.10	0.30	0.025
SL4010D-500-110	50	110	132	12	60	.63	0.40	0.10	0.30	0.025
SL2005D-101-040	100	40	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-050	100	50	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-060	100	60	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-070	100	70	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-080	100	80	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-090	100	90	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-100	100	100	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-110	100	110	50	6	30	.08	0.20	0.05	0.20	0.020
SL3010D-101-110	100	110	132	8	45	.35	0.30	0.10	0.25	0.020
SL2005D-101-120	100	120	50	6	30	.08	0.20	0.05	0.20	0.020
SL2008D-251-120	250	120	150	6	30	.13	0.20	0.08	0.20	0.020
SL2010D-501-120	500	120	250	6	30	.16	0.20	0.10	0.20	0.020
SL2010D-102-110	1000	110	300	6	30	.16	0.20	0.10	0.20	0.020
SL2012D-152-110	1500	110	350	6	30	.19	0.20	0.12	0.20	0.020

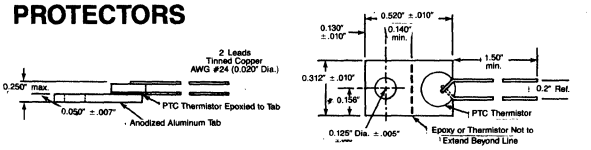
CONFIGURATIONS



*Other lead lengths available

The values for dissipation constant and time constant are for reference only. Mounting method and environmental conditions can affect these parameters.

PTC SURFACE MOUNT OVERTEMPERATURE PROTECTORS



OVER CURRENT PROTECTORS

The PTC over current protector is connected in series with the load which is to be protected. During normal operating conditions, the PTC remains in its low resistance state resulting in negligible attenuation to current flow. When a short circuit or over-current condition occurs, the PTC will switch into its high resistance state thereby limiting the current flow in the circuit to a point well below the normal operating level. When the fault condition is removed, the PTC will return to its low resistance state allowing the current flow to recover to its normal level. Ketema-Rodan Division produces over-current protectors for a whole range of load protection applications.

TYPICAL APPLICATIONS

• Telephone Line Fault Protection • Transformer Protection • FHP Motor Protection • Transistor Protection • Speaker Protection

FEATURES

- Fast Switching
- No Electrical Noise
- Virtually Unlimited Life
- Self Resetting
- No Contacts
- Automatic Operation
- Efficient

Part Number	Base Resistance (Ohms)	Base Resistance Tolerance (±)	Maximum Voltage	Maximum* Continuous Current (Amps)	Minimum** Switching Current (Amps)	Switch Temp. (°C)	Heat Capacity (Watt-Sec./°C)	Dissipation Constant (mW/°C)	Maximum Dia. (In.)	Lead Dia. (In.)
SP5504D-1R0-120	1	20%	15	0.60	1.30	120	.48	13	0.60	.032
SP5004D-2R0-120	2	20%	25	0.44	.900	120	.39	12	0.55	.032
SP4004D-3R3-120	3.3	30%	25	.300	.690	120	.25	10	0.45	.025
SP6709D-4R7-110	4.7	20%	132	.290	.650	110	1.59	16	0.70	.032
SP4004D-5R0-110	5	20%	25	.220	.500	110	.25	10	0.45	.025
SP3505D-7R5-120	7.5	30%	50	.180	.400	120	.24	8	0.40	.020
SP5510D-100-110	10	30%	132	.170	.430	110	1.19	13	0.60	.025
SP3505D-100-120	10	30%	50	.150	.350	120	.24	8	0.40	.020
SP2505D-200-120	20	30%	50	.095	.215	120	.12	6	0.30	.020
SP3510D-300-110	30	30%	132	.075	.190	110	.48	8	0.40	.020
SP3010D-500-110	50	30%	132	.055	.140	110	.35	7	0.35	.020
SP3010D-101-110	100	30%	132	.040	.100	110	.35	7	0.35	.020
SP2008D-251-120	250	30%	150	.028	.070	120	.13	7	0.25	.020
SP2010D-501-120	500	30%	250	.020	.050	120	.16	7	0.25	.020
SP2010D-102-110	1000	30%	300	.012	.032	110	.16	7	0.25	.020
SP2012D-152-110	1500	30%	350	.010	.026	110	.19	7	0.25	.020

*Maximum Continuous Current (I_{cc})—The maximum amount of current, expressed in AMPS, the PTC must be capable of passing without switching into its high resistance state.

**Minimum Switching Current (I_s)—The minimum amount of current, expressed in AMPS, required to switch the PTC into its high resistance state.

The values for minimum switching current and maximum continuous current are for reference only. Mounting method and environmental conditions can affect these parameters.

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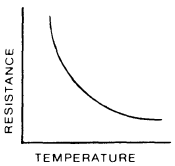
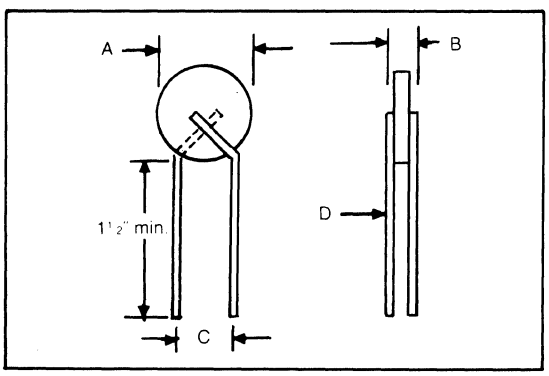
DISC TYPE THERMISTORS WITH CROSSED LEADS



NTC (Negative Temperature Coefficient) thermistors decrease in resistance as temperature increases. Their maximum operating temperature is 125° C. Zero-power resistance values at 25° C range from 10 Ω to 250K Ω ; other values upon request. Disc thermistors are available with various coatings, lead styles, and resistance tolerances. Contact Keystone Thermistor Engineering or write for catalog T787.



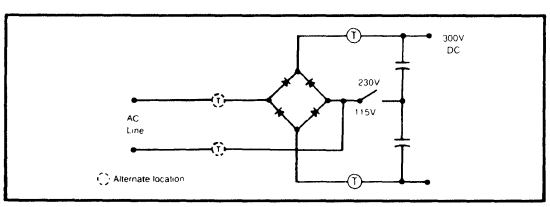
Keystone Thermistors are distributed by

Allied Electronics	1-800-228-6705	Newark Electronics	312-638-4411
		Digi-Key Corp.	1-800-344-4539

KCC TYPE	R_o @ 25°C (Ω)	Tol. ±%	A (in.)	B (in.)	C (in.)	D (AWG)	Dissipation Constant (mW/°C)	Resist.† Ratio	Temp. Coef. @ 25°C (%/°C)
RL1004-65.6-59-D1	100	20	0.110	0.120	0.100	26	2.5	5.6	-3.42
RL1003-312-73-D1	500	10	0.110	0.110	0.100	26	2.5	6.9	-3.83
RL1007-624-73-D1	1,000	10	0.110	0.150	0.100	26	2.8	6.9	-3.83
RL1003-1157-95-D1	2,000	10	0.110	0.110	0.100	26	2.8	9.2	-4.43
RL1003-1746-97-D1	3,000	10	0.110	0.110	0.100	26	2.5	9.1	-4.40
RL1004-2910-97-D1	5,000	10	0.110	0.120	0.100	26	2.5	9.1	-4.40
RL1009-5820-97-D1	10,000	10	0.110	0.170	0.100	26	3.0	9.1	-4.40
RL1005-5744-103-D1	10,000	10	0.110	0.130	0.100	26	2.5	9.6	-4.49
RL1007-13.8K-120-D1	25,000	10	0.110	0.150	0.100	26	2.8	11.4	-4.84
RL1003-26.7K-140-D1	50,000	10	0.110	0.110	0.100	26	2.5	12.9	-5.08
RL1006-53.4K-140-D1	100,000	10	0.110	0.140	0.100	26	2.7	12.9	-5.08
RL1004-104.7K-155-D1	200,000	10	0.110	0.120	0.100	26	2.5	13.8	-5.23
RL1006-135.2K-138-D1	250,000	10	0.110	0.140	0.100	26	2.7	12.1	-4.96
RL2004-16.4-59-D1	25	20	0.220	0.130	0.156	24	6.5	5.6	-3.42
RL2007-32.8-59-D1	50	20	0.220	0.160	0.156	24	6.5	5.6	-3.42
RL2003-62.4-73-D1	100	10	0.220	0.120	0.156	24	6.5	6.9	-3.83
RL2006-125-73-D1	200	10	0.220	0.150	0.156	24	6.5	6.9	-3.83
RL2008-187-73-D1	300	10	0.220	0.170	0.156	24	6.5	6.9	-3.83
RL2003-289-95-D1	500	10	0.220	0.120	0.156	24	6.0	9.2	-4.43
RL2004-582-97-D1	1,000	10	0.220	0.130	0.156	24	6.5	9.1	-4.40
RL2007-1164-97-D1	2,000	10	0.220	0.160	0.156	24	6.5	9.1	-4.40
RL2006-1600-103-D1	2,786	10	0.220	0.150	0.156	24	6.5	9.6	-4.49
RL2005-2203-120-D1	4,000	10	0.220	0.140	0.156	24	6.5	11.4	-4.84
RL2006-2753-120-D1	5,000	10	0.220	0.150	0.156	24	6.5	11.4	-4.84
RL2012-5506-120-D1	10,000	10	0.220	0.210	0.156	24	7.2	11.4	-4.84
RL2006-13.3K-140-D1	25,000	10	0.220	0.150	0.156	24	6.5	12.9	-5.08
RL2005-27K-138-D1	50,000	10	0.220	0.140	0.156	24	6.5	12.1	-4.96
RL2008-52.3K-155-D1	100,000	10	0.220	0.170	0.156	24	6.5	13.8	-5.23
RL3004-6.56-59-D1	10	20	0.320	0.130	0.250	24	7.0	5.6	-3.42
RL3504-31.2-73-D1	50	10	0.370	0.130	0.250	24	7.5	6.9	-3.83
RL3006-59.4-85-D1	100	10	0.320	0.150	0.250	24	7.2	8.4	-4.23
RL3004-144-95-D1	250	10	0.320	0.130	0.250	24	7.0	9.2	-4.43
RL3004-291-97-D1	500	10	0.320	0.130	0.250	24	7.0	9.1	-4.40
RL3005-574-103-D1	1,000	10	0.320	0.130	0.250	24	7.0	9.6	-4.49

†Resistance Ratio: Ratio of zero-power resistance @ 0°C to zero-power resistance @ 50°C.

INRUSH CURRENT LIMITERS



The circuit diagram above displays a typical way to limit inrush current.

Protection against extremely high peak inrush current, especially in AC/DC switching power supplies, is now available with Keystone Inrush Current Limiters. These special NTC thermistors effectively control surge currents because the thermal time constant of the current limiter is longer than the electrical time constant (RC) of the thermistor and the capacitor.

All inrush current limiters are insulated with a protective coating.

Type	R_o @ 25 C ± 25% (Ω)	Max.* Steady State Current (amps)	Nominal Resistance @ Imax (Ω)	A max. (in.)	B max. (in.)	C ref. (in.)	D (AWG)
CL-10	0.7	12	0.03	0.770	0.220	0.328	18
CL-20	1.3	8	0.04	0.550	0.210	0.328	18
CL-30	2.5	8	0.06	0.770	0.220	0.328	18
CL-40	5	6	0.11	0.770	0.220	0.328	18
CL-50	7	5	0.16	0.770	0.260	0.328	18
CL-60	10	5	0.18	0.770	0.220	0.328	18
CL-70	16	4	0.27	0.770	0.220	0.328	18
CL-80	47	3	0.49	0.770	0.220	0.328	18
CL-90	120	2	1.18	0.930	0.220	0.328	18
CL-100	0.5	16	0.02	0.930	0.220	0.328	18
CL-110	10	3.2	0.18	0.400	0.170	0.250	24
CL-120	10	1.7	0.34	0.400	0.170	0.250	24
CL-130	50	1.6	0.76	0.450	0.170	0.250	24
CL-140	50	1.1	0.89	0.450	0.170	0.250	24
CL-150	5	4.7	0.11	0.550	0.180	0.328	22
CL-160	5	2.8	0.20	0.550	0.180	0.328	22
CL-170	16	2.7	0.33	0.550	0.180	0.328	22
CL-180	16	1.7	0.49	0.550	0.180	0.328	22
CL-190	25	2.4	0.41	0.550	0.180	0.328	22
CL-200	25	1.7	0.49	0.550	0.180	0.328	22

*These values are *suggested* maximums based upon a 25° C ambient, no air flow environment with the thermistor mounted ½" from the circuit board. Contact Keystone Engineering to discuss Iss ratings with air flow.

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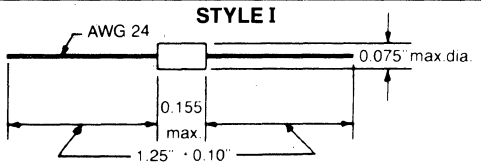
GLASS ENCAPSULATED THERMISTORS

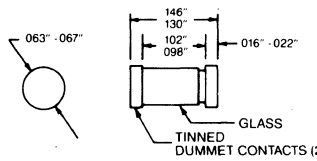
Keystone glass encapsulated NTC thermistors are tiny pellets of thermistor material hermetically sealed in glass bodies with a controlled amount of selected atmosphere. The hermetic seal makes these parts extremely stable in applications up to 204°C (400°F).

STYLE I



Temperature Range: -50°C to +204°C
Dissipation Constant: 2.0 mW/°C
Time Constant: 3 sec.
Tolerance: ±10% @ 25°C

STYLE II (SURFACE MOUNT)



NOTE: FOR KCC TYPE FOR STYLE II DELETE AL PREFIX AND ADD G100 SUFFIX

Type	R_0 @ 25°C Ω	Temp. Coef. @25°C (%/°C)	Material
AL03006-624-73-G1	1K	-3.83	GE73
AL03006-1248-73-G1	2K	-3.83	GE73
AL03006-1847-76-G1	3K	-3.85	GE76
AL03006-2463-76-G1	4K	-3.85	GE76
AL03006-3079-76-G1	5K	-3.85	GE76
AL03006-5818-97-G1	10K	-4.41	GE97A
AL03006-11.7K-98-G1	20K	-4.34	GE98
AL03006-17.53K-98-G1	30K	-4.34	GE98
AL03006-29.1K-97-G1	50K	-4.32	GE97B
AL03006-58.2K-97-G1	100K	-4.32	GE97B
AL03006-269.8K-138-G1	500K	-4.99	GE138
AL03006-535K-145-G1	1M	-5.07	GE145

HIGH TEMPERATURE THERMISTORS

Type	Resistance	Beta (°K) ± 3%	Max. Oper. Temp.
A-923	2260Ω ± 5% @ 250°C	4870°K 200°C to 300°C	400°C
A-924	8020Ω ± 5% @ 250°C	5250°K 200°C to 300°C	450°C
A-925	25000Ω ± 10% @ 300°C	5100°K 250°C to 300°C	550°C

PTC SURFACE-MOUNT OVERTEMPERATURE PROTECTORS

Positive Temperature Coefficient (PTC) thermistors — act as solid-state switches. A typical application of these surface mount units is to prevent destruction of a power transistor.

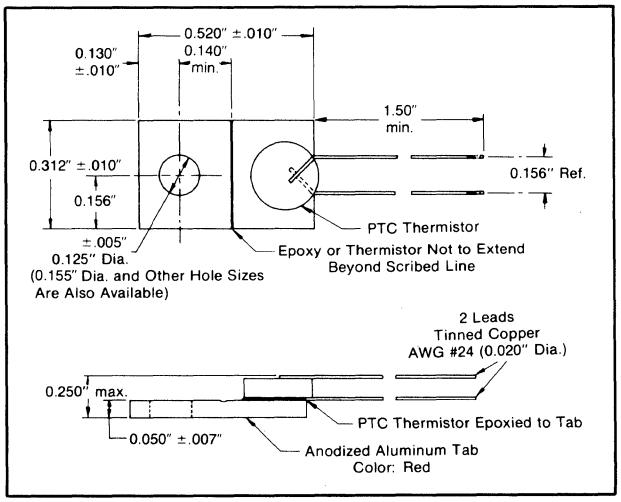
The PTC Sensor is mechanically mounted to the power transistor package. The PTC thermistor measures the surface temperature of the transistor. When the temperature of the transistor case reaches a critical point, the PTC switches and turns off the drive circuitry for the transistor. This action prevents its destruction. Then, as the transistor cools, so does the thermistor, automatically resetting itself to once again guard the power transistor.

Specifications

1. Resistance @ 25°C: 100Ω ± 30% (70Ω — 130Ω).
2. Transition temperature per table is defined as the temperature at which the measured resistance is two times the minimum resistance.
3. Maximum voltage that can be applied to the device in DC or 60Hz sinusoidal wave form AC is 30 volts.
4. Maximum operating temperature 140°C.
5. Dielectric withstand between PTC element and aluminum tab is 50 VDC min.
6. Basic construction: .200" dia. x .060" thk. PTC disc with radial leads attached to an anodized aluminum tab.
7. Physical design — per drawing.
8. Optional resistance values, switch temperatures and physical designs are available upon request.

PTC SURFACE TEMPERATURE SENSORS

Type Number	Transition Temp. °C (Ref.)
RL2006-100-30-30-PT1	30
RL2006-100-40-30-PT1	40
RL2006-100-50-30-PT1	50
RL2006-100-60-30-PT1	60
RL2006-100-70-30-PT1	70
RL2006-100-80-30-PT1	80
RL2006-100-90-30-PT1	90
RL2006-100-100-30-PT1	100
RL2006-100-110-30-PT1	110
RL2006-100-120-30-PT1	120



Keystone also manufactures:

Thermistor Probes • Linistor® Assemblies • Glass Beads • Glass Probes • Rod-type, Surface-mount, Hi-Temp, Cryogenic and Precision Thermistors

Phone for information.

Keystone CARBON COMPANY
Thermistor Division, St. Marys, PA 15857
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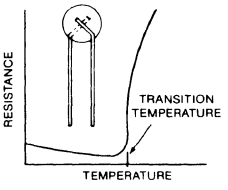
Keystone
CARBON COMPANY

NOTE: Keystone PTC devices can be supplied as UL-recognized components (E-82830). Contact factory for recognized type number.

PTC — POSITIVE TEMPERATURE COEFFICIENT THERMISTORS



Positive Temperature Coefficient (PTC) thermistors are characterized by an extremely large resistance change in a small temperature span. The figure at left depicts a generalized resistance temperature plot for a PTC. The temperature at which the resistance begins to increase rapidly is referred to as the transition temperature. This point can be changed from below 0° C to above 160° C.

TYPICAL PTC APPLICATIONS

• Automatic Color TV Degaussing • Air Flow Measurement • Non-Destructive Fuse • Single Phase Motor Starting • Liquid Level Sensing • Combination Heater-Thermostat • Arc Suppression • Time Delay Fusing.

For detailed application notes, write for Catalog T787.

Operating Voltage V_{OP}	Type Number	R_o @ 25°C ±30% (Ω)	Transition Temperature T_{TR} (°C)	Reference Dimensions (In.) A	B	C	D	E	Dissipation† Constant δ (mW/°C)	Time† Constant τ (Sec.)	Fig. No.*
12	RL5505-1-120-12-PTO	1	120	0.55	0.05	1.5	0.33	0.032	14.0	50	A
	RL5305-2-120-12-PTO	2	120	0.53	0.05	1.5	0.33	0.032	14.0	50	A
	RL3005-10-120-12-PTO	10	120	0.30	0.05	1.5	0.25	0.020	7.0	35	A
	RL3005-25-120-12-PTO	25	120	0.30	0.06	1.5	0.25	0.020	7.0	35	A
20	RL5505-2.5-120-20-PTO	2.5	120	0.55	0.05	1.5	0.33	0.032	14.0	50	A
	RL5505-5-120-20-PTO	5.0	120	0.55	0.05	1.5	0.33	0.032	14.0	50	A
25	RL3006-20-120-25-PTO	20	120	0.30	0.06	1.5	0.25	0.025	7.0	35	A
	RL3006-50-30-25-PTO	50	30	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-40-25-PTO	50	40	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-50-25-PTO	50	50	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-60-25-PTO	50	60	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-70-25-PTO	50	70	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-80-25-PTO	50	80	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-90-25-PTO	50	90	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-100-25-PTO	50	100	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-110-25-PTO	50	110	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-120-25-PTO	50	120	0.30	0.06	1.5	0.25	0.020	7.0	35	A
50	RL5506-5-65-50-PTO	5	65	0.55	0.06	1.5	0.33	0.032	14.0	50	A
	RL5506-10-110-50-PTO	10	110	0.55	0.06	1.5	0.33	0.032	14.0	50	A
	RL5510-20-110-50-PTO	20	110	0.55	0.10	1.5	0.33	0.032	15.0	80	A
	RL4010-50-110-50-PTO	50	110	0.40	0.10	1.5	0.33	0.025	12.0	60	A
120	RL7510-10-120-120-PTO	10	120	0.75	0.10	1.5	0.33	0.020	20.0	90	A
	RL6010-20-120-120-PTO	20	120	0.60	0.10	1.5	0.33	0.032	18.0	90	A
	RL5510-25-65-120-PTO	25	65	0.55	0.10	0.5	0.33	0.025	15.0	90	B
	RL4510-50-120-120-PTO	50	120	0.45	0.10	1.5	0.33	0.025	12.0	70	A
240	RL5515-50-65-240-PTO	50	65	0.55	0.15	1.5	0.33	0.032	17.0	80	A
	RL6015-100-120-240-PTO	100	120	0.60	0.15	1.5	0.33	0.032	18.0	90	A
	RL3020-1500-100-240-PTO	1500	100	0.30	0.20	1.5	0.25	0.020	12.0	60	A

† The values for dissipation constant and time constant are for reference only. Actual values are a function of method of mounting, air flow, and other factors which affect the PTC's ability to dissipate heat. Contact Keystone Engineering for further information.
* Represents standard lead configurations. Other lead styles shown are available for custom made thermistors.

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TYPICAL CONFIGURATIONS

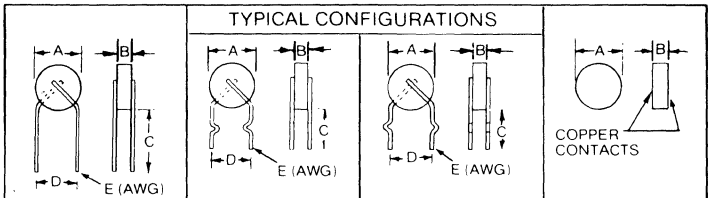


FIG. A (STRAIGHT LEAD) | FIG. B (INSIDE KINK) | FIG. C (OUTSIDE KINK) | FIG. D (NO LEADS)

NOTE: 1. Operating Voltage: D.C. or 60Hz A.C. (for higher voltage req. — contact factory).
2. The specifications and configurations shown above are typical of standard items. Special characteristics, designs and alternate physical sizes are available upon request.

PTC RESETTABLE FUSES

Typical applications for PTC fuses:

- Telephone line fault protection
- Fuse for intermittent solenoids
- Over-current protection for transformers
- Locked rotor protection for FHP motors

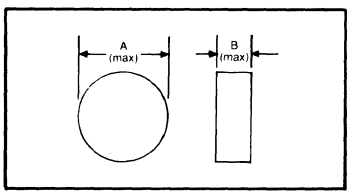
Minimum Limit Current — The minimum amount of current required by the PTC to guarantee switching at the minimum ambient temperature.

Maximum Limit Current — The maximum amount of current the PTC must be able to pass without switching at the maximum ambient temperature.

Operating Voltage V_{OP}	No Load Resistance @ 25°C (±20%) (Ω)	Type Number	Minimum Limit† Current (amps) 0°C	20°C	Maximum Limit† Current (amps) 30°C	55 C	T_{TR} (Ref.) (C)	Heat Capacity (Watt-Sec/ C)	Diss.† Const. (mW/ C)	Max. Dia. (In.)
12	1	RL5305-1-110-12-PTF	1.30	1.20	0.80	0.60	110	0.5	14.0	0.60
	5	RL4005-5-110-12-PTF	0.44	0.37	0.29	0.20	110	0.3	10.0	0.45
	10	RL3005-10-110-12-PTF	0.33	0.30	0.20	0.16	110	0.2	7.0	0.35
	25	RL2505-25-110-12-PTF	0.23	0.19	0.13	0.09	110	0.1	6.0	0.32
50	5	RL5506-5-110-50-PTF	0.55	0.50	0.30	0.25	110	0.7	14.0	0.60
	10	RL4006-10-110-50-PTF	0.30	0.27	0.18	0.16	110	0.4	10.0	0.45
	50	RL5310-50-110-50-PTF	0.23	0.20	0.11	0.10	110	1.1	15.0	0.60
	100	RL3810-100-110-50-PTF	0.10	0.09	0.06	0.05	110	0.5	12.0	0.42
120	10	RL7510-10-110-120-PTF	0.39	0.36	0.25	0.17	110	2.2	20.0	0.80
	50	RL4510-50-110-120-PTF	0.16	0.15	0.09	0.07	110	0.7	14.0	0.50
	100	RL3510-100-110-120-PTF	0.09	0.08	0.06	0.04	110	0.5	11.0	0.40

†The values for minimum and maximum limit current and dissipation constant are for reference only. Actual values are a function of method of mounting, air flow, and other factors which affect the PTCs ability to dissipate heat. Contact Keystone engineering for further information.

PTC HEATERS



Typical applications for PTC heaters:

- Contact lens cleaner kits
- Medical equipment
- In-line diesel fuel heaters
- Temperature stabilization of electronic components

Operating Voltage V_{OP}	Type Number	No Load Resistance @ 25 C (Ref.) (Ω)	Transition Temperature (Ref.) (C)	A (In.)	B (In.)	Typical Operating Temperature Minimum Heat Sinking† C
24	6306-200-15-24-PTH	200	15	0.68	0.08	50
	5506-20-120-24-PTH	20	120	0.60	0.08	160
	5506-20-140-24-PTH	20	140	0.60	0.08	180
	5506-40-110-24-PTH	40	110	0.60	0.08	130
120	5510-100-120-120-PTH	100	120	0.60	0.12	160
	5510-200-110-120-PTH	200	110	0.60	0.12	140
	5510-150-140-120-PTH	150	140	0.60	0.12	180
240	6315-250-120-240-PTH	250	120	0.68	0.18	160
	5520-250-140-240-PTH	250	140	0.60	0.23	180
	6315-500-110-240-PTH	500	110	0.68	0.18	140

†Measured at 25 C ambient. PTC mounted in small spring clip

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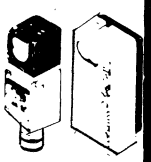
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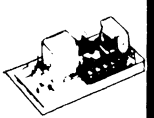
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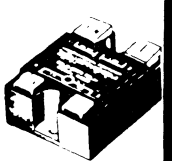
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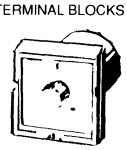
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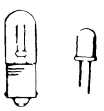
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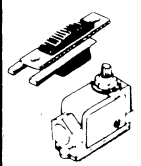
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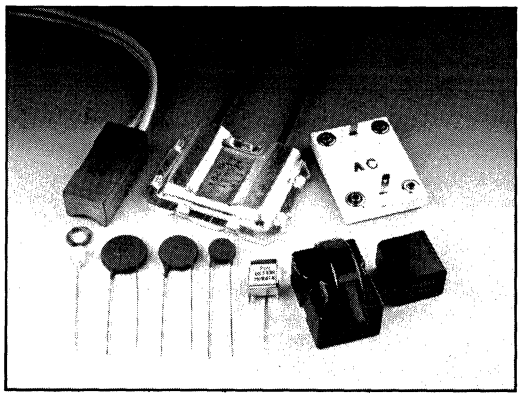
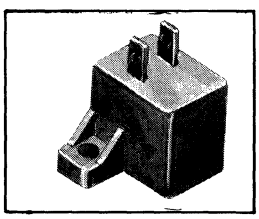


Murata Erie Posistors are basically positive temperature coefficient thermistors with a very well defined resistance-temperature "knee" and the unique ability to "switch" relatively large amounts of power. They may also be used as self-regulating heating devices at useful power levels and as control devices for high power heaters. Applications include temperature sensing, over temperature and over current protection and motor starting to name a few.

Products utilizing Posistors are extremely safe and reliable and offer all of the design, manufacturing, repair and sales advantages of solid state technology.

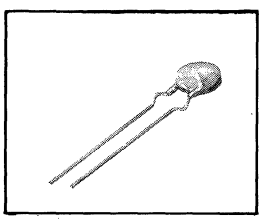
- Compact
- Reduced component count
- Extremely reliable
- "Stepless" temperature control
- Simple repair or replacement
- Long term reliability
- Shock and vibration immunity
- Nonflammable case and insulation available
- No electrical or acoustical noise
- No electrical contacts

FOR MOTOR STARTING



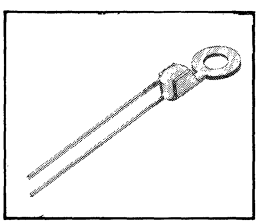
Provides a smooth, solid state electronic starting device for single phase motors utilizing a split-phase starting winding or for PSC motors as a direct replacement for starting capacitors and switches.

FOR CIRCUIT PROTECTION



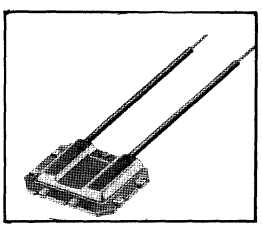
Provides overcurrent protection in a variety of applications. When connected in series with the protected device, Posistors limit the circuit current to a predetermined value — above that value they switch to a high resistance state and limit the current to a safe level.

FOR SEMICONDUCTOR OVERLOAD PROTECTION



Senses the case temperature of high power semiconductors and appropriately reduces the power dissipation when dangerous power or current levels are reached by switching to a high resistance state and reducing base bias current.

FOR HIGH POWER HEATING



Posistors for heating are self-temperature regulating with fast thermal response and power ratings to 170 watts.

NTC thermistors for temperature sensing

This series offers a wide range of resistance values and B-constants. This makes applications where temperature compensation is required, appropriate for this device.

FEATURES

- Thermally stable with consistent performance
- Highly reliable
- Appropriate for many applications

Part Number	Resistance 25°C (Ω)	B Constant 25/50°C (°K)	Resistance Temp. Coeff. 25°C (%/°C)
NTH5D221KA	220	3,300	−3.7
NTH5D331KA	330	3,300	−3.7
NTH5D471KA	470	3,500	−3.9
NTH5D681KA	680	3,500	−3.9
NTH5D102KA	1,000	3,800	−4.3
NTH5D152KA	1,500	3,800	−4.3
NTH5D222KA	2,200	3,900	−4.4
NTH5D332KA	3,300	3,900	−4.4
NTH5D472KA	4,700	3,900	−4.4
NTH5D682KA	6,800	4,100	−4.6
NTH5D103KA	10,000	4,100	−4.6
NTH5D153KA	15,000	4,100	−4.6
NTH5D223KA	22,000	4,200	−4.7
NTH5D333KA	33,000	4,200	−4.7
NTH5D473KA	47,000	4,200	−4.7
NTH5D683KA	68,000	4,400	−4.9
NTH5D104KA	100,000	4,400	−4.9
NTH5D154KA	150,000	4,400	−4.9

DIMENSIONS: (mm)
Dia. Max: 6.0
Thick. Max.: 5.0
Lead Space: 5±1.5
Lead Dia.: 0.5
Lead Length: 25 min.

- B-constant deviation: ±10%
- Max. allowable power: 0.56W(25°C)
- Typical dissipation constant: 5.6mW/°C (25°C)
- Thermal time constant: 20sec.
- Operating temp. range: −30 to +125°C

glass encapsulated NTC thermistors

This NTC Thermistor Series features chip elements for high accuracy and stability. Encapsulated in glass, these thermistors are suitable for applications demanding high reliability and/or temperature and humidity extremes.

FEATURES

- Stable performance with negligible resistance and B-constant variation
- Glass encapsulation for reliable operation in high humidity-temperature environments
- Compact, light weight, easy to handle
- Custom orders can be produced to meet specific applications

Part Number	Resistance (25°C)	B-Constant[2]	Thermal Dissipation Constant	Thermal Time Constant	Operating Temperature Range
NTH300XH502□01	5KΩ	3350K±3%	2.0mW/°C (Typical)	20 Seconds (Typical)	−40~+300°C
NTH300XK103□01	10KΩ	3400K±3%			
NTH300XQ103□01	10KΩ	3650K±3%			
NTH300XW203□01	20KΩ	3950K±3%			
NTH300WA503□01	50KΩ	4000K±3%			
NTH300WC104□01	100KΩ	4100K±3%			
NTH300WE204□01	200KΩ	4200K±3%			

1: Letter denoting the resistance tolerance is entered into the box. (K: ±10%, J: ±5%, E: ±3%).
2: Denotes the value obtained from the resistance at 25 and 50°C.

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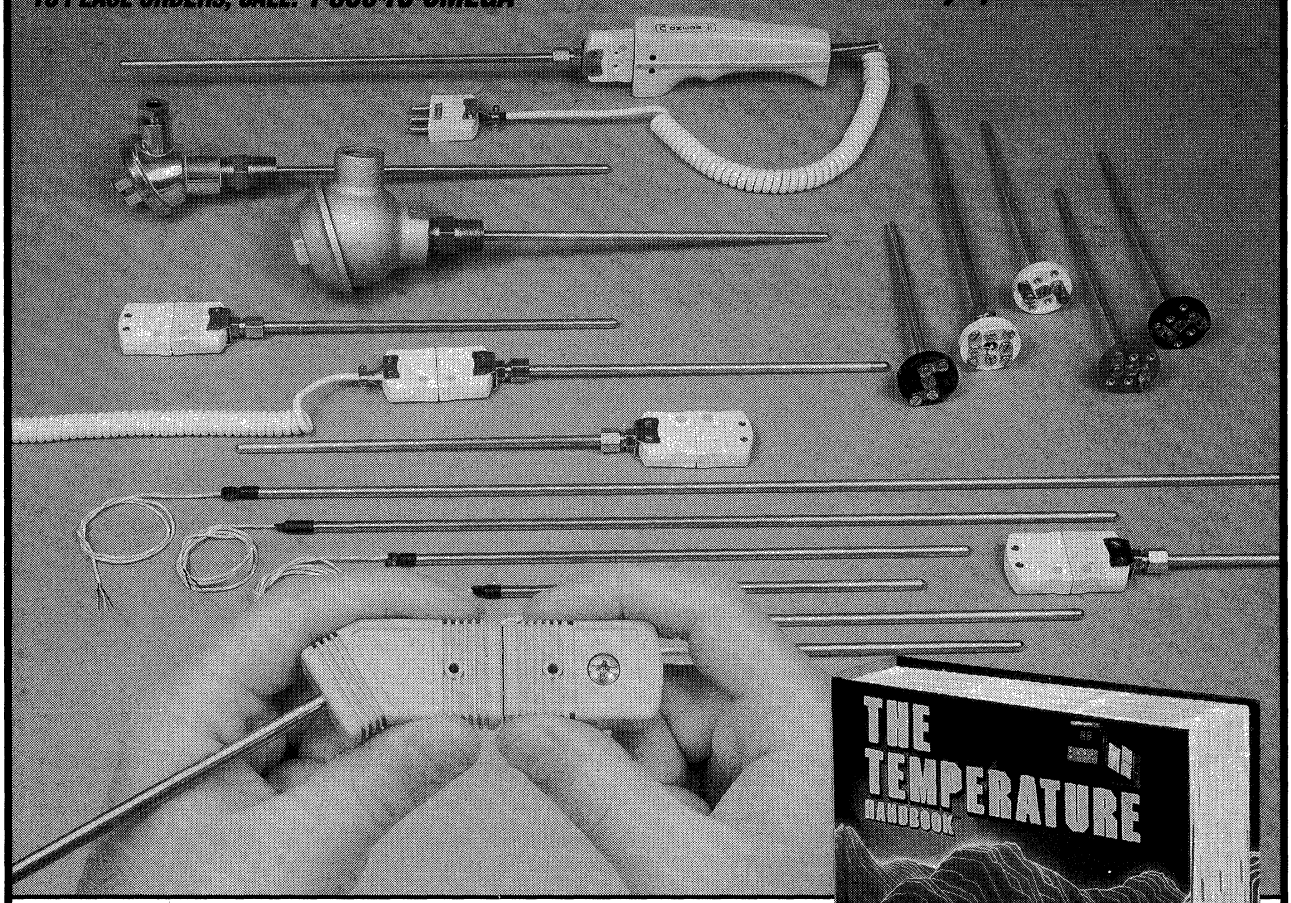

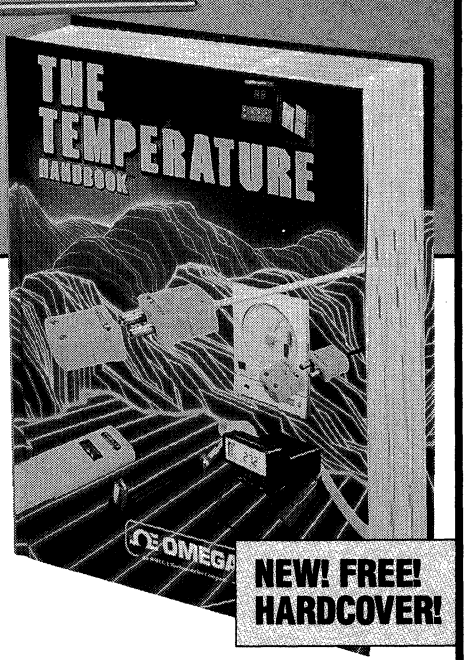

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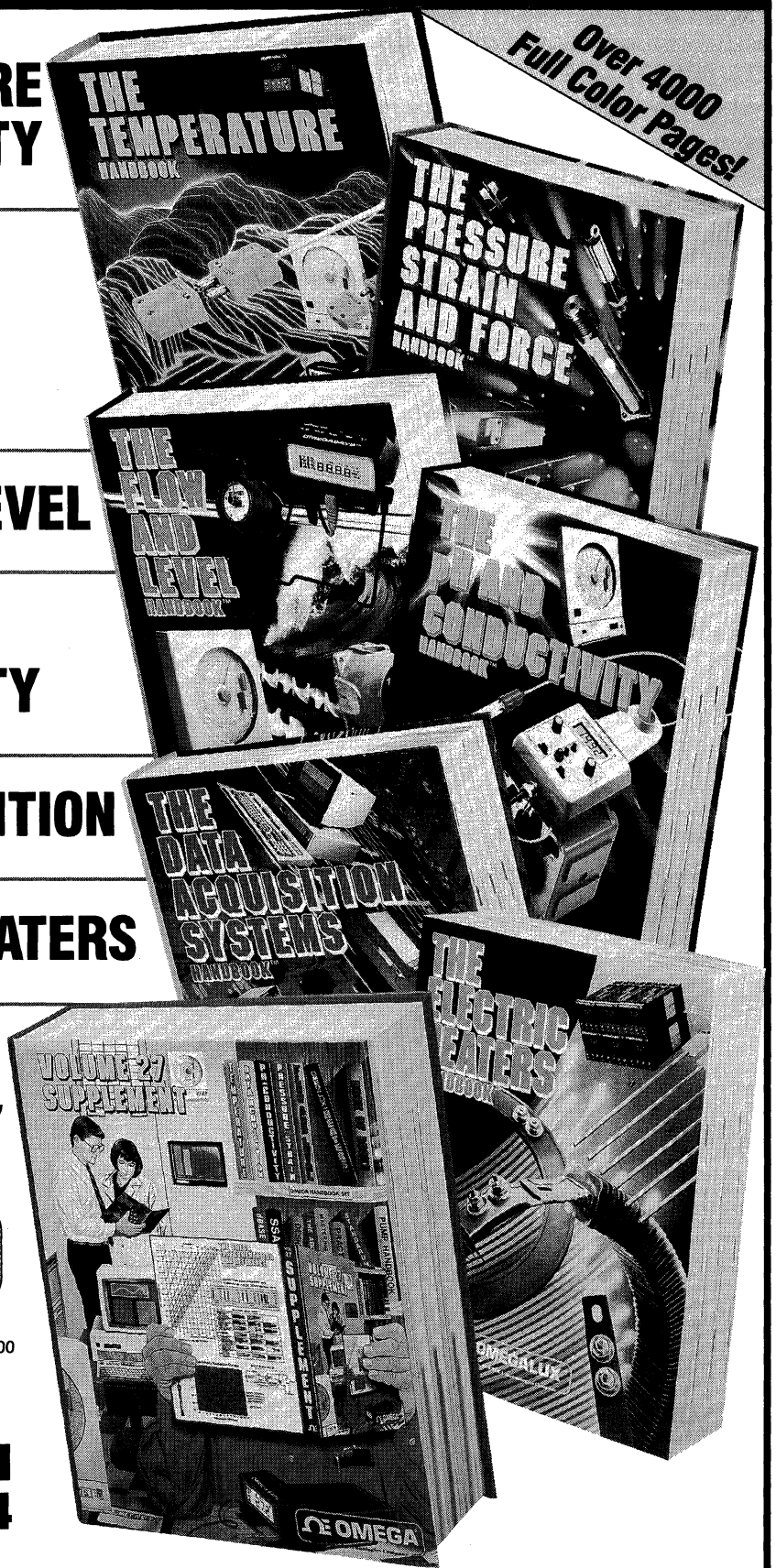

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2322 661 91xxx	7.5 mm	coated disc, radial leads	30 to 50	25 to 110	40 DC
2322 662 91xxx	10.8 mm	coated disc, radial leads	36 to 50	115	180 DC
2322 662 93xxx	12.6 mm	coated disc, radial leads	45 to 120	75 to 120	265 RMS
2322 671 91xxx	1.7 mm	chip	120 max	60 to 140	25 DC
2322 671 91xxx	1.5 mm	chip	120 max	60 to 140	25 DC
2322 671 911xx	4.0 mm	coated chip, copper leads	120 max	60 to 140	25 DC
2322 671 912xx	n/a	ring terminal mounted	120 max	60 to 150	25 DC
2322 672 91xxx	3.5 mm	coated disc, radial leads	30 to 250	70 to 150	25 DC
2322 672 91xxx	3.4 mm	bare disc	30 to 250	70 to 150	25 DC

(xxx) defines switch temperature

DEGAUSSER CONTROLS

Series	Minimum Inrush Current (A)	Maximum Residual Current (>180 sec)	Resistance (ohms @ 25°C)	Coil Impedance	Max Voltage (RMS)
2322 662 96xxx	5.4 to 25	1 mA to 50 mA	5 to 36	5.4 to 25 ohms	140 to 270

OVERLOAD PROTECTION

Series	Style	Resistance (ohms) (@ 25°C)	Non-Trip Current (mA @ 25°C)	Trip Current (mA @ 25°C)	Tswitch (°C)	Max Voltage
2322 660 1xxxx	bare disc, radial leads	42.0 to 1900.0	15 to 105	22 to 150	120	56 to 265
2322 660 5xxx1	coated disc, radial leads	6.0 to 50.0	94 to 270	145 to 405	140	30 to 60
2322 660 5xxx2	coated disc, radial leads	28.0 to 240.0	47 to 130	70 to 195	140	145
2322 660 5xxx3	coated disc, radial leads	56.0 to 3000.0	11 to 95	17 to 143	140	265
2322 661 1xxxx	bare disc, radial leads	18.0 to 280.0	42 to 193	61 to 274	120	56 to 265
2322 661 5xxx1	coated disc, radial leads	1.9 to 5.0	320 to 540	480 to 810	140	30
2322 661 5xxx2	coated disc, radial leads	8.0 to 19.0	170 to 270	255 to 405	140	145
2322 661 5xxx3	coated disc, radial leads	18.0 to 48.0	110 to 190	165 to 285	140	265
2322 662 1xxxx	bare disc, radial leads	6.5 to 26.0	154 to 348	220 to 493	120	56 to 265
2322 662 5xxx1	coated disc, radial leads	0.9 to 1.7	610 to 920	915 to 1380	140	30
2322 662 5xxx2	coated disc, radial leads	3.8 to 6.7	320 to 450	480 to 675	140	145
2322 662 5xxx3	coated disc, radial leads	8.4 to 17.0	210 to 320	315 to 480	140	265
2322 663 1xxxx	bare disc, radial leads	2.6 to 10.0	284 to 606	402 to 808	120	56 to 265
2322 663 5xxx1	coated disc, radial leads	0.5 to 0.7	1170 to 1390	1755 to 2085	140	30
2322 663 5xxx2	coated disc, radial leads	2.1 to 2.9	600 to 710	900 to 1065	140	145
2322 663 5xxx3	coated disc, radial leads	4.4 to 6.6	400 to 490	600 to 735	140	265
2322 664 1xxxx	bare disc, radial leads	1.6 to 7.0	426 to 878	603 to 1242	120	56 to 265
2322 664 5xxx1	coated disc, radial leads	0.3 to 0.4	1770 to 2050	2655 to 3075	140	30
2322 664 5xxx2	coated disc, radial leads	1.3 to 1.7	880 to 1000	1320 to 1500	140	145
2322 664 5xxx3	coated disc, radial leads	2.8 to 4.0	590 to 700	855 to 1050	140	265

(xxxx) defines non-trip current. Most series available on tape & reel or bare disc.

CAPACITIVE HUMIDITY SENSOR

Series	Style	Capacitance @ 25°C, 43% RH	Humidity Range
2322 691 90001	pin mount, plastic housing	122 pF ± 15%	10 to 90%

Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871 FAX: 817-325-1052

Philips Components

Discrete Products Division

A North American Philips Company

VARISTORS, THERMISTORS & SENSORS

METAL OXIDE VARISTORS

UL File E-98144; CSA File LR-86645-1; VDE/CECC File 14480-4790-1001/AIF
Transient voltage suppression discs. Available in bulk, tape & reel, with straight, kink or flange leads.

Series	Disc Size	V_{rms}	V_{dc}	Joules	Max i surge	Capacitance (@ 1 KHz)
2322 592 xxxxx	5 mm	14 to 460	18 to 615	0.5 to 21	100A to 400 A	30 pF to 1,300 pF
2322 593 xxxxx	7 mm	14 to 460	18 to 615	1.7 to 63	250 A to 1,200 A	75 pF to 2,800 pF
2322 594 xxxxx	10 mm	14 to 550	18 to 745	4.3 to 98	500 A to 2,500 A	120 pF to 6,000 pF
2322 595 xxxxx	14 mm	14 to 550	18 to 745	5.4 to 160	1,000 A to 4,500 A	180 pF to 15,00 pF

(xxxxx) defines packaging and AC voltage rating (V_{rms})

NEGATIVE TEMPERATURE COEFFICIENT (NTC) THERMISTORS

Used for inrush current limiting and temperature sensing

SENSORS

Series	Body Size	Style	Resistance (ohms @ 25°C)	Dissipation	Temp Range (°C)	Tolerance (±%)
2322 610 0xxxx	8.70 mm	ceramic disc	4 to 33	1 watt	−25 to +125	10,20
2322 610 1xxxx	9.40 mm	coated disc, radial leads	4 to 33	1 watt	−25 to +125	10,20
2322 633 5xxxx	3.70 mm	MELF, glass encapsulated	10 K to 500 K	100 mW	−55 to +155	5,10
2322 633 8xxxx	1.85 mm	axial leads, glass	10 K to 500 K	100 mW	−40 to +155	5,10
2322 640 5xxxx	3.80 mm	coated chip, nickel leads	2.2 K to 470 K	100 mW	−40 to +150	1,2,3,5
2322 640 6xxxx	3.80 mm	coated chip, copper leads	2.2 K to 470 K	500 mW	−40 to +150	1,2,5,10
2322 640 7xxxx	8.00 mm	aluminum stud mount	2.7 K to 470 K	500 mW	−40 to +150	5,10
2322 640 900xx	10.00 mm	steel watertight housing	2.7 K to 12 K	250 mW	−40 to +150	5,10
2322 642 6xxxx	5.30 mm	coated disc, radial leads	3.3 to 1500	500 mW	−40 to +150	5,10
2322 642 7xxxx	8.00 mm	aluminum stud mount	3.3 to 1500	500 mW	−40 to −150	5,10
2322 645 0xxxx	4.00 mm	coated disc, radial leads	5.0 K to 10 K	100 mW	−40 to +150	5,10

(xxxxx) defines packaging, resistance (at 25°C) and tolerance

INRUSH CURRENT LIMITERS

Series	Style	Resistance (ohms at 25°C)	Current (A)
2322 653 61xxx	coated disc, radial leads	5.0 to 20.0	2 to 4
2322 654 61xxx	coated disc, radial leads	2.5 to 7.0	3 to 8
2322 655 61xxx	coated disc, radial leads	5.0 to 10.0	6 to 8
2322 656 61xxx	coated disc, radial leads	2.0 to 8.5	13 to 15

(xxx) defines resistance (at 25°C)

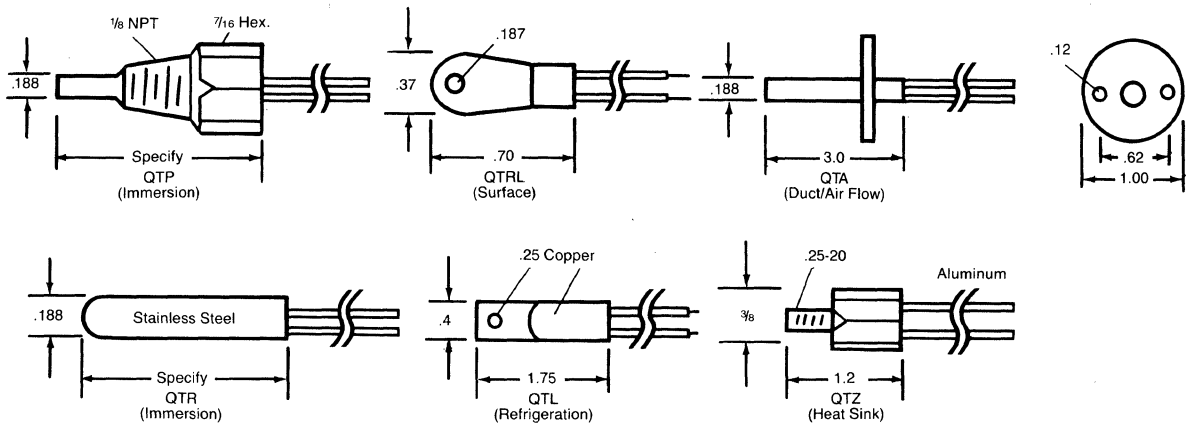
Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871 FAX: 817-325-1052

QUALITY THERMISTOR, INC.

2147 CENTURION PLACE/BOISE, ID 83709/PHONE (208) 377-3373 FAX (208) 376-4754

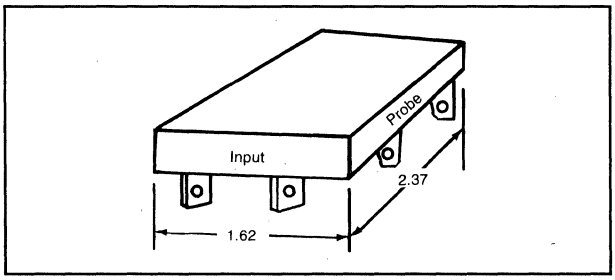
TEMPERATURE SPECIALTY PRODUCTS & SERVICES

THERMISTOR PROBE ASSEMBLIES



THERMISTOR DIRECT CURRENT MUFFIN FAN CONTROLLER "DC-100"

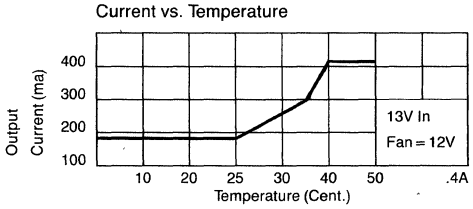
Designed for speed control of D.C. muffin fans, the versatile DC-100 can be used in any application where a biased output voltage is required as a function of temperature.



SPECIFICATIONS
Electrical Characteristics at 25C.

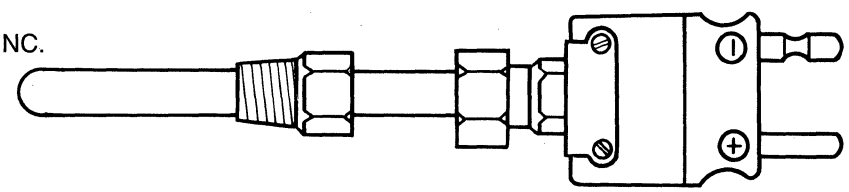
Parameter	Min.	Max.
Input Voltage	—	18V
Output Voltage	—	17V
Output Current	—	2A
Output Power	—	10W
Operating Temp.	0C	70C

Current vs. Temperature



THERMOCOUPLES:
NORTHWEST THERMOCOUPLE, INC.

2161 Centurion Place
Boise ID 83709
Phone (208) 376-0842
Fax (208) 376-4754



Elements: All Industry Standard ANSI Calibrations Available

Type	Max. Temp.	Error	Wire Gauges (AWG)
J	1400 F	+/– 4 F	#16 to #30
K	2300 F	+/– 4 F	#16 to #30
T	700 F	+/– 4 F	#16 to #30
E	1600 F	+/– 3 F	#16 to #30
R	3000 F	+/– 5 F	#16 to #30
S	3000 F	+/– 5 F	#16 to #30

SEE OUR PAGES IN SECTION 4800

QUALITY THERMISTOR, INC.

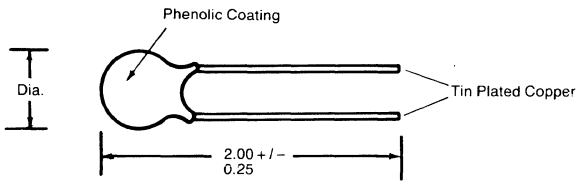
2147 CENTURION PLACE/BOISE, ID 83709/PHONE (208) 377-3373 FAX (208) 376-4754

COMMERCIAL & MILITARY GRADE THERMISTOR PRODUCTS TO MIL-T-23648A

NTC & PTC LEADED THERMISTORS FOR CIRCUIT BOARD AND PROBE ASSEMBLIES

"QTMC" SERIES

Radial Leaded Negative Temperature Coefficient Thermistors
Operating Temperature – 55 to + 125 C



Part # QTMC	R@25C (Ohms)	R-T Curve	NTC@25C %R/deg. C	Body Diam. inches	Leads #AWG
–1	500	Z	–4.4	0.240	28
–7	2.252K	Z	–4.4	0.125	28
–11	5.000K	Z	–4.4	0.125	28
–14	10.00K	Z	–4.4	0.125	28
–19	20.00K	Z	–4.4	0.125	30
–21	100	Y	–3.9	0.220	28
–24	300	Y	–3.9	0.150	28
–28	2.000K	Y	–3.9	0.125	30
–38	50.00K	V	–4.9	0.125	30
–43	100.0K	V	–4.9	0.125	30
–48	100.0K	M	–4.2	0.125	30
–65	1.0Meg	P	–5.3	0.125	28
–70	9.8Meg	R	–6.2	0.125	30
–82	10.00K	S	–4.0	0.125	30

"QTMC" units listed are typical values. Consult factory for full range. Available Tolerances: K = 10% J = 5% G = 2% F = 1% C3 = 0.2 deg. C from 0 to 70 C.

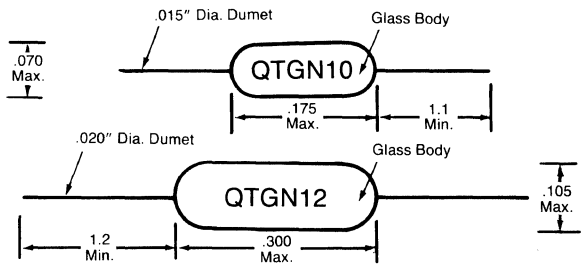
ORDERING INFORMATION

QTMC - 14 C3

Prefix
Value Designator
Tolerance

"QTGN" SERIES

Hermetically Sealed Negative Temperature Coefficient Operating Temperature Range: – 55 to + 125 C



Part Number	R@25C (ohm)	R-T Curve	NTC@25C %R/deg. C	R125 / R@25
QTGN10-1	3000	Y	–3.9	0.05040
QTGN10-2	5000	Y	–3.9	0.05040
QTGN10-3	10000	Y	–3.9	0.05040
QTGN10-4	20000	Z	–4.4	0.03416
QTGN10-5	50000	Z	–4.4	0.03416
QTGN10-7	250000	V	–4.9	0.02170
QTGN10-8	500000	V	–4.9	0.02170
QTGN10-9	1.0Meg	V	–4.9	0.02170
QTGN12-10	5000	Z	–4.4	0.03416
QTGN12-12	10000	Z	–4.4	0.03416
QTGN12-14	50000	Z	–4.4	0.03416

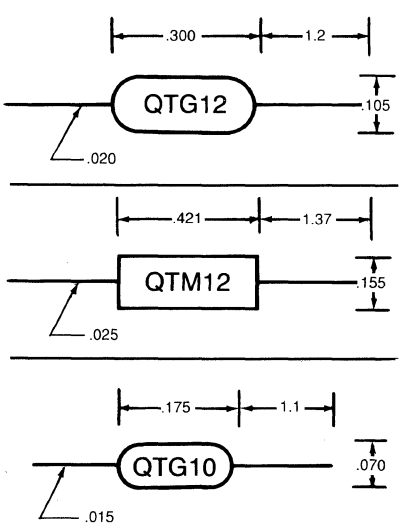
Available Tolerances: K = 10% J = 5%

ORDERING INFORMATION

QTGN10 - 4 J

Prefix
Value Designator
Tolerance

POSITIVE TEMPCO THERMISTORS
0.7% TRC from – 55 to + 125 C



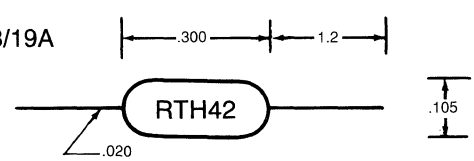
QTG12
Hermetically Glass Sealed Thermistor
Leads: 0.020" Tinned Dumet
Power: 1/8 Watt @ 100 C
Resistance Range: 10 to 10K Ohm

QTM12
Rugged Molded Design Thermistor
Leads: 0.025" Tinned Copper
Power: 1/8 Watt @ 100 C
Resistance Range: 10 to 40K Ohm

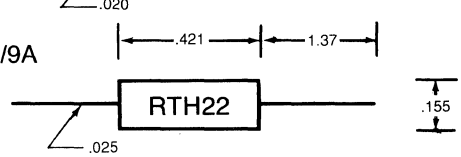
QTG10
Miniature Hermetically Glass Sealed Thermistor
Leads: 0.015" Tinned Dumet
Power: 1/16 Watt @ 100 C
Resistance Range: 10 to 5.0K Ohm

MILITARY GRADE PTC THERMISTORS: MIL-T-23648A

"RTH42"
MIL-T-23648/19A



"RTH22"
MIL-T-23648/9A



ORDERING INFORMATION

RTH42ES 33 2 K

Style
1st & 2nd Resistance Digit
Zeroes following
Resistance Tolerance

SEE OUR PAGES IN SECTION 5300

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

ABNT **Brazil (ABNT)** Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

ELOT **Greece (ELOT)** The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

SII **Israel (SII)** Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

STAS **Romania** Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

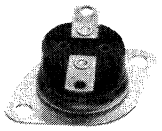
Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

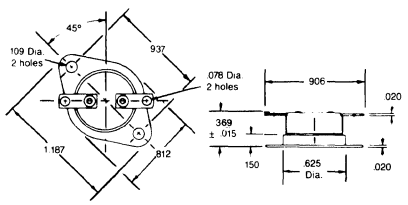
Selco Products Co.
7580 Stage Road • Buena Park, CA 90621
Tel. (213) 921-0681 • (714) 521-8673 • 1-800-25-SELCO • FAX 714-739-1507

STOCK ½" DISC THERMOSTATS

SC/SO



These compact thermostats are the industry standard. As with all of our snap-action thermostats, a C in the part number means the circuit will close when the temperature rises and an O in the part number means the circuit will open when the temperature rises. Snap-action means reliability. A high-force bimetallic disc inside these thermostats keeps the circuit the way you want it. The thermostats respond instantly to temperature change—not shock, vibration or anything else.



ELECTRICAL
120 VAC, 8 Amps, Resistive
100,000 Cycles
1/16" clearance through air and over surface

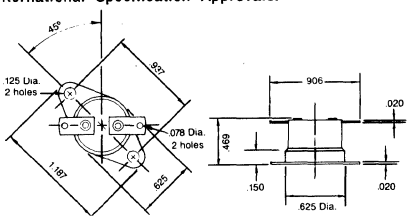
TEMPERATURE RANGE
32 Degrees F. to 500 Degrees F.

APPROVALS
UL File no. E36103, Guide XAPX2
CSA File No. 21048, Guide 400-E-0

SC-A/SO-A



Designed for applications requiring a higher electrical rating, our newest thermostats have the same dimensions as SC and SO thermostats, except they are .12" taller, the mounting holes are .016" larger and the bracket is .187" narrower. The slightly taller thermostat puts more space between the terminals and the base, giving the A model its higher electrical rating and all International Specification Approvals.



ELECTRICAL
120 VAC, 15 Amps, Resistive
240 VAC, 8.3 Amps, Resistive
100,000 Cycles
¼" clearance through air and over surface

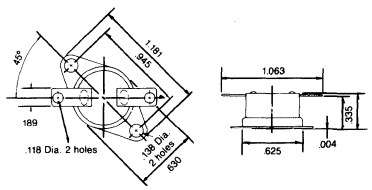
TEMPERATURE RANGE
32 Degrees F. to 325 Degrees F.

APPROVALS
UL File No. MH8267, Guide MBPR2
CSA File No. 21048, Guide 400-E-0
Also has VDE and all other International Approvals

CA/OA



A breakthrough in price and technology, these thermostats perform under a wide range of operating conditions. One-piece contact construction makes the CA and OA models the most reliable in the industry. They are about the same size as the SC and SO models and are manufactured in a high-tech clean room in Japan. In fact, the CA and OA might just set a new industry standard.



ELECTRICAL
125 VAC, 15 Amps, Resistive
250VAC, 8 Amps, Resistive
100,000 Cycles
1/16" clearance through air and over surface

TEMPERATURE RANGE
100 Degrees F. to 302 Degrees F.

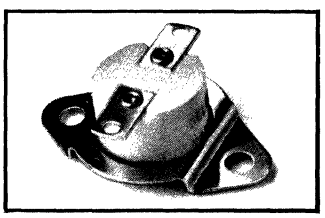
APPROVALS
UL File No. E52529 (S) Guide XAPX2
CSA File No. LR63201

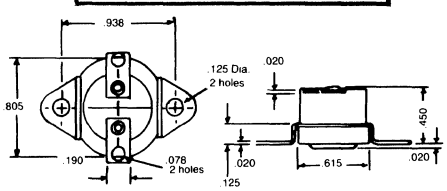
MODELS AVAILABLE FROM STOCK

SC AND SO	SC-A AND SO-A	CA AND OA	SET POINT	ACTION AT SET POINT	DIFFERENTIAL
SO-35(1)	–	–	35F. ± 5F.	open	15F.
SO-60(2)	SO-60-A(2)	–	60F. ± 5F.	open	20F.
SO-60-PCB(3)	SO-60-A-PCB(3)	–	60F. ± 5F.	open	20F.
–	SC-60-A	–	60F. ± 7F.	closes	20F.
SO-85	–	–	85F. ± 5F.	open	15F.
	SC-85-A	–	85F. ± 7F.	closes	15F.
SO-100	SO-100-A	–	100F. ± 5F.	open	30F.
SC-100	SC-100-A	–	100F. ± 7F.	closes	30F.
SO-110	–	OA-110	110F. ± 5F.	open	30F.
–	SC-110-A	–	110F. ± 7F.	closes	30F.
–	SC-110-A-PCB(3)	–	110F. ± 7F.	closes	30F.
SO-120	SO-120-A	–	120F. ± 5F.	open	30F.
SC-120	SC-120-A	CA-120	120F. ± 7F.	closes	30F.
–	SO-130-A	–	130F. ± 5F.	open	30F.
SO-140	SO-140-A	OA-140	140F. ± 5F.	open	30F.
–	SO-140-QC(4)	–	140F. ± 5F.	open	25F.
SC-140	SC-140-A	CA-140	140F. ± 7F.	closes	30F.
SC-140-RVT(5)	–	–	140F. ± 7F.	closes	20F.
SO-150	SO-150-A	OA-150	150F. ± 5F.	open	30F.
SO-150-WOB(6)	–	–	150F. ± 5F.	open	25F.
–	SO-150-AM	–	150F. ± 8F.	open	manual-reset
SO-150-QC(7)	–	–	150F. ± 5F.	open	30F.
SO-160	SO-160-A	OA-160	160F. ± 5F.	open	30F.
SC-160	SC-160-A	–	160F. ± 7F.	closes	30F.
SO-170	SO-170-A	OA-170	170F. ± 5F.	open	30F.
SC-170	SC-170-A	CA-170-QC(4)	170F. ± 7F.	closes	30F.
SO-175	SO-175-A	OA-175	175F. ± 5F.	open	15F.
SO-175-QC(7)	–	–	175F. ± 5F.	open	30F.
SO-175-ST(8)	–	–	175F. ± 5F.	open	30F.
SO-180	SO-180-A	OA-180	180F. ± 5F.	open	30F.
SO-180-QC(9)	–	–	180F. ± 5F.	open	30F.
SC-180	SC-180-A	CA-180	180F. ± 7F.	closes	30F.
SO-190	SO-190-A	OA-190	190F. ± 5F.	open	30F.
SO-190-TPZ(10)	–	–	190F. ± 6F.	open	30F.
SO-194-QC(4)	–	–	194F. ± 5F.	open	41F.
–	–	OA-190-QC(4)	190F. ± 5F.	open	18F.
–	–	CA-190-QC(4)	190F. ± 7F.	closes	18F.
–	–	OA-194M	194F. ± 7F.	open	manual-reset
–	–	CA-194-QC(11)	194F. ± 7F.	closes	30F.
–	S0-195-AM	–	195F. ± 8F.	open	manual-reset
–	SO-200-A	–	200F. ± 5F.	open	30F.
SC-200	SC-200-A	CA-200	200F. ± 7F.	closes	30F.
–	–	CA-205	205F. ± 8F.	closes	30F.
SO-210	SO-210-A	OA-210	210F. ± 6F.	open	30F.
SO-220	–	OA-220	220F. ± 6F.	open	30F.
SC-225	SC-225-A	CA-225	225F. ± 8F.	closes	30F.
SO-230	SO-230-AQC(4)	OA-230	230F. ± 6F.	open	30F.
SC-240	–	CA-240	240F. ±10F.	closes	100F.
SO-250	SO-250-A	OA-250	250F. ± 7F.	open	30F.
–	SO-250-AM	OA-250M	250F. ±10F.	open	manual-reset
SC-270	–	–	270F. ± 7F.	closes	30F.
–	SO-280-A	–	280F. ± 7F.	open	30F.
–	SO-300-A	–	300F. ± 7F.	open	30F.
–	SO-315-AQC(7)	–	315F. ± 7F.	open	25F.
SO-325	SO-325-A	–	325F. ± 7F.	open	50F.
–	SO-350-A	-	350F. ±10F.	open	60F.

HIGH TEMPERATURE CERAMIC CONSTRUCTION THERMOSTATS
MODELS AVAILABLE FROM STOCK

SC-A AND SO-A	SET POINT	ACTION AT SET POINT	DIFFERENTIAL
SC-105-AC	105F. ± 7F.	close	15F.
SO-400-AC	400F. ±25F.	open	100F.
SO-450-AC	450F. ±25F.	open	100F.
SO-500-AC	500F. ±25F.	open	100F.





ELECTRICAL SPECIFICATIONS
Contact Type: SPST
Contact Ratings at 100,000 cycles:
5 Amps at 120 VAC; 10 Amps at 240 VAC

(1.) Has .250 turned up quick connects, no bracket.
(2.) Freeze point thermostat – closes before 32F. on drop.
(3.) Printed circuit board mount.
(4.) Has .250 turned up quick connects 90° to mounting hole centerline.
(5.) Vertical solder terminals.
(6.) Has no bracket.
(7.) Has .250 turned up quick connects 45° to mounting hole centerline.
(8.) Has .250 turned up quick connects – 6-32" stud, ¼" length.
(9.) Has 3/16" horiz. quick connects – 45° to mounting hole centerline.
(10.) Has .250 turned up quick connects in line with mounting holes, open slot on one mounting hole.
(11.) Has 3/16" turned up quick connects 90° to mounting hole centerline.

NEW Thermal Products from SELCO:
IMMERSIBLE/PROBE THERMOSTATS
TUBE ADAPTOR THERMOSTATS
ELECTRONIC AND CAPILLARY TEMPERATURE CONTROLS
For more information, Contact SELCO.

Sensor Scientific, inc.

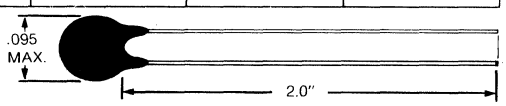
NTC THERMISTORS

INTERCHANGEABLE WAFER THERMISTORS 0-70°C

Resistance vs. Temperature Conversion Chart

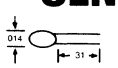
TEMP °	MATERIAL C				MATERIAL D		
	OHMS				OHMS		
	2,252	3,000	5,000	10,000	30,000	50,000	100,000
-50	151424	201720	336200	672400			
-40	75982	101220	168700	337400	1204500	2007500	4015000
-30	39928	53190	88650	177300	618900	1031500	2063000
-20	21883	29151	48585	97170	330900	551500	1103000
-10	12474	16617	27695	55390	183510	305850	611700
0	7357	9801	16335	32670	105300	175500	351000
10	4481	5970	9950	19900	62310	103850	207700
20	2813	3747	6245	12490	38010	63350	126700
25	2252	3000	5000	10000	30000	50000	100000
30	1814	2417	4029	8057	23826	39710	79420
40	1200	1598	2664	5327	15309	25515	51030
50	812	1081	1802	3604	10077	16795	33590
60	560	746	1243	2486	6777	11295	22590
70	394	525	875	1749	4647	7745	15490
80	282	376	627	1253	3243	5405	10810
90	206	274	457	913	2307	3845	7690
100	153	203	339	677	1665	2775	5550
110	115	153	255	509	1221	2035	4070
125	77	102	170	340	786	1310	2620
130	68	90	150	300	678	1130	2260
140	53	70	117	234	513	855	1710
150	42	56	93	185	396	660	1320

Sensor Scientific has developed a low cost interchangeable wafer thermistor product line. These highly reliable units provide a resistance temperature curve that can be matched within ±.2°C over a range of 0° to 70°C. This means that a matched replacement thermistor can be purchased several years from now with the identical R/T curve as the original thermistor.

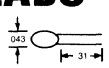


EPOXY COATED

SENSORBEADS



S14 GLASS BEAD

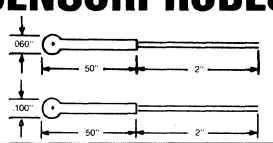


S43 GLASS BEAD

PART #	R @ 25°C	DIA	25/125°C
S14A102	1,000	.014	13.7
S14A502	5,000	.014	15.1
S14A103	10,000	.014	19.6
S14A104	100,000	.014	30.2
S14A105	1,000,000	.014	39.8
S43A102	1,000	0.43	18.6
S43A502	5,000	0.43	20.7
S43A103	10,000	0.43	27.8
S43A104	100,000	0.43	34.1
S43A105	1,000,000	0.43	51.6

These are typical units. Resistance values are available at 25°C from 100 ohms to 5 meg ohms.

SENSORPROBES



PART #	R @ 25°C	DIA	25/125°C
SP60A	1,000	.060	18.6
SP60A	10,000	.060	27.8
SP60A	100,000	.060	34.1
SP100A	1,000	.100	18.6
SP100A	5,000	.100	20.7
SP100A	10,000	.100	27.8
SP100A	100,000	.100	34.1
SP100A	1,000,000	.100	51.6

These are typical units. Resistance values are available at 25°C from 100 ohms to 5 meg ohms. Glass encapsulations are available from 1/8" to 1" in length.

CUSTOM ASSEMBLIES

Sensor Scientific recognizes the growing demand of diversified mounting and assembly requirements. Our engineers are responsive to your design criteria and will work with you to fulfill your application needs.

GENERAL APPLICATIONS

- Air temperature sensing
- Medical probes
- Corrosive solution testing
- Surface temperature probes
- Pipe and plug fitting probes
- Gas temperature measurements
- Armored cable assemblies

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Sensor Scientific, inc.

NTC THERMISTORS

TEMPERATURE ASSEMBLIES

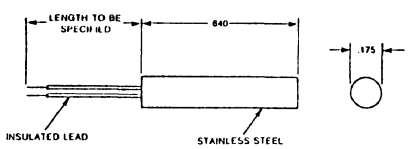
Sensor Scientific manufactures many different types of thermistor assemblies. The housing drawings in this section are offered as a guide to assist the engineer in designing a complete thermistor assembly that meets his project needs best.

The housing material specified in most of the drawings is stainless steel. If the requirements are such that other material would be preferable, brass and aluminum are also available.

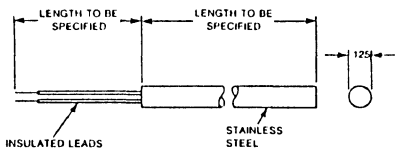
The basic element in these assemblies is the thermistor. Sensor Scientific manufactures a complete line of thermistors. The glass bead probe thermistor and the wafer or thermistor are units that are typically used in these assemblies.

Sensor Scientific has trained application engineers who will assist you in the design and selection of the thermistor assembly that meets your needs best. Our probes have been designed to maximize sensitivity and stability. They are also constructed to minimize the risk of damage due to operation and handling.

All assembly work is performed by carefully trained and supervised individuals. All units are extensively tested throughout the manufacturing process to insure that customers receive the highest quality thermistor assemblies.



Series 100



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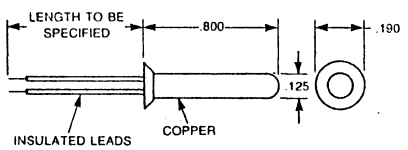
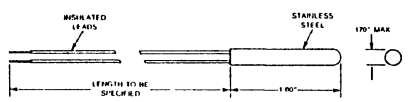
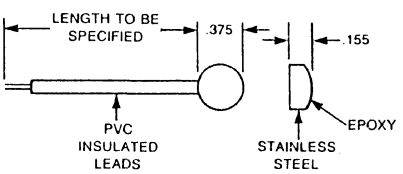


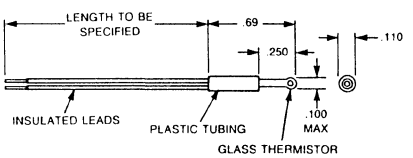
Series 200



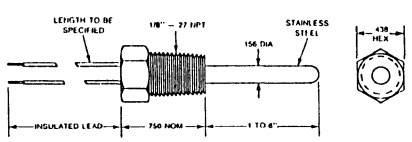
Series 210



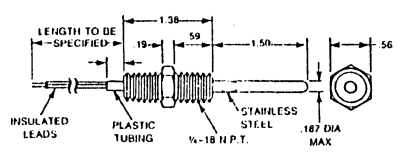
Series 300



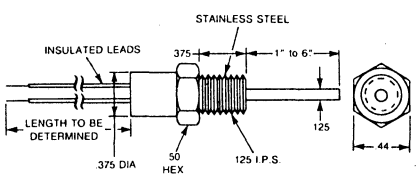
Series 400



Series 500



Series 501



Series 510

The quality control at Sensor Scientific is qualified to Mil-Q-9858A. All units are tested in carefully calibrated sensitive temperature control baths and all calibrations are traceable to the National Bureau of Standards.

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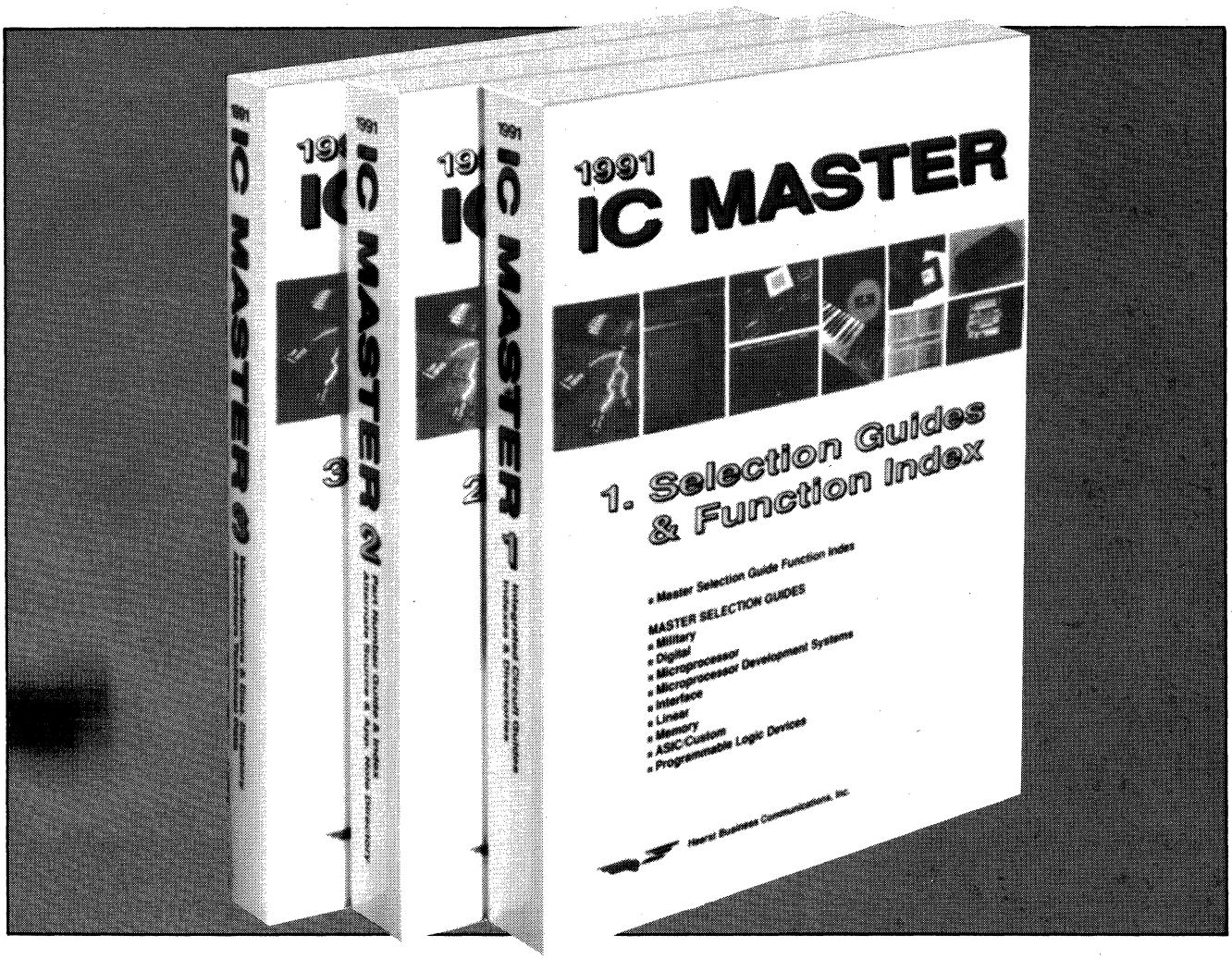
SUPER TIME SAVER!



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Do we have good news for you! Get your hands on the latest annual copy of the IC Master. The Master will save you both time and money. Here's how.

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THERMODISC®

TEMPERATURE CONTROLS

Product Overview

Therm-O-Disc bimetal disc temperature controls are widely used in the appliance, HVAC and many other industries. They are powered by bimetal discs which open or close a set of electrical contacts when a predetermined temperature is reached.

Therm-O-Disc temperature controls combine reliability and performance with high volume production methods for maximum value at a low cost. Many terminals and mounting arrangements are available for application flexibility. These products are approved by most major testing agencies around the world.

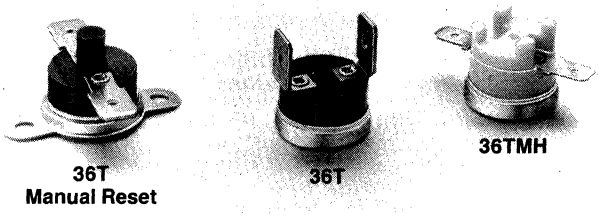
In addition to the products shown, Therm-O-Disc offers a variety of other products designed to meet unique applications. We have the expertise and experience to custom design products to meet your application for temperature sensing and control, electric power control, water flow control and pressure control.

This chart contains an overview of some of the most widely used Therm-O-Disc products. Products with similar attributes are grouped so you may compare their features.

Control Chart

Series	Type	General Description	Calibration Range °C	Calibration Range °F	Maximum Electrical Ratings Volts	Res. Amp.
General Purpose	36T	½" Disc Multi-Purpose Control	2-220	35-428	120	15
	60T	¾" Disc Multi-Purpose Control	−18-177	0-350	240	25
	64T	¾" Disc DPST Control	−18-177	0-350	240	25
	49T	¾" Disc High Temperature Control	27-288	80-550	240	25
	69T	¾" Disc Heater Biased Control	−18-82	0-180	240	25
	37T	¾" Disc Moisture Resistant Control	−29-149	−20-300	120	10
	14T	1" Disc Moisture Resistant Control	−18-105	0-221	240	25
Special Purpose	58T	Adjustable Control	−1-66	30-150	277	25
	79T	Adjustable Control with Thermal Cutoff	−1-66	30-150	277	25
	74T	¾" Disc Adjustable Control	43-121	110-250	240	25
	59T/	Electric Water Heater Control	43-93	110-200	250	30
	66T	Electric Water Heater Limit	38-104	100-220	277	40
	12S/14S/15S	Sequencer/Time Delay Relay	N/A	N/A	277	25
	10H	Linear Limit	66-149	150-300	277	25
	18T/19T	Glass Top Range Limiter Hot Light Indicator	500-750 75-150	932-1382 193-328	277 240	10 1
	10RS	Radiant Sensor	163 Max	325 Max	120	5.75
	10M	Fractional H.P. Motor Protector	80-150	176-302	120	36
	20M	Fractional H.P. Motor Protector	80-150	176-302	240	37
	14M	Hermetic Motor Protector	80-150	176-302	240	37
	30M	Manual Reset Motor Protector	80-150	176-302	240	37
	83T	Printed Circuit Board Control	30-120	86-248	48 (DC)	0.05
	Reed Switch	Temperature Sensitive Magnetic Reed Switch	−18-79	0-175	120	15
	44T	Low Voltage Control	49-149	120-300	1 (DC)	1
	HLX	High Capacity Limit	49-149	120-300	480	50
	75TF	Combination Control and Limit	27-177	80-350	600	25
Microtemp® Thermal Cutoffs	TCO	"One-Shot" Thermal Fuse	60-240	140-464	250	25

36T Series ½" Bimetal Disc



36T
Manual Reset

36T

36TMH

36T—The 36T is the industry standard ½" bimetal disc thermostat for controlling or limiting temperature in appliances, HVAC and office equipment. It is available with automatic or manual reset switching action. A single operation version may be specified for applications requiring "one shot" protection. Board mount, surface, air stream and stud mount configurations are available.

36TMH—Typically used in coffee makers and tea kettles, the 36TMH is a ceramic version of our 36T. It is also available with a variety of mounting brackets and terminal configurations.

36T General Electrical Ratings* and Worldwide Test Agency Recognitions

Thermostat Type	Maximum Temperature	Cycles	Inductive Amperes FLA	Inductive Amperes LRA	Pilot Duty VA	Resistive Amperes	Volts Ac	Recognized By
Automatic Reset Standard Construction	350°F 350°F 350°F	100,000 100,000 6,000	3 1.5 15(.75PF)-	12 6 —	125 125 —	15 10 —	120 240 120	U.L.
Automatic Reset— High Temp Construction	428°F 428°F	100,000 100,000	— —	— —	— —	15 10	120 240	
Manual Reset	350°F 350°F	6,000 6,000	5 1.5	25 6	125 125	15 10	120 240	
Single Operation	350°F 350°F 310°F	1 1 1	10	60 — —	— — —	— 15 25	240 240 120	
Automatic Reset— Standard Construction	350°F 350°F	100,000 100,000	3 1.5	12 6	125 125	15 10	120 240	C.S.A.
Automatic Reset— High Temp. Construction	400°F 400°F	100,000 100,000	— —	— —	— —	15 10	120 240	
Manual Reset	350°F 350°F	6,000 6,000	5.5 1.5	20.5 6	125 125	15 10	120 240	
Automatic Reset Auto Reset—High Temp Construction Manual Reset	175°C 220°C 175°C	100,000 100,000 200	— —	— —	— —	10 10 10	250 250 250	NEMKO
Automatic Reset Manual Reset	175°C 175°C	10,000 15	1.66 1.66	— —	— —	10 10	250 250	SEMKO
Automatic Reset Manual Reset	175°C 175°C	100,000 15	— —	— —	— —	10 10	250 250	SEV
Automatic Reset Auto Reset High Temp. Con.	175°C 220°C	60,000 100,000	— —	— —	— —	10 10	250 250	BEAB
Automatic Reset Manual Reset	175°C 175°C	100,000 20	1.66 1.66	— —	— —	10 10	250 250	DEMKO, UTE
Automatic Reset	175°C	20,000	1.66	—	—	10	250	SETI
Automatic Reset Automatic Reset— High Temp. Construction Manual Reset	175°C 220°C 175°C	100,000 100,000 20	6 6 6	— — —	— — —	10 10 10	250 250 250	VDE
Automatic Reset Manual Reset	175°C 175°C	100,000 200	1.6 1.6	— —	— —	10 10	250 250	KEMA

*For complete ratings, please contact our sales engineering department

For further information on your specific design application, contact a Therm-O-Disc sales engineer at 419-525-8500.

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NTC THERMISTORS

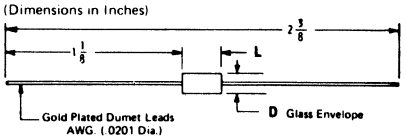
H-Series and leadless SMS™ Hermetically Sealed Thermistors are small, rugged and good for use up to 400°C. Their fast response, interchangeability and longterm stability makes both series ideal for temperature sensing and compensation. The leadless SMS™ Thermistor is designed for applications where surface mounting is required. Both sensors are available on tape and reel for automatic mounting.

H-SERIES LEADED SENSOR

Typical Characteristics		Catalog Number				
Specification	Test Condition	1H	PIH	UH	2H	4H
Resistance @ 25° C. (OHMS)	Zero Power	3K-100K	3K-100K	3K-100K	2K-5K	200K-1M
Resistance Ratio $\frac{R_{25C}}{R_{128C}}$		29.85	29.85	29.85	19.80	48.78
Maximum Withstand Temperature. °C		-55 to 400	-55 to 400	-55 to 400	-55 to 400	-55 to 400
Operating Temperature Range. °C		-50 to 400	-50 to 400	-50 to 400	-50 to 400	-50 to 400
Interchangeability °C (see curve reverse side)	0-100°C	N/A	1°C	.2°C	N/A	N/A
Stability (change in resistance)	1000 Hours at 100°C	< .1%	< .1%	< .1%	N/A	N/A

OUTLINE DRAWING

(Dimensions in Inches)



GRADE	D	L	AWG
1H (3K-8K)	.095	.170	20
1H (10K-100K)	.070	.150	24
2H (2K-5K)	.070	.150	24
4H (200K-1M)	.070	.150	24

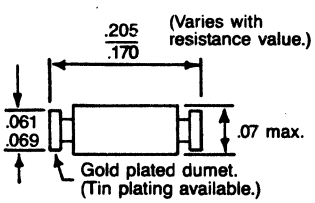
*Dissipation Constant—Free Air
1H (3K-8K)—4mw/°c
1H (10K-100K) 2H-4H—2mw/°c

**Time Constant—Stirred Oil
1H (3K-8K)—1.5 sec. max.
1H (10K-100K)—2H-4H—1 sec. max.

SMS™ - SURFACE MOUNT SENSOR

Typical Characteristics	Catalog Number 2S202	2S502	1S103	1S203	1S503	1S104	4S204	4S504	4S105
Zero Power Resistance @ 25°C: OHMS ± 10%	2,000	5,000	10,000	20,000	50,000	100,000	200,000	500,000	1,000,000
Resistance Ratio: $\frac{R_{25°C}}{R_{125°C}}$	19.80	19.80	29.41	29.41	29.41	29.41	48.78	48.78	48.78
*Dissipation Constant (∂): $\frac{\text{milliwatts}}{°C}$	2	2	2	2	2	2	2	2	2
**Thermal Time Constant (τ):(sec.)	8	8	8	8	8	8	8	8	8
Time Constant with Stirred Oil (sec.)	1	1	1	1	1	1	1	1	1
Maximum Operating Temperature: (°C)	400	400	400	400	400	400	400	400	400
(°F)	752	752	752	752	752	752	752	752	752

OUTLINE DRAWING



*The ratio in a 25°C still air ambient, of the power input to raise the Thermistor temperature to 125°C and its temperature rise (125°C-25°C) above ambient.

**Time required for a Thermistor to change 63.2% of the temperature difference between its initial and final body temperature when subjected to a step function change in temperature under zero-power conditions.

Temperature		Resistance Ratio Characteristics		
°C	°F	R_T/R_{25} MULTIPLIER 1H-	2H-	4H-
-55	-67	95	54	131
-40	-40	34	21.7	45.5
-21.5	-6.7	10.5	8.0	13.2
0	32	3.3	2.82	3.71
25	77	1.00	1.00	1.00
37.8	100	.58	.62	.543
50	122	.36	.41	.32
75	167	.148	.182	.114
104.4	220	.0595	.082	.0399
125	257	.0335	.505	.0205
150	302	.0180	.0300	.0101
200	392	.00670	.0116	.00285
250	482	.00280	.00555	.00110
300	572	.00140	.00291	.000454
350	662	.000800	.00178	.000113
400	752	.000450	.00104	.000113

To find the resistance of a particular H-Series Thermistor at any temperature in this table, multiply its 25°C resistance by the multiplier for that temperature.

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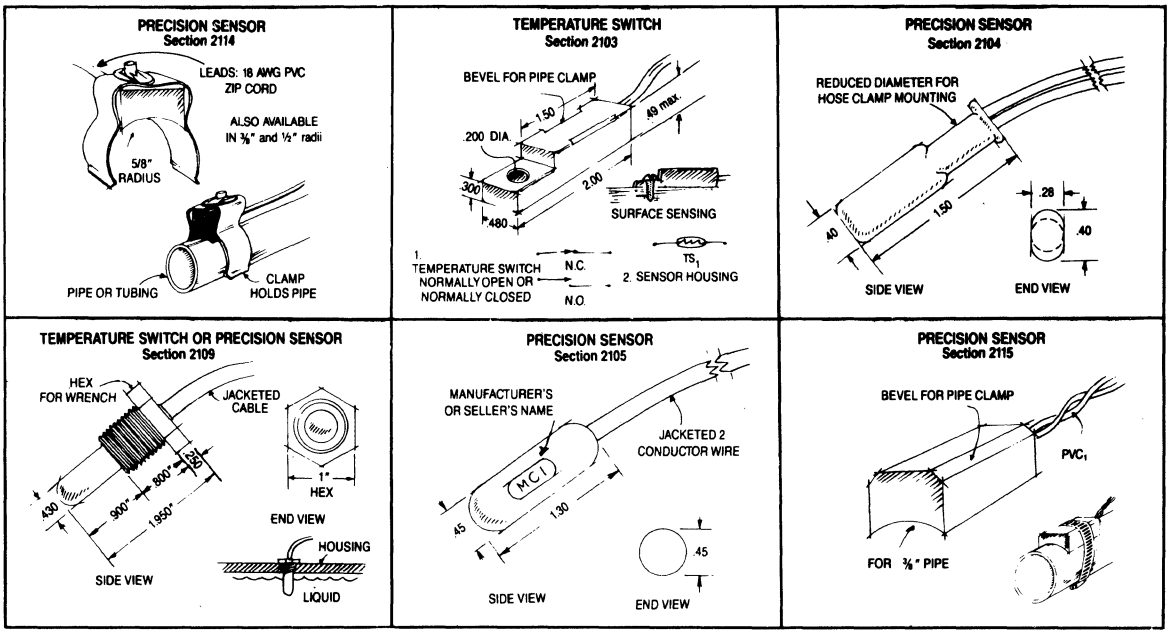
TUFF-SENSORS™

TEMPERATURE SENSORS INCAPSULATED IN THERMOPLASTIC

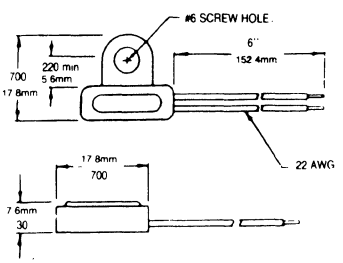
TUFF-SENSORS™, a family of thermoplastic molded probes, provide reliable protection against environmental extremes for our line of temperature sensors and switches. Use of high performance plastics creates a temperature probe that resists temperature variations, humidity, chemicals and rough handling.
Many standard sizes and shapes are available, with selection of type based on conditions of use.
Custom designs available to your specifications.



NTC THERMISTORS

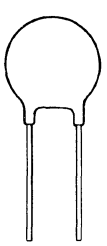
TAB MOUNTED PROTECTORS

Over Temperature Protectors provide shutoff or regulation of expensive Power Transistors and protect against over-heating that occurs from component failure or short conditions. The sensor is an NTC (Negative Temperature Coefficient) device. Unlike fuses or bi-metal elements its action is recyclable and has no hysteresis effect. Available in resistance packages from 100Ω to 100K in tolerances of .8% to 40%.



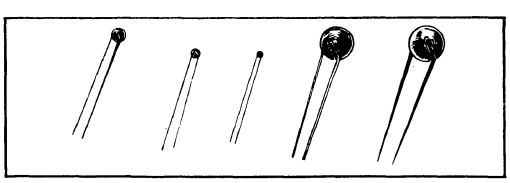
INRUSH CURRENT SUPPRESSORS FOR SWITCHING POWER SUPPLIES.

Switching power supplies present high initial currents due to filter capacitor impedance upon turn-on. The use of NTC (Negative Temperature Coefficient) devices limits this current to a low value. After current flow their resistance becomes negligible and offers little voltage drop.



• TEMPERATURE COMPENSATION AND SENSING

Disc Series Thermistors are small rugged Thermistors with close electrical tolerances. Their small mass gives short thermal time constants, yet they are not so small that it is difficult to handle them. The tinned copper leads are easily soldered into electrical circuits.



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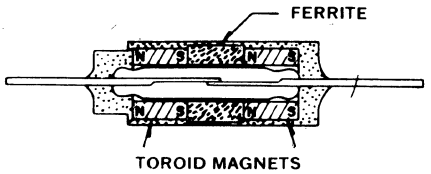
TEMPERATURE SENSING SWITCHES

CONVENIENT AND RELIABLE TEMPERATURE CONTROL

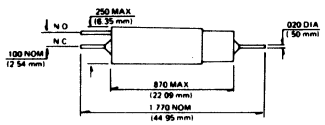
Miniature temperature switches use an electro-ceramic element instead of a bimetallic switch. The Reed Switch Temperature Sensor works on these two principles: a reed switch actuation occurs because of changes in strength of a magnetic field in the vicinity of the contact gap; and certain materials exhibit great changes in magnetic reluctance when the temperature is varied in the vicinity of the material's curie temperature.

The unit has good response time, and is operable in a variety of atmospheres and solutions. Variations in configurations suitable for installation in automotive engine crankcases and automatic transmissions, or mountings for use in computer cabinets are possible. Other applications include oven over-heat alarms, corrosive liquid temperature control, food freezer thaw warning and cooling fan stop indication. This switch replaces many thermally actuated devices now used where increased life is required or protection of the switching contacts from adverse environments is deemed desirable.

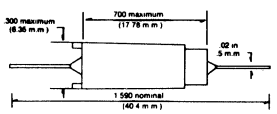


MOLDED SWITCHES

Switches feature small size for fast response. epoxy package resists most chemicals and is good for use up to 115°C. Standard units from 0° to 115°C are available in five degree nominal increments.



SPDT Form C



SPST Form B (NC)
SPST Form A (NO)

SPECIFICATIONS

	ST Form B (NC) SPST Form A (NO)	SPDT Form C
CONTACT RATING	Watts – 10W maximum Volt Amps – 12 V.A. maximum	Watts – 10W maximum Volt Amps – 12 V.A. maximum
VOLTAGE	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum
CURRENT	Carry – 1 amp maximum Break – 1 amp maximum Make – .5 amp maximum	Carry – 1 amp maximum Break – 1 amp maximum Make – .500 amp maximum
OPEN TEMPERATURE – NOMINAL	5° increments starting at 0°C	5° increments starting at 0°C
TOLERANCE	±5°C	±5°C
RESET DIFFERENTIAL	10°C maximum	10°C maximum

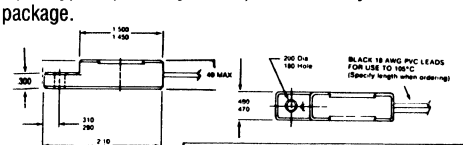
KEY TO ORDERING:
MTS XXX A or B
Temp. Switch Temp. in °C Form
EXAMPLE: MTS 50B

REED SWITCHES—PMS SERIES

Midwest Components Product Group has now packaged the reliable temperature sensing reed switch in a convenient and easy to use housing. The molded plastic body offers the additional advantages of complete moisture and dust protection at an economical price.

This rugged switch can be quickly mounted with a screwdriver. An indentation on the housing also facilitates attachment by ordinary hose clamps or clip hardware supplied by the user. Type A (normally open) or Type B (normally closed) switches may be used in this new package.

CONTACT ARRANGEMENT	SPST Form B (NC)	SPST Form A (NO)
CONTACT RATING	Watts – 10W maximum Volt Amps. – 12 V.A. maximum	Watts – 10W maximum Volt Amps – 12 V.A. maximum
VOLTAGE	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum
CURRENT	Carry – 1 amp maximum Break – 1 amp maximum Make – .5 amp maximum	Carry – 1 amp maximum Break – 1 amp maximum Make – .5 amp. maximum
SWITCH TEMPERATURE – NOMINAL	5° increments starting at 0°C	5° increments starting at 0°C
TOLERANCE	±5°C	±5°C
RESET DIFFERENTIAL	10°C maximum	10°C maximum



KEY TO ORDERING:
PMS XXX A or B XX
Temp. Switch Temp. in °C Form Lead Length in Inches

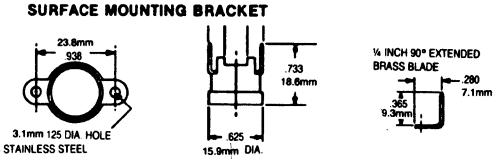
SNAP-ACTION BI-METAL SWITCHES

The electrical switch of the SAS is operated by a thermally-responsive ½inch diameter bimetal disc. The switch is used as a temperature limiting or regulating thermostat. Because of its relatively small size and inexpensive design, it is suitable for a vast array of applications.

Features

Impact Action: The bimetal disc of the SAS is factory calibrated at both its top and bottom temperatures. When the disc, which is dished like a saucer, reaches its calibrated temperature it suddenly snaps through and imparts its kinetic energy to the bumper, then to the contacts. The resulting high speed of contact separation insures long life at high electrical loads, and a minimum of radio and TV interference.

SURFACE MOUNTING BRACKET



SPECIFICATIONS

CONTACT ARRANGEMENT	SPST Form A (NO) or Form B (NC)
CONTACT RATING—AC	Watts—2400 maximum AC Volt Amps—125 V.A. maximum AC
CONTACT RATING—DC	Volts Amps—30 V.A. maximum DC
VOLTAGE	Volts D.C.—120 VDC maximum Volts A.C.—240 VAC maximum
CURRENT—RESISTIVE LOAD	Carry—10 amp maximum AC Carry—.25 amp maximum DC
OPEN TEMPERATURE—NOMINAL	5° increments starting at 0°C
TOLERANCE	±5°C
RESET DIFFERENTIAL	25° maximum

KEY TO ORDERING:
SAS XXX A
Temp Switch Temp in °C Form
EXAMPLE: SAS 50A

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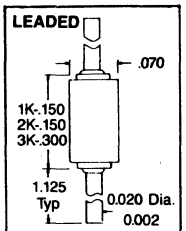
TEMPSISTOR

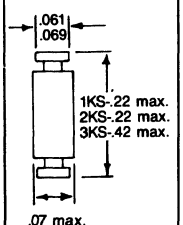
TEMPSISTOR • TEMPERATURE COMPENSATOR •

LEADED



Dimensions are in inches. **K-SERIES**

SMS™ - SURFACE MOUNT SENSOR



KS-SERIES

The Tempsistor® is a temperature compensator designed to offset the temperature drift of metallic and semi-conductors. Applications include pressure transducers, opto amplifiers, inductive motor controllers, and automatic gain controls. Small size can replace 1/8 watt or resistors.

The Tempsistor® is available in resistances from 10 to 12K ohms at 25°C.

Both devices are available on tape and reel for automated assembly.

TEMPSISTOR® SPECIFICATIONS

Resistance Ratio Temperature Characteristics					
Temp.		R / R Multiplier			
		RESISTANCE VALUE (Ohms)			
°C	°F	10-56Ω	68-820Ω	1-2.7KΩ	3.3-39KΩ
-25	-13	.73	.65	.65	.61
0	32	.86	.82	.81	.83
25	77	1.00	1.00	1.00	1.00
50	122	1.15	1.21	1.19	1.19
75	167	1.32	1.44	1.39	1.37
100	212	1.49	1.68	1.58	1.52
125	257	1.68	1.94	1.75	
150	302	1.89	2.21		

DISSIPATION CONSTANT - Style 1K and 2K = 2.5 MW/°C Style 3K = 5 MW/°C

TIME CONSTANT - Style 1K and 2K = 8 sec. in still air, 1 sec in rapidly stirred oil. Style 3K = 19 sec. in still air, 2.2 sec. in rapidly stirred oil.

STANDARD ZERO-POWER RESISTANCE VALUES (Ohms) at 25°C AMBIENT TEMPERATURE

10	11	12	13	15	16	18	20	22	24	27	30
100	110	120	130	150	160	180	200	220	240	270	300
1000	1100	1200	1300	1500	1600	1800	2000	2200	2400	2700	3000
10000	11000	12000									
33	36	39	43	47	51	56	62	68	75	82	91
330	360	390	430	470	510	560	620	680	750	820	910
3300	3600	3900	4300	4700	5100	5600	6200	6800	7500	8200	9100

PART NUMBER DESIGNATION: XXX—XXX—X

LEADED DEVICE

SPECIFY ONE OF THREE CHOICES FOR FIRST 2 DIGITS

1K — Resistance range 10-820 Operate Temp. 150°C
2K — Resistance range 1K-3.0 K Operate Temp. 125°C
3K — Resistance range 3.3K-12K Operate Temp. 100°C

SMS™ - SURFACE MOUNT SENSOR

SPECIFY ONE OF THREE CHOICES FOR FIRST 3 DIGITS

1KS — Resistance range 10-820 Operate Temp. 150°C
2KS — Resistance range 1K-3.0K Operate Temp. 125°C
3KS — Resistance range 3.3K-12K Operate Temp. 100°C

NEXT 3 DIGITS DENOTE RESISTANCE VALUE AT 25°C.

1st digit denotes 1st significant figure
2nd digit denotes 2nd significant figure
3rd digit denotes multiplier by the power of 10

LAST DIGIT OF PART NUMBER DENOTES TOLERANCE AT 25°C.

L — ±20% K — ±10% (standard) J — ±5%

EXAMPLE OF PART NUMBER SPECIFICATION (FOR LEADED DEVICE)

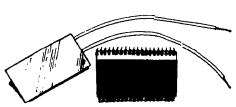
2K — 272 — K
Part would be a .150" long body, 2.7 K ±10% @25°C.

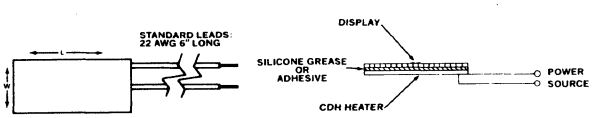
SPECIALTY CERAMICS

SELF REGULATING DISPLAY HEATER

The unique self-regulating heating effects of specially doped ceramics are utilized to create a new type heater for liquid crystal or other temperature sensitive displays. These devices produce heat at cold temperatures and curtail heating at normal or high temperatures. This feature allows its use in battery operated instruments due to low normal current drain. Use of this heater allows a broader application of displays by removing the adverse effects of temperature.

Heater is attached to reverse side of display with thermally conductive epoxies or silicone adhesives depending upon display's thermal coefficient of expansion or temperature to which it may be subjected. Actual performance of the display will depend upon manufacturers specifications.





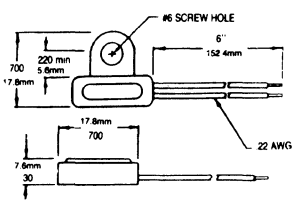
ORDER NUMBER	SIZE* L X W	OPERATING VOLTAGE**	NOMINAL RESISTANCES R@ - 35°C	NOMINAL RESISTANCES R@ 50°C
CDH001	2.0" x .9"	12-28 AC or DC	5 OHMS	1500 OHMS MIN.
CDH002	3.1" x 1.1"	12-28 AC or DC	3 OHMS	1000 OHMS MIN.
CDH003	3.6" x 1.1"	12-28 AC or DC	2.5 OHMS	750 OHMS MIN.

*Other sizes available — consult factory

POSITIVE OVER TEMPERATURE PROTECTORS

Therm-O-Discs' Over Temperature Protector provides shutoff or regulation of expensive RF or AF Power Transistors. Protects against over heating that occurs from output stage component failure, antenna breakage, or short conditions.

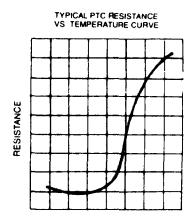
Unlike fuses or bi-metal elements its action is recyclable and has no hysteresis effect.

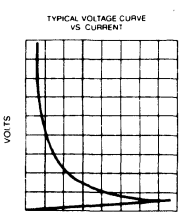


PTC SWITCHING THERMISTORS

THE POSITIVE WAY TO SENSE, MEASURE, CONTROL, REGULATE AND PROTECT.

PTC switching thermistors are thermally sensitive resistors which exhibit large positive increases in resistance with temperature. At customer specified temperatures the resistance rises abruptly from a low value to a high value. This resistance shift is infinitely repeatable and has no hysteresis associated with its action.







Write for your FREE PRODUCT CATALOG or for immediate answers, call one of our application engineering specialists at 419-525-8450.

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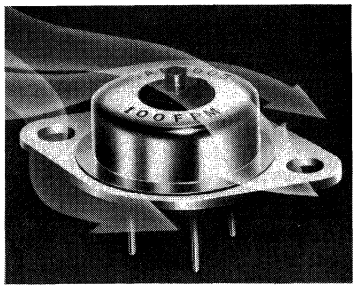
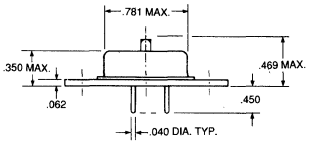
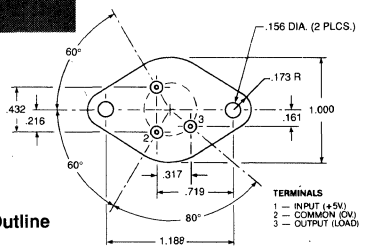
STATE-OF-THE-ART THERMAL MANAGEMENT OF MODERN ELECTRONIC EQUIPMENT

THE WARREN G-V SOLID STATE AIRFLOW SWITCH





SAF1005



T-03 Outline

The advanced SAF Series Airflow Switch provides early detection and protection from overheating in mainframe computers and peripherals, large power supplies; HVAC applications, medical diagnostic equipment, and other complex electronic systems requiring forced air cooling.
This highly innovative, low profile airflow sensor is also easily mountable directly on the most densely populated circuit boards, on equipment racks with as little as .625 inch spacing between boards, on sockets or bracket mount plenums. All SAF models are complete, self contained sensor/alarm devices – no additional circuitry or signal conditioning as required.

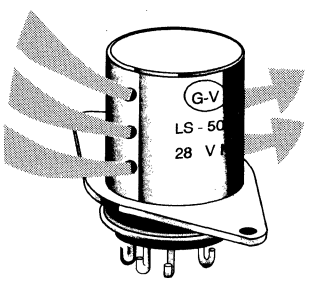
Specifications

Input voltage: +5 VDC (±5%)
Power Dissipation: ½ w max
Output: open collector, solid state, able to sink up to 100 MA to ground, from DC Sources up to 30V
Sensing Range: 50 to 1500 F.P.M.
Sensing Tolerance: ±25 F.P.M. or ±10%, whichever is greater
Ambient Range: +10°C to +60°C ambient temperature compensation curves available
Sensitivity: ±25 F.P.M. from actual setting
Hysteresis: Series SAF1005 (standard Model) is typically 10% of the setting

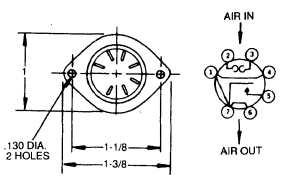
Mounting Accessories

- Military Socket Assembly with leads, no mounting bracket–PN 4-1-261 (Switch not included)
- Bracket only with leads attached to SAF Sensor–PN 4-1-270
- Socket Assembly with mounting bracket and leads–PN 4-1-260

AIR FLOW SENSORS *LS Series*



MILITARY APPLICATIONS



Outline Dimensions

- Available for varied voltage sources
- Built in time delay interval ignores transient airflow interruptions
- Ambient compensated design provides stable performance under wide ambient
- Rugged design meets MIL shock/vibration/ ambient requirements
- No additional circuitry required

Specifications

Heater Voltage: 5V., 12 V., 28 V., or 115 V. AC/DC Other voltages available
Input Power: 4 Watts, nominal
Contact Rating: 2 A. resistive up to 115V. AC
1 A. resistive up to 32V. DC
Usable Voltage Range: ± 10% of nominal, voltage variation chart available
Setting: 75 to 1000 F.P.M.
Response Time: 1 to 20 seconds (depending on setting and air velocity prior to stoppage)
Temperature Range: -55°C-85°C, energized
Vibration: 10g to 500 Hz.
Shock: 50g for 11 msec.

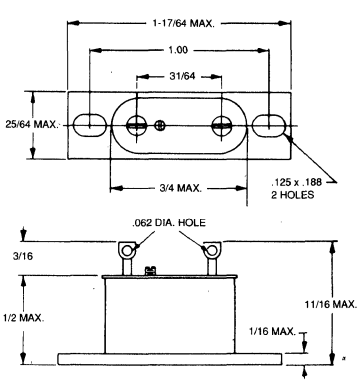
TEMPERATURE SENSORS *Electrical Thermostats*

VE SERIES SURFACE TEMPERATURE SENSOR

VE Surface Temperature Sensors have a unique dual bimetal design which produces larger forces and contact motion than ordinarily found in devices of this size. Intimate coupling between the mounting base and actuating elements produce an exceptionally fast response time. Contact chatter is eliminated and the unit has no resonant points below 2000 Hz.

Specifications

Setting Tolerance: ±5°F (±3°C)
Contact: SPST open on rise or SPST close on rise
3 A. @ 115 V AC Resistive
1 A. @ 32 V DC Resistive
Vibration: 25 g to 1000 Hz
Shock: 50 g, 11 ms
Temperature Range: 0°C to +150°C



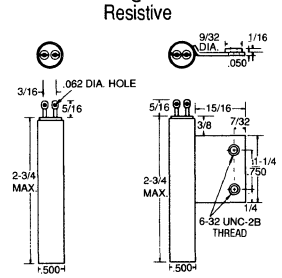
Direct replacement for fenwal Series 32410/32411–The Fenwal Company discontinued this popular surface sensing series in 1987–The Warren GV Series VE Thermostat mounts on the same 1.00" centerline as a direct replacement meeting all electrical and thermal requirements of the former unit.

C-8 SERIES AMBIENT TEMPERATURE SENSORS

C8 Sensors are based on a differential expansion principle, comparing the expansion or contraction of the outer shell in relation to an internal member that is not affected by temperature. The differential in expansion of these two members is then multiplied by the internal mechanism and transferred as a motion to the contacts. The contacts are built in a separate fused glass header with a minimum current path to reduce self-heating effects.

Specifications

Setting Tolerance: ±5°F (±3°C)
Contact: SPST open on rise or close on rise
Rating: 5A @115 VAC Resistive
1A @ 32 VDC Resistive
Vibration: 10 g to 2000 Hz
Shock: 10 g 11 ms
Temperature Range: -25°C to +150°C



TYPE C8-C **TYPE C8-B** **TYPE C8-F** **TYPE C8-P**

A UNIT OF GENERAL SIGNAL GS

WARREN

1 Apollo Drive • Whippany, New Jersey 07981 • 201-386-1200 • Fax: 201-386-9331

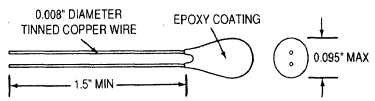
U.S. SENSOR Corp.
1832 West Collins Avenue • Orange, California 92667
Telephone: 714-639-1000 • FAX: 714-639-1220

PRECISION INTERCHANGEABLE THERMISTORS

U.S. Sensor's precision interchangeable thermistors are low cost, highly accurate, stable devices designed specifically for temperature sensing, control and compensation applications. They are particularly suited for uses where their precision interchangeability eliminates the necessity for costly individual circuit calibration.

Features

- Low Cost
- Long life
- Encapsulated
- Fast thermal time response
- High stability
- Highly accurate
- Curve matched



SPECIFICATIONS

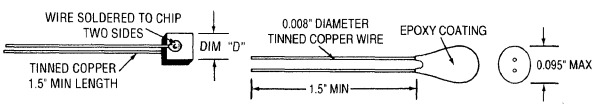
Part Number	Resistance @25°C	Interchangeability Tolerance 0-70°C	R-T Curve	BETA (K) 0-50°C	Resis-Ratio 25-125°C	MAX Operating Temp. °C
AT102E2	1000	0.2	E	3265	17.3	100
AT102F2	1000	0.2	F	3420	19.1	100
AT222J2	2252	0.2	J	3890	29.3	120
AT302J2	3000	0.2	J	3890	29.3	120
AT502J2	5000	0.2	J	3890	29.3	120
AT103J2	10000	0.2	J	3890	29.3	120
AT203J2	20000	0.2	J	3890	29.3	120
AT303J2	30000	0.2	J	3890	29.3	120
AT303H2	30000	0.2	H	3810	29.2	120
AT503J2	50000	0.2	J	3890	29.3	120
AT503R2	50000	0.2	R	4140	38.1	120
AT104R2	100000	0.2	R	4140	38.1	120

STANDARD LEADED CHIP THERMISTORS

U.S. Sensor's leaded chip thermistors are manufactured using the same state of the art manufacturing techniques as those used to produce precision interchangeability devices. This results in devices with superior long term reliability characteristics especially suitable for temperature control and temperature compensation applications.

Features

- Low cost
- Small size
- High stability
- Fast thermal response



Part # Coated	Part # Uncoated	Resistance @25°C	* Resistance Tol ±%	R-T Curve	BETA (K) 0-50	DIM "D"	Max Operating Temp. °C
SC102E2K	SC102E1K	1000	10	E	3265	.095	150
SC102F2K	SC102F1K	1000	10	F	3420	.095	150
SC222J2K	SC222J1K	2252	10	J	3890	.095	150
SC302J2K	SC302J1K	3000	10	J	3890	.095	150
SC502J2K	SC502J1K	5000	10	J	3890	.095	150
SC103J2K	SC103J1K	10000	10	J	3890	.095	150
SC203J2K	SC203J1K	20000	10	J	3890	.095	150
SC303J2K	SC303J1K	30000	10	J	3890	.095	150
SC303H2K	SC303H1K	30000	10	H	3810	.095	150
SC503J2K	SC503J1K	50000	10	J	3890	.095	150
SC503R2K	SC503R1K	50000	10	R	4140	.095	150
SC104R2K	SC104R1K	100000	10	R	4140	.095	150

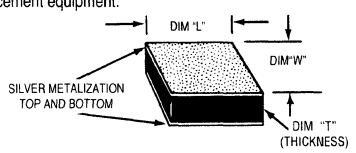
*Resistance Tolerances of 1%, 2%, 5% and 20% are available upon request

UNLEADED CHIP THERMISTORS

U.S. Sensor's unleaded thermistor elements are designed for use on hybrid substrates, integrated circuits or printed circuit boards. They have silver metallization on their top and bottom surfaces which is suitable for various contact techniques including wire bond, epoxy or solder. Since they are manufactured using the most advanced equipment and technology available, their dimensional parameters are extremely uniform making the devices especially suitable for use with automatic handling and placement equipment.

Features

- Surface mountable
- Small size
- Low cost
- Fast thermal response



Part Number	Resistance @25°C	*Resistance Tol ±%	R-T Curve	BETA (K) 0-50°C	Nominal Dimensions " Inches" DIM " L"	DIM " W"	DIM "T"
BC102E1K	1000	10	E	3265	0.040	0.040	0.015
BC102F1K	1000	10	F	3420	0.045	0.045	0.015
BC222J1K	2252	10	J	3890	0.070	0.070	0.010
BC302J1K	3000	10	J	3890	0.065	0.065	0.010
BC502J1K	5000	10	J	3890	0.055	0.055	0.015
BC103J1K	10000	10	J	3890	0.040	0.040	0.015
BC203J1K	20000	10	J	3890	0.030	0.030	0.015
BC303J1K	30000	10	J	3890	0.025	0.025	0.020
BC303H1K	30000	10	H	3810	0.040	0.040	0.015
BC503J1K	50000	10	J	3890	0.020	0.020	0.020
BC503R1K	50000	10	R	4140	0.050	0.050	0.015
BC104R1K	100000	10	R	4140	0.035	0.035	0.015

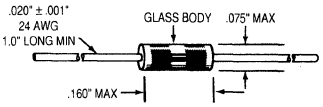
*Resistance Tolerances of 1%, 2%, 5% and 20% are available upon request

GLASS ENCAPSULATED THERMISTORS

U.S. Sensor's glass encapsulated thermistors are manufactured using super stable NTC chips which are hermetically sealed in a glass (DO35 diode style) package. The result is a device which exhibits excellent long term reliability and stability even when subjected to severe environmental or thermal conditions. Their uniform dimensions and axial lead configuration makes them especially suitable for use with automatic insertion equipment.

Features

- High temperature capability(-55 to +220 °C)
- Hermetically sealed glass package
- Low cost
- High stability

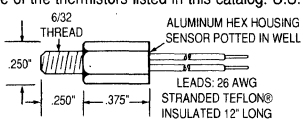


Part Number	Resistance @ 25°C (Ohms)	*Resistance Tol ±%	R-T Curve	BETA (K) 0-50°C
202FG1K	2000	10	F	3420
502FG1K	5000	10	F	3420
103FG1K	10000	10	F	3420
203JG1K	20000	10	J	3890
253JG1K	25000	10	J	3890
503JG1K	50000	10	J	3890
753JG1K	75000	10	J	3890
104JG1K	100000	10	J	3890

*Resistance Tolerances of ±1%, 2%, 5% and 20% are available upon request

STANDARD PROBE ASSEMBLIES

U.S. Sensor manufactures a complete line of probes and assemblies suitable for temperature measurement and control in a variety of commercial, industrial and military applications. Most probe assemblies can include one or more of the thermistors listed in this catalog. U.S. Sensor's highly skilled applications engineering personnel are available to aid in the design of the most advantageous housing and sensor for your application.



Part Number	Resistance @ 25°C (Ohms)	*Resistance Tol ±%	R-T Curve	BETA (K) 0-50°C	Max. Operating Temp. °C
SP102F1K	1000	10	F	3420	150
SP222J1K	2252	10	J	3890	150
SP302J1K	3000	10	J	3890	150
SP502J1K	5000	10	J	3890	150
SP103J1K	10000	10	J	3890	150
SP203J1K	20000	10	J	3890	150
SP303J1K	30000	10	J	3890	150

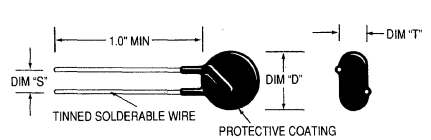
*Resistance Tolerances of 1%, 2%, 5% and 20% are available upon request

CUSTOM PROBES AND ASSEMBLIES

U.S. Sensor manufactures a complete line of probes and assemblies suitable for temperature measurement and control in a variety of commercial, industrial and military applications. Most probe assemblies can include one or more of the thermistors listed in this catalog. U.S. Sensor's highly skilled applications engineering personnel are available to aid in the design of the most advantageous housing and sensor for your application.

INRUSH CURRENT LIMITING POWER THERMISTORS

U.S. Sensor's inrush current limiting power thermistors are specially formulated and processed NTC thermistors suitable for suppressing high inrush currents in switching power supplies and other applications where the high initial starting currents are undesirable. Their unique design enables them to handle extremely high current and voltage levels. In a typical power supply application, the device is used in series with the filter capacitors. Upon application of the initial voltage, the device, due to it's relatively high resistance, limits the current flow to an acceptable level until the capacitors are charged. Thereafter, the device decreases in resistance substantially to a level where the voltage drop across it is negligible.



Part Number	Ro Resistance @ 25°C ±20%	Imax / MAX Steady State Current	Rlmax Resistance @ MAX Current Ω	Dimension "D" MAX over Coating	Dimension "T" MAX over Coating	Lead Diameter (NOM)	Dimension "S" (NOM)
SS2R018	2.0	18	0.030	0.900"	0.350"	.040"	0.310"
SS2R505	2.5	5	0.050	0.475"	0.200"	.032"	0.200"
SS2R507	2.5	7	0.050	0.600"	0.250"	.032"	0.310"
SS2R509	2.5	9	0.040	0.600"	0.250"	.032"	0.310"
SS2R510	2.5	10	0.040	0.900"	0.250"	.040"	0.310"
SS2R515	2.5	15	0.030	0.900"	0.300"	.040"	0.310"
SS4R008	4.0	8	0.070	0.670"	0.235"	.040"	0.310"
SS5R002	5.0	2	0.250	0.400"	0.200"	.032"	0.200"
SS5R005	5.0	5	0.150	0.600"	0.250"	.032"	0.250"
SS5R007	5.0	7	0.070	0.600"	0.250"	.032"	0.310"
SS7R004	7.0	4	0.150	0.600"	0.250"	.032"	0.250"
SS10003	10.0	3	0.200	0.450"	0.200"	.032"	0.200"
SS10005	10.0	5	0.250	0.600"	0.300"	.032"	0.310"
SS10008	10.0	8	0.100	0.900"	0.350"	.040"	0.310"
SS20002	20.0	2	0.500	0.500"	0.200"	.032"	0.200"
SS40002	40.0	2	0.600	0.500"	0.200"	.032"	0.200"
SS40003	40.0	3	0.500	0.700"	0.250"	.040"	0.310"
SS12103	120.0	3	0.900	0.925"	0.250"	.040"	0.310"

SENSORS/TRANSDUCERS

Manufacturer	Starting EEM Page No.	Current, DC			Current, AC		Power					Voltage		
		Magnitude	Level Sensing	Bidirectional	Ampl/RMS	Level Sensing	True (W)	Apparent (VAR)	Power Factor	Phase Angle	Frequency	DC	AC	Other
Airpax Corp.	B•1875	√		√							√	√		MIL
American Aerospace Controls	B•1876		√	√			√	√				√	√	MIL
Approved Purification	B•1878		√			√						√	√	Sensors: Liquid level, temperature
Bicron Electronics	B•1883				√									
Contaq	B•1889		√			√								
Hamlin Inc.	B•1903		√									√	√	
LEM USA	B•1912	√	√		√	√	√					√	√	
Micro Switch	B•1916	√	√	√										
Morgan-Matroc	B•1921													Piezoelectric ceramic shapes
Murata Erie North	B•1922													Motion, IR
Ocean Motions	B•1924		√											
Ohio Semitronics	B•1925		√	√	√	√	√	√	√	√	√	√	√	
Setra Systems	B•1948	√		√								√		
Transducers & Systems	B•1947													Inclinometer

ENCODERS, SHAFT ANGLE

Manufacturer	Starting EEM Page No.	Optical			Contact			Other
		Abs.	Diff.	Incr.	Abs.	Diff.	Incr.	
BEI Motion Systems Co.	B•1879	√	√	√				Fiber Optic
Canon USA Inc.	B•1886			√				Linear encoders
Clarostat Mfg. Co.	B•1888			√	√		√	
IVO Industries	B•1906	√		√			√	
Lucas Ledex Inc.	B•1915	√		√				
Micro Mo Electronics Inc.	B•1920			√				
Sumtak Electronics	B•1950	√	√	√				
US Digital Corp.	B•1952	√		√				
Vernitech Div./Vernitron Corp.	B•1956	√	√	√	√	√	√	

transducers/encoders-5500

TRANSDUCERS

Manufacturer	Starting EEM Page No.	Audio	Force/ Weight	Mag-netic Field	Pres-sure	Temp.	Position		Position Velocity	Velocity	Other
							ABS	Displace-ment			
American Aerospace	B•1876										
Approved Purification	B•1878				√	√		√			
BEI Motion Systems Co.	B•1879						√	√	√	√	
F. W Bell	B•1882			√							
Blatek Industries	B•1885	√									
Contaq	B•1889	√					√	√	√	√	
Data Instruments	B•1891				√			√			
Entran Devices Inc.	B•1892		√		√						
Hamlin Inc.	B•1903			√				√			
Hermetic Switch	B•1904			√				√			
Micro Mo Electronics Inc.	B•1920							√	√	√	
Micro Switch	B•1916			√	√	√					Magnetic, Current
Morgan-Matroc,Vernitron	B•1921										Piezoelectric ceramics
Murata Erie North	B•1922	√				√		√			
Ocean Motions	B•1924		√				√	√	√	√	Ultrasonic Pencils
Ohio Semitronics	B•1925			√							
Omega Engineering	B•1945		√	√	√	√					
Setra Systems Inc.	B•1948		√		√						
Sumtak Electronics	B•1950									√	
Transducers & Systems	B•1947		√								
Vernitech Div./Vernitron	B•1956				√				√		
Vibra-Metrics Inc.	B•1957										Vibration instruments
Wilcoxon Research	B•1959									√	

ACCELEROMETERS

Manufacturer	Starting EEM Page No.	Acceleration	Vibration	Shock
Entran Devices Inc.	B•1892	√	√	√
Setra Systems Inc.	B•1948	√	√	√
Vibra-Metrics	B•1957	√	√	√
Wilcoxen Research	B•1959	√	√	

TRANSCEIVERS: Ultrasonic

Manufacturer	Starting EEM Page No.	High Resolution	Narrow Beam
Blatek Industries	B•1885	√	√
Contaq	B•1889	√	√
Ocean Motions	B•1924	√	√

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

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AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
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Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
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Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
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Fiber Optics, Product Selection Guide **B**•1214
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Filters, Signal, Product Selection Guide **A**•1651
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Keyboards & Keypads, Product Selection Guide **B**•1794
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Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
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Timers, Miniglossary **B**•1409, **D**•1149
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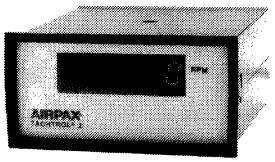
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

TACHOMETERS AND MAGNETIC SPEED SENSORS

For accuracy, fast response time and reliable, long-lasting performance, specify Airpax tachometers and magnetic speed sensors. Contact Airpax, Cheshire Industrial Park, Cheshire, CT 06410. (203)271-6000. Fax (203)271-6100. For nearest distributor call: **1-800-982-0030**. A North American Philips Company.



Tachtrol® 2—Speed/Rate Monitor

A single input digital instrument, this speed/rate monitor offers fast-response, high-precision monitoring. Measured values are displayed in engineering units: RPM, FPM, frequency or other values. Rugged, easy to set up, yet costs less than competitive models.

Features:

- Single-channel precision speed or rate monitoring.
- Period mode measuring system.
- Five-digit auto-ranging .56" LED display; full or partial auto-ranging with leading zero suppression. Updates twice per sec.
- Active or passive sensor input; accepts any pulse output device, magnetic digital speed sensor.
- Meets MIL-810C shock and vibration.

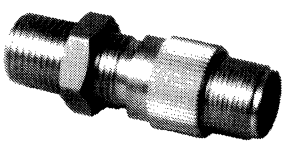


Tachtrol® 3—Dual Input Digital Tachometer

Single or dual channel instrument, this computing tachometer measures input frequencies and displays the resulting quantities in RPM, FPM, % Draw and other rates. A unique method of setting conversion factors and instrument functions allows easy configuring or altering at any time.

Features:

- Measures speed or frequency (2 Hz to 30,000 Hz).
- Active or passive speed sensor inputs.
- Auto ranging LED display.
- Meets MIL-810C shock and vibration.



70084-1713-111 Low-Cost Molded Magnetic Speed Sensor

Stainless steel housing and one-piece construction, this speed sensor has interior section coated with epoxy resin to resist both oil and moisture.

Features:

- Wide operating and storage temperature range: - 40°F to 300°F
- I90-volt minimum output (P-P).
- Mates with MS3106A-1OSL-4S.

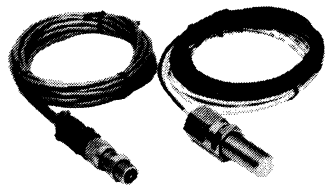


Tach-Pac® 3

The single channel, microcomputer-based Tach-Pak®3 uses adaptive period averaging which permits a combination of fast response and high accuracy. It measures input frequency and converts the resulting quantities to a meter output, an analog output, and four relays. A unique method of setting instrument functions permits them to be easily configured or altered in the field at any time.

Features:

- Measures frequency from .0625 to 30,000 Hz.
- Active or passive sensor inputs: accepts input from any frequency source.
- Response time—50 millisecond updates above 100 Hz.
- Field programmable.

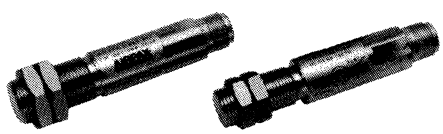


7085-1010-001 & 085-101-0005 Passive Magnetic Speed Sensors

Convert mechanical motion to AC voltage. The frequency of the AC signal is exactly proportional to the speed or RPM.

Features:

- No moving parts.
- Wide temperature range.
- Stainless steel housing.
- UL/CSA and FM listed, intrinsically safe sensors available.

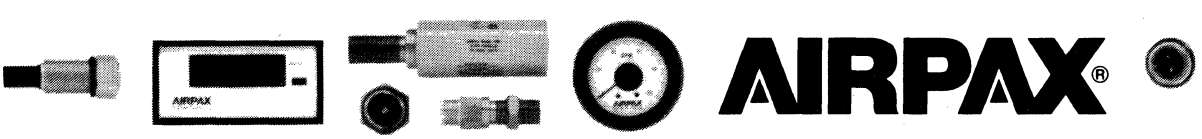


70087-3040-070 & 087-304-0036 Active Magnetic Speed Sensors/Zero Velocity

Either speed sensor can be used to sense the speed of any rotating machinery, including motors, generators, turbines, compressors, conveyors—wherever speed or RPMs need to be monitored.

Features:

- Low cost.
- 12V ± 2VDC power supply.
- - 25°C to + 70°C operating temperature range.
- 087-304-0036 is UL listed.
- DC to IOK Hz frequency.
- UL/CSA listed sensors available.



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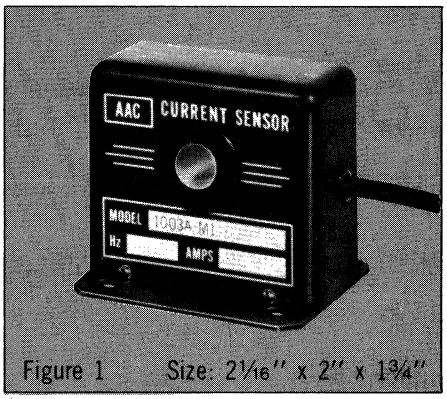

Figure 1 Size: 2 1/16" x 2" x 1 3/4"

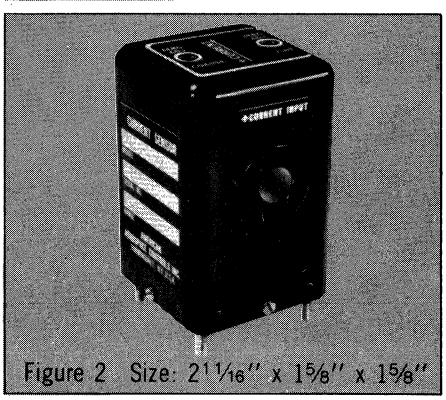

Figure 2 Size: 2 11/16" x 1 5/8" x 1 5/8"

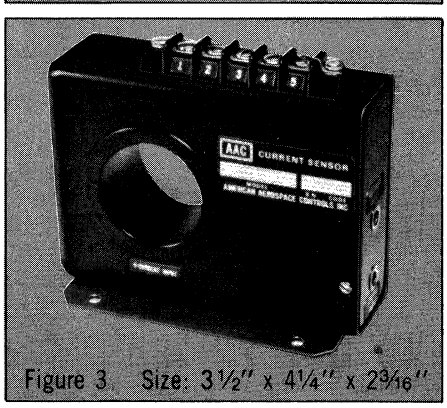

Figure 3 Size: 3 1/2" x 4 1/4" x 2 3/16"

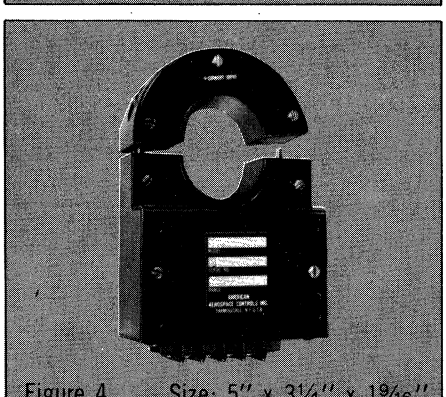

Figure 4 Size: 5" x 3 1/4" x 1 9/16"

AC CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
1002M1	0.25, 0.5, 1, 5, 10, 20, 25, 50, 100, 150, 200, 250Aac @400Hz	+ 5Vdc	0.5%FS	10ms	5
1012	0.25, 0.5, 1, 5, 10, 20, 25, 50, 100, 150, 200, 250Aac @60Hz	+ 5Vdc	0.5%FS	50ms	—
C	1, 2, 5, 10, 20Aac (In-line connection)	+ 1mAdc	0.25%FS	400ms	6
S383	2, 5, 10, 15, 20, 25, 30, 40, 50, 75, 100, 200, 250Aac @60Hz	4-20mAdc	0.5%FS	200ms	—
1004	2, 5, 10, 20, 50, 100, 150, 200, 250, 300Aac @400Hz	+ 5Vdc	0.5%FS	150ms	5
1003AM1	2, 5, 10, 15, 20, 25, 30, 50, 75, 100Aac @60Hz	+ 5Vdc	1%FS	150ms	1
1003AM2	30, 50, 75, 100, 150, 200, 250Aac @60Hz	+ 5Vdc	1%FS	150ms	—
1005	2, 5, 10, 20, 30, 50, 75, 100, 150, 200, 250, 300Aac @60Hz	+ 5Vdc	1%FS	80ms	—
1006	10, 25, 50, 100, 200, 400, 500, 600, 800, 1000Aac @60Hz	+ 5Vdc	0.5%FS	130ms	—
1006X	10, 25, 50, 100, 200, 400, 500, 600, 800, 1000Aac @60Hz	4-20mAdc	0.5%FS	130ms	—
S461(1001)	100, 150, 250, 500, 750, 1000, 1500, 2000, 2500, 3000Aac	+ 5Vdc	1%FS	100ms	4

DC CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
904B	0.1, 0.2, 0.5, 1, 2, 5mAdc (In-line connection)	+ 5Vdc	1%FS	50ms	—
903B	5, 10, 20, 50, 100, 200, 500mAdc & 1, 2, 5Adc	+ 5Vdc	1%FS	50ms	5
S403	5, 10, 20, 50, 100, 200, 500mAdc & 1, 2, 5Adc	+ 5Vdc	1%FS	50ms	5
936	10, 20, 50, 100, 200, 250, 500mAdc & 1, 2, 5Adc	+ 5Vdc	1%FS	100ms	3
S218-903	100, 200, 500mAdc & 1, 2, 5Adc	+ 5Vdc	1%FS	50ms	—
937	10, 20, 30, 50, 100Adc	+ 5Vdc	2%FS	200μs	—
913A	10, 20, 25, 30, 40, 50, 75, 100Adc	+ 5Vdc	1%FS	1ms	2
913B	10, 20, 25, 30, 40, 50, 75, 100Adc	+ 5Vdc	1%FS	1ms	5
950	10, 20, 30, 40, 50Adc	+ 5Vdc	0.5%FS	10ms	5
952	100, 200, 250, 300, 400, 500, 600, 750Adc	+ 5Vdc	0.5%FS	50μs	5
S465(S338)	150, 250, 500, 750, 1000, 1500, 2000, 2500Adc	4-20mAdc	1%FS	200μs	4
S444(S347)	200, 225, 250 300 500 750 1000 1500 2000 2500Adc	+ 5Vdc	1%FS	200μs	4

BIDIRECTIONAL CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
S263	± 5, 10, 20, 50, 100, 200, 500mA & ± 1, 2, 5A	± 5V	2%FS	40μs	—
905B	± 50, 100, 200, 500mA & ± 1, 2, 5A	± 5V	1 %FS	50ms	5
925B	± 10, 20, 50, 100A	± 5V	1%FS	1ms	5
S273-925	± 25, 50, 100A	± 5V	1%FS	40μs	5
910	± 25, 50, 100, 150, 200, 250A	± 250mV	2%FS	5μs	—
907	± 25, 50, 100, 150, 200, 250, 300A	± 5V	2%FS	100μs	—
907A	± 25, 50, 100, 150, 200, 250, 300A	± 5V	2%FS	40μs	—
908	± 25, 50, 100, 150, 200A	± 250mV	2%FS	5μs	—
927B	± 50, 100, 150, 200, 250, 300, 500, 750, 1000A	± 5V	1%FS	100μs	5
942	± 100, 200, 300, 400, 500, 600, 800, 1000, 1500, 2000A	± 5V	1%FS	100μs	3
909	± 100, 150, 250, 500, 750, 1000, 1500, 2500, 5000A	± 250mV	1%FS	200μs	4
9000	± 150, 250, 500, 750, 1000, 1500, 2000, 2500A	± 5V	1%FS	200μs	4

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AC & DC CURRENT LEVEL DETECTORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
870	1, 2, 5, 10, 15, 20, 50, 100, 150, 200, 250, 300Aac	RELAY	0.5%FS	500ms	8
S212-850	500mAac (75Aac Overload)	RELAY	±75mAac	200ms	5
901B	20, 50, 100, 200, 250, 500mAdc & 1, 2, 5Adc	+5V & SW	1%FS	50ms	–
S204-800	100, 150mAdc & 2, 3, 5Adc (10Adc Overload)	RELAY	10%FS	3ms	5
S58-800	200mAdc (10Adc Overload)	SWITCH	N/A	1ms	–
S201-800	1Adc (100Adc Overload)	RELAY	±150mAdc	200ms	5

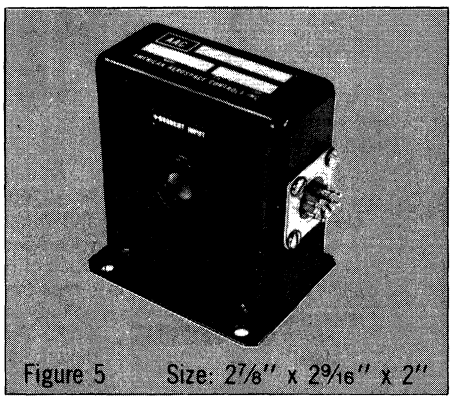

Figure 5 Size: 2⅞" x 2⁹⁄₁₆" x 2"

AC VOLTAGE SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
108	130, 150, 270, 500, 600Vac @ 47-420Hz (0 to FS)	+5Vdc	0.5%FS	200ms	—
108X	130, 150, 270, 500, 600Vac @ 57-63Hz (0 to FS)	4-20mAdc	0.5%FS	300ms	—
S190-108	130, 150, 270, 300, 600Vac @ 47-63Hz (0 to FS)	+10Vdc	2%FS	200ms	—
V	150, 300, 500Vac @ 47-1000Hz (0 to FS)	+1mAdc	0.25%FS	400ms	6
V-X	150, 300, 500Vac @ 47-1000Hz (0 to FS)	4-20mAdc	0.5%FS	400ms	6
101M3	90-150Vac @ 60Hz (Suppressed Zero)	+5Vdc	0.5%FS	17ms	—
102M3	90-175Vac, 105-130Vac or 175-225Vac @ 400Hz*	+5Vdc	0.5%FS	3ms	—
105	390-490Vac, 430-530Vac or 455-505Vac @ 60Hz*	+5Vdc	0.5%FS	17ms	—
109	120, 125, 135, 240, 250, 270Vac @ 60Hz*	+1mAdc	0.5%Vmax	300ms	—

*Suppressed Zero

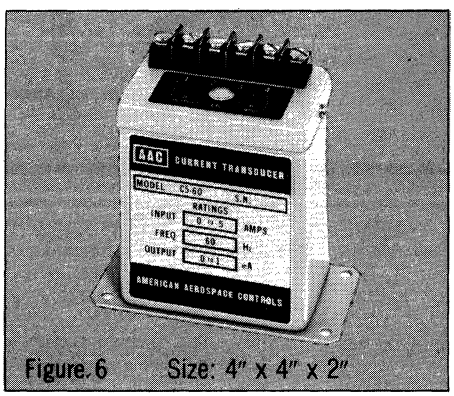

Figure 6 Size: 4" x 4" x 2"

WATT & VAR TRANSDUCERS

SERIES	FULL SCALE (FS) INPUT POWER RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
415A/416A	1-200KW 120, 220 or 440Vac	+5Vdc	2%FS	400ms	8
S217-413	2-80KW 220 & 440Vac	+5Vdc	2%FS	400ms	8
S73-413	0-100KW (0 to 150Vac or 0 to 300Vac)	+5Vdc	2%FS	400ms	8
W106	0.5-2KW (1 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W206	1-4KW (2 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W256	1-4KW (2½ ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W306	1-4KW (3 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
Q106	0.5-2K VAR (1 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
407	0.3-60KW dc 12-240Vdc & 25-250Adc	250mV	2%FS	5μs	–
401	2.7-150KW dc 18-150Vdc & 150-1000Adc	250mV	2.5%FS	200μs	4

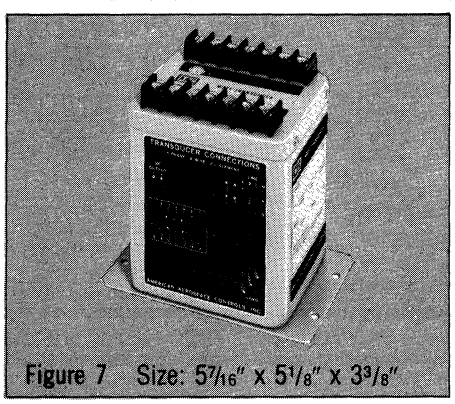

Figure 7 Size: 5⁷⁄₁₆" x 5⅛" x 3⅜"

FREQUENCY TRANSDUCERS

SERIES	FULL SCALE (FS) INPUT FREQUENCY RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
S343	360 to 440Hz (102-127Vac or 200-250Vac)	+5Vdc	±0.8Hz	250ms	–
S350L	100, 200, 300, 500, 1K, 2K, 3K, 5K, 10K & 20K Hz	+5Vdc	0.25%FS	3-300ms	–

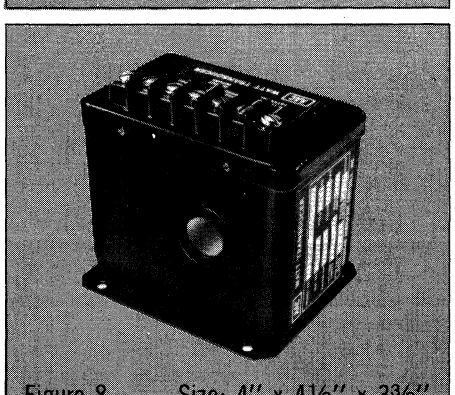

Figure 8 Size: 4" x 4⅛" x 3⅜"

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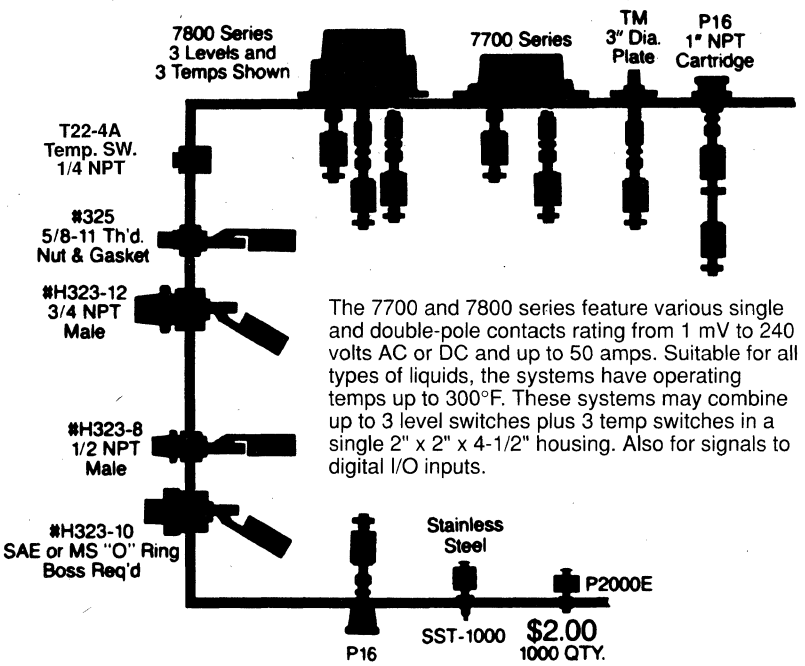

The 7700 and 7800 series feature various single and double-pole contacts rating from 1 mV to 240 volts AC or DC and up to 50 amps. Suitable for all types of liquids, the systems have operating temps up to 300°F. These systems may combine up to 3 level switches plus 3 temp switches in a single 2" x 2" x 4-1/2" housing. Also for signals to digital I/O inputs.

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LH012	LIQUID LEVEL SWITCH, VERTICAL, MT. 100 WATT	35.75
H325	NYLON 66 LEVEL SWITCH, HORIZONTAL, 1.5 AMP	21.00
SST1000	LEVEL SWITCH, STAINLESS STEEL FLOAT AND STEM	29.59
P2000	LEVEL SWITCH, ALL POLYPROPYLENE FOR FOOD, CHEM., ETC.	7.90
H323	LEVEL SWITCH, HORIZONTAL, STEEL MOUNT THREADS	32.90
T-22-4A	TEMP. SWITCH, 600 PSI OPER., 1/4 NPT MOUNTING	23.00
T6006	TEMP. SWITCH, 5000 PSI OPER., 3/8 NPT MOUNTING	26.08
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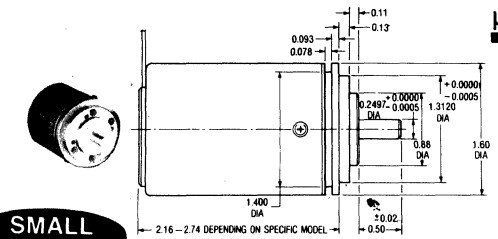

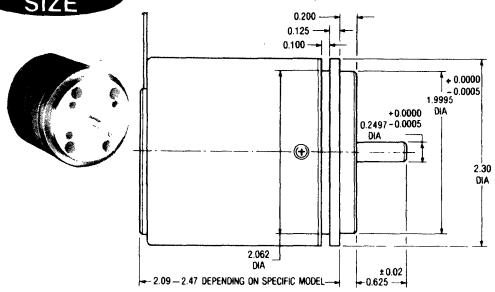

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L, LS, LC Models	Quanta/ Revolution	Accuracy[1] (Arc Minutes)
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µS14/16	16384	1.4
µS15/16	32768	1.0 or 0.7
µS 16/16	65536	0.5

µS/23 FAMILY

L, LS, LC Models	Quanta/ Revolution	Accuracy[1] (Arc Minutes)
µS14/23	16384	1.0
µS15/23	32768	0.7
µS16/23	65536	0.5 or 0.2
µS17/23	131072	0.2
K Model		
µS12/23	4096	2.6
µS13/23	8192	1.3

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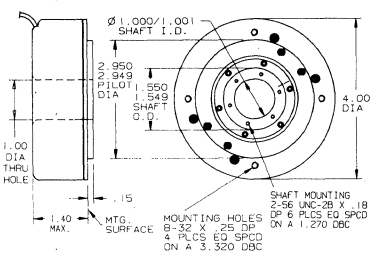
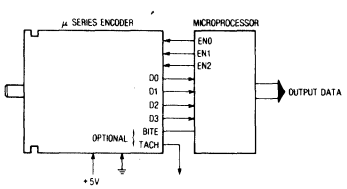
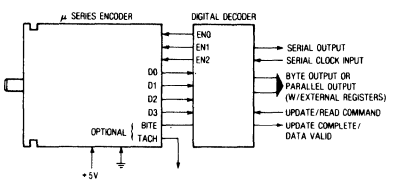
µS15/40	32768	0.7
µS16/40	65536	0.25
µS17/40	131072	0.2

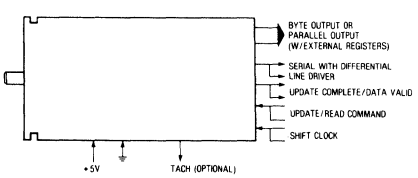


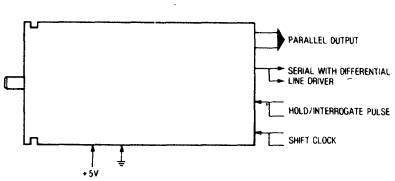
[1] Peak Transition Error of Transducer and Electronics, Excludes Quantizing Error of 1/2 LSB.

VERSATILE INTERFACE









L MODEL

The L model is the basic encoder configuration which outputs a 4 wire multiplexed, 3-State Logic Level MicroSeries Code Word. the encoder is addressed by 3 Enable Lines activated in a controlled sequence. This model is intended for direct interface with a user (or Itek) furnished microprocessor where the microprocessor can be programmed to perform the encoder's digital logic functions.

LS MODEL

The LS model consists of the basic L encoder (described above) and a separate Digital Decoder. The use of the external Digital Decoder is suggested when the user does not have a microprocessor available to perform the digital processing of the outputs of the L Model encoder or when the length of the LC encoder exceeds available space in the intended application. The external digital decoder also affords the user the flexibility to access the various input/output programming modes available with MicroSeries encoders. The Digital Decoder can be user programmed for three output modes: serial, 8 bit bytes, or parallel with strobe signals to latch user supplied external registers. Additionally, two data acquisition modes are possible: Update and Read.

LC MODEL

The LC Model contains an Integral MicroSeries Digital Decoder Chip. This model, essentially similar to the LS, is appropriate when an encoder without external processing circuits is desired. The same output and data acquisition modes as the LS Model are available but are built in at the factory for the LC Model.

K MODEL

The µS/23K Model encoders are *low cost* absolute encoders which provide 12 or 13 bits resolution with either parallel or serial output. In the parallel output mode all bits are continuously available. The HOLD pulse prevents any bit from changing state while the encoder is being read. In the serial output mode the user provides an interrogate pulse which provides the hold function and loads the shift register. Shift (clock) pulses provided by the user serially shift out the stored information.

BEI MOTION SYSTEMS COMPANY
Itek Encoder Division
178 A Street ▪ Needham Heights, MA 02194 ▪ Tel: (617) 455-1414 ▪ Fax: (617) 455-6514

PRECISION ENCODERS ON TARGET:
HIGH PERFORMANCE IN A SMALL PACKAGE.

Our precision encoders have substantially better accuracy than other shaft angle digitalizers of similar size and are designed for military or other demanding applications where high reliability is desired.

All precision encoders are specifically designed for rugged military environments – tracked vehicles, shipboard, and airborne – and have been tested to corresponding vibration, shock, and temperature levels for these applications.

Digisec® Encoders–RA series

Rotary Absolute Encoders

SIZE (Inches) Model	O.D.	Shaft Diam.	Resolution (Quanta/Rev.) Binary (2^xx)	BCD
SOLID SHAFT 15	1.5	.187		
23	2.3	.25	C 11, C 12, C 13, T 16, T 17, T 18, T 19, T 20	
35	3.5	.375	C 12, C 13, C,S 14, C,S 15, C,S 16, C,S 17, S 18	S 3.6K, S 36K
THRU-HOLE 55	5.5	.75	S 16, S 17, S 18, S 19, S 20	
60	6.0	2.25	S 16, S 17, S 18, S 19, * 20, * 21	
100	10.0	2.75	S 16, S 17, S 18, S 19, S 20, S 21, * 22, * 23	S 36K, S 360K
106	10.0	6.0	S 16, S 17, S 18, S 19, S 20, S 21, * 22, * 23	S 36K, S 360K
117	11.0	7.0	S 19, S 20, S 21	
158	15.0	8.0	S 20, S 21, S 22, S 23, S 24	

OD—Outside Diameter ID—Inside Diameter C—Self-contained Electronics

Features: • Parallel whole word unambiguous output • T TL/DTL compatible • Resolution to O.31 arc-seconds (22 bits) • Highest accuracies available anywhere • Operating temperature –40° to +71°C • Military Specification rated • Instant on-the-fly readout • LED light sources • Separate Electronics—no electronics in optical unit (thru-hole systems)

Available Options: • Serial readout • Line driver output • Redundancy • Chrome slit and disc (standard on size 23 and size 158) • Binary lamp display • Subtractor card for electronic zeroing

RI series

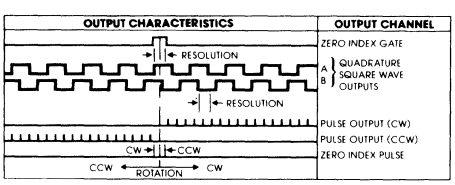
Rotary Incremental Encoders

Resolution (Quanta/Rev.) Model	Binary (2^xx)	Decimal
SOLID SHAFT 15	C 8, C 9, C 10, C 11, C 12, C 13	C 0.5K, C 1.0K, C 1.8K, C 2.0K, C 3.6K, C 4.0K, C 5.0K, C 6.4K, C 8.0K
23		
35	C 13, C 14, C 15, C 16, C 17, C 18, C 19	C 20K, C 32K, C 36K, C 40K, C 50K, C 64K, C 72K, C 100K, C 128K, C 180K, C 200K, C 320K, C 360K, C 640K
THRU-HOLE 55	C 16, C 17, C 18, C 19, S 20	
60		
100	C 17, C 18, C 19, C 20, S 21	C 360K
106	C 17, C 18, C 19, C 20, S 21	C 360K
117		
158	C 20, C 21, S 22	

S—Separate electronic enclosure T—2 speed geared paired configurations * Consult factory

Features: • Quadrature square wave or pulse output, zero index • T TL/DTL compatible • Resolution to O.31 arc-seconds (22 bits) • Self-contained electronics • Operating temperature –40° to +71°C • Military Specification rated • LED light sources

Available Options: • Line driver output • Pigtail cable • Square wave or pulse output



Environmental Ratings. All DIGISEC® encoders are designed to meet rigid military specifications. The following environmental specifications are typical: Temperature: –40° to +71°C Vibration: 10-20g Humidity: O to 98% Shock: 50g, 11 milliseconds (higher on solid shaft models)

Spacecraft Encoders: Absolute & Incremental

Model	Type	Diam. (Inches)	Resolution (Quanta/Rev.)	Accuracy	Weight (lbs.)	Power (watts)	Features
RA21/1510	Absolute	15.O	2^{21}	2.6 sec	20.O	3.O	10 Inch Thru-hole Electrical Redundancy.
RA18/6O	Absolute	6.O	2^{18}	10.O sec	8.5	3.O	Elect. & Mech. Redundancy.
RI13/35	Incremental	3.5	2^{13}	2.6 min	3.O	2.O	Commutator Outputs
RI2O/63	Incremental	6.3	2^{20}	1.5 sec	1.7	O.5	Unhoused. Commutator Outputs.
RI36K/4O	Incremental	4.O	36,OOO	2.5 sec	3.O	O.3	Electrical Redundancy
RI14.4K/23	Incremental	2.3	14,OOO	1.5 min	.75	O.4	Commutator Outputs

Features: LED Illuminators • Resolution to O.31 Arc Seconds (22 Bits) • Highest Accuracy Available Anywhere. Available with bearings (housed) or without (unhoused).

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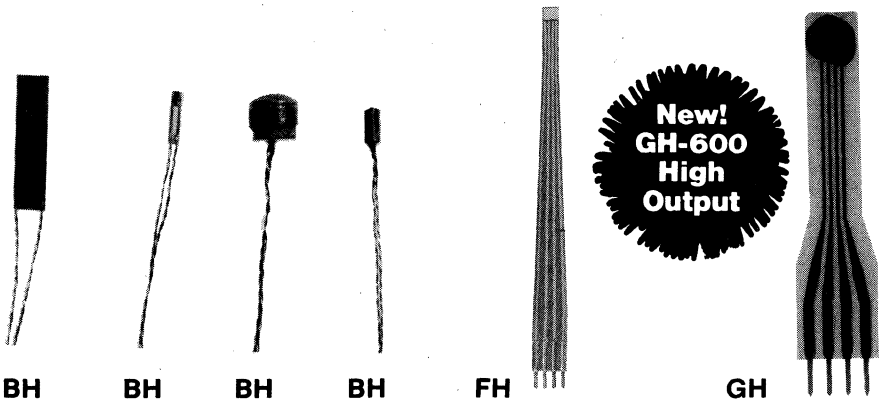
Hall Generators



- Cryogenic/High Field
- Magnetic Field Measurements
- Electrical Power Measurements
- Guidance Systems
- Brushless dc Motors
- Proximity Sensors
- Watt-hour Meters

DESCRIPTION

The F.W. Bell series of Hall effect magnetic field sensors consists of 29 standard models designed to meet the requirements of most magnetic field measurement applications. The sensors are small, solid-state devices. They produce a voltage which is proportional to the product of the control current and the magnetic field component normal to the Hall active area. Each unit has four electrical connections. Two carry the control current (I_C) and the other two supply the Hall voltage.

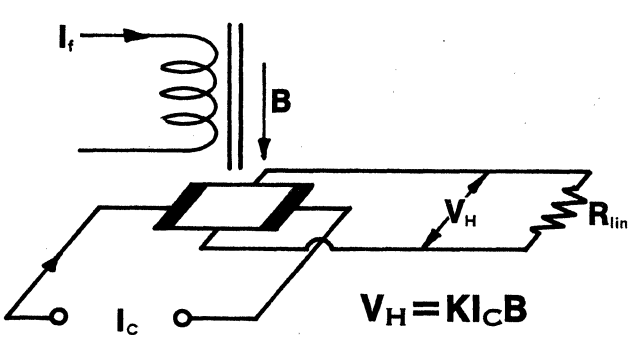
These models are built in various configurations to measure axial, transverse, and tangential magnetic field components. Their operating characteristics permit virtually any application: frequency, dc to MHz; magnetic flux density, milligauss to kilogauss; linearity to 0.1%; temperature, -269°C to +100°C.

MODELS

BH-200
General Purpose
Transverse
BH-201
Ultra-Thin
Transverse
BH-202
Small Axial
BH-203
General Purpose
Axial
BH-204
Midget Axial
BH-205
Midget Transverse
BH-206
High Sensitivity
Transverse
BH-207
High Resolution
Tangential
BH-208
Ultra-Midget Axial
BH-700
Low Cost
Transverse
BH-701
High Linearity
Transverse
BH-702
Ferrite Imbedded
BH-703
3-Axis
FH-301, -302, -500
Thin Film
GH-600
High Output
BHT/BHA-900
High Field
BHT/BHA-910
High Linearity
BHT/BHA-921
High Field/
Cryogenic

SPECIFICATIONS

	BH	FH	GH
Control Current I_C	100-200 mA	15-30 mA	10 mA dc
Input Resistance, R_{in}	1-6 ohms	20-80 ohms	450-900 ohms
Output Resistance, R_{out}	1-6 ohms	50-200 ohms	1000 ohms
Magnetic Sensitivity, λB	6-16 mV/kG, standard 5 mV/kG, high sensitivity		50-120 mV



This schematic representation illustrates both the measuring and multiplying capabilities of a Hall generator. By holding I_C constant, V_H becomes a direct function of B, the magnetic flux density. If both, I_C and B are variable, V_H is proportional to the product of the two functions. Holding B and I_C constant, V_H becomes a function of the angle between B and the plane of the Hall-generator active area.

Special units are available to fit your application.

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CURRENT SENSORS
CURRENT TRANSFORMERS

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"Excellence Through Teamwork"

BICRON'S Current Sensors are designed to provide a programmable voltage output proportional to the input current.

The current sensor is readily interfaced to computer I/O hardware, or other control and monitoring configurations.

Functions such as: UNDER CURRENT, OVER CURRENT, PEAK CURRENT, monitoring, indicating, or controlling are easily accomplished with few additional components.

Uses range from simple LED current indicators to vector sumation of primary currents providing applications for current controller, warning devices, trip-out systems, phase balance and more.



IMPORTANT ADVANTAGES FOR YOUR PRODUCT

- Non-Contact Measurement of Current
- Current Range up to 200 AMPS (Ip)
- Programmable Voltage Output (Vs)
- Programmable Burden Resistor (Rs)
- Accuracies to .1%
- Overload Capacity > 300 AMPS

FOR YOUR DESIGN

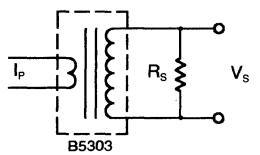
- Customized Transformers
- Current or Voltage Outputs
- Dimensional Flexibility
- Mounting Variety
- Personal Indepth Commitment

STANDARD PRODUCT

Specifications:

CATALOG NUMBER B5303

- Frequency Range 50/60 Hz
- Dielectric Strength 1500 VRMS (winding to surface)
- Class A Temperature Rated
- Leads #24 AWG – 12″ Long



- Electrical Performance
  Vs = $2 \cdot Ip \cdot Rs \cdot 10^{-4}$
  Vs = Output Voltage (up to 10 Volts RMS)
  Ip = Input Current (Specify up to 200A)
  Rs = Programmable Burden Resistor (User Supplied)
- Mechanical Dimensions
  O.D. = 2.0″
  I.D. = .7″
  H.T. = .8″

Data subject to change without notice.

BICRON, established in 1964, is a manufacturer of "Standard" and "Modified Standard" current transformers and toroidal power transformers. The Total Quality Management process at BICRON has allowed us to be certified suppliers to numerous customers.

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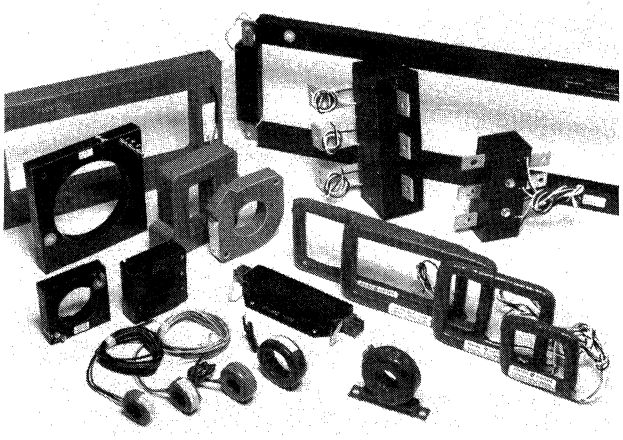
Ask Us About Our "MODIFIED STANDARD", Part Of BICRON'S Commitment to You.



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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Ultrasonic Transducers

From prototype to production, we will help you get the highest quality transducer for your application.

Blatek, Inc. is a piezoelectric device manufacturer dedicated to solving customer problems. From a home base in Central Pennsylvania, we manufacture ultrasonic and audio transducers for industrial, non-destructive testing, medical diagnostic, level measurement, and ultrasonic cleaning applications.

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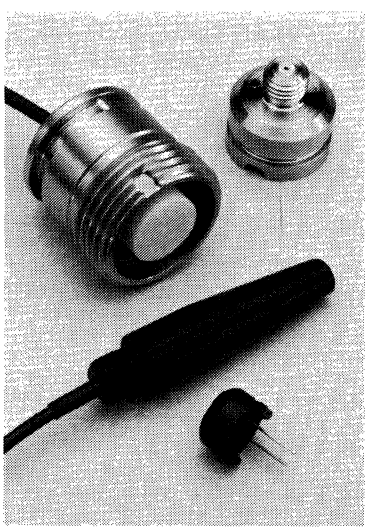
Special services:

- Provide transducers with performance test data.
- Design and manufacture prototype transducers.
- Provide special NDE testing solutions.
- Manufacture to military specifications.



Transducer applications:

- Aerospace
- Aircraft
- Automotive
- Electronics
- Military devices
- Marine
- Medical
- Non-destructive testing
- Nuclear
- Petrochemical
- Quality control
- Utilities
- Weld inspection

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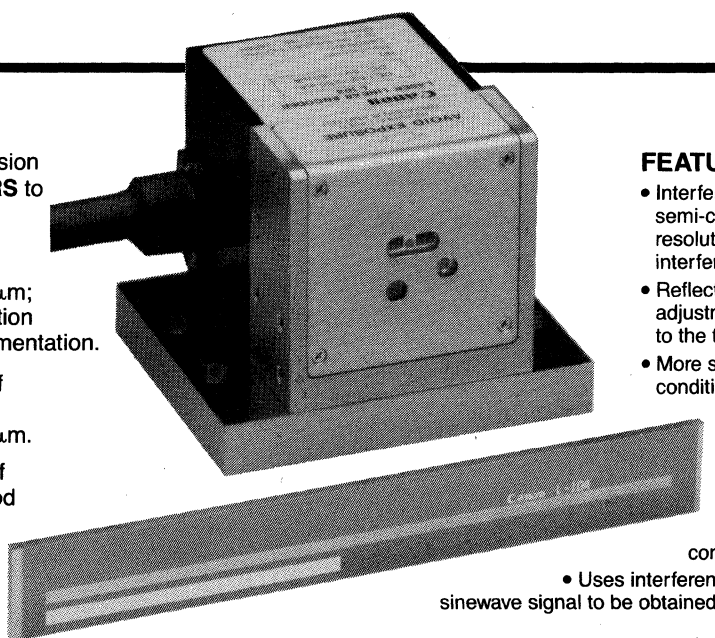
Canon Laser Linear Encoders

0.01μm RESOLUTION. EVEN IN THE REAL WORLD.



Canon has added high-precision **LASER LINEAR ENCODERS** to its full line of laser rotary encoders. The Canon laser linear encoder provides for maximum resolution of 0.01μm; thereby allowing high resolution closed loop control of instrumentation.

L-104 has a scale slit pitch of 1.6μm and sinewave period output from main unit of 0.4μm.

L-108 has a scale slit pitch of 3.2μm and a sinewave period output from main unit of 0.8μm.

A 16 signal interpolator CI16-2 and 40 signal interpolator, CI40-2 are available, enabling optimum combinations to achieve various resolution and responsiveness.

FEATURES:

- Interference by fine grating with a semi-conductor laser achieves resolution equal to that of laser interferometers.
- Reflection-type, allowing easier adjustment of alignment as compared to the transmission type.
- More stable under variable ambient conditions compared to conventional laser interferometers due to the use of a scale method instead of the laser wavelength standard method.
- Zero-phase index signals are output, allowing simple control of positioning.
- Uses interference, thus providing a full sinewave signal to be obtained from the photodetector.

Please contact CANON directly for special applications in O.E.M. quantities

Canon Interface/Display Unit CL-40 or CL-16 (optional)



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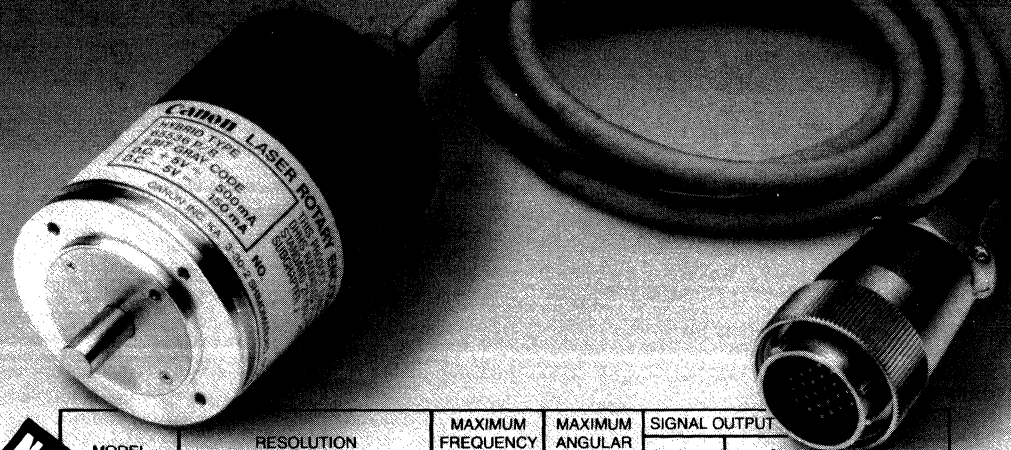

MODEL	RESOLUTION (ppr)		MAXIMUM FREQUENCY RESPONSE (KHz)	MAXIMUM ANGULAR VELOCITY (rps)	SIGNAL OUTPUT		SIZE (mm x mm)
					Analog or Digital	Output Circuit	
New **X-1**	225,000	18,000,000**	675	3 (180 rpm)	Analog	Op Amp + Serial Resistor (Balanced)	140 x 50
K-1	81,000	1,296,000*	500	6.2 (372 rpm)	Analog	Op Amp + Serial Resistor (1 Vp-p)	36 x 48
R-10	81,000		500	6.2 (372 rpm)	Digital	Open Collector	36 x 48
R-1L	81,000		500	6.2 (372 rpm)	Digital	Line Driver (Balanced)	36 x 58
R-2A	65,536 (2^{16})	1,048,576 (2^{20})*	500	7.6 (456 rpm)	Analog	Op Amp + Serial Resistor (1 Vp-p)	56 x 80
R-2L	65,536 (2^{16})		500	7.6 (456 rpm)	Digital	Line Driver (Balanced)	56 x 80
M-1	50,000		2,000	40 (2400 rpm)	Digital	Line Driver (Balanced)	56 x 70

* With CI 16-1, -2 (16x output pulse) Interpolator. ** With IU-80/120 (80x output pulse) Interpolator.

FEATURES: • COMPACT SIZE • LOW INERTIA • HIGH RESOLUTION

• Direct Coupling • Pure Sine Wave Output • Either Sine Or Square Wave Output
• Analog May Be Multiplied • Absolute Models Available

APPLICATIONS: • Robotics • Machine Tool • Imaging Systems • Calibration Equipment • Surveying Equipment

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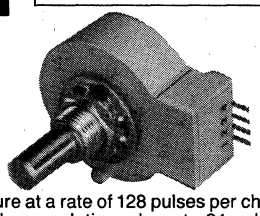
CLAROSTAT

ENCODERS

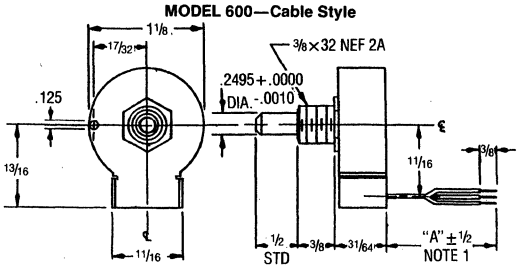
SERIES 600
OPTICAL ROTARY ENCODER



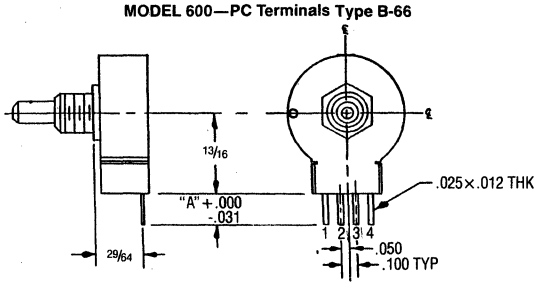
DESCRIPTION:
The series 600 controls are manually operated, rotary, optical encoders that output two square waves in quadrature at a rate of 128 pulses per channel per revolution as a standard with other resolutions down to 24 pulses available. The outputs are TTL compatible. The variation by construction is the terminal configuration, with the one model having (4) cable leads, and the other model having (4) pin leads and internal resistors.

Electrical Specifications
INPUT POWER: 5 volts DC ±5% @ 30 MA max. plus external requirements.
OUTPUT RATE: 128 pulses/revolution per channel—standard
Other pulses/revolution between 24 and 128 are available.
CHANNELS: Two separate output channels in quadrature, 90° ± 45°
OUTPUT VOLTAGE: High level voltage—2.4 volts min. with 10K load to ground. Low level voltage—.4 volt max.

MODEL 600—Cable Style

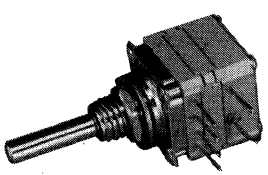


MODEL 600—PC Terminals Type B-66



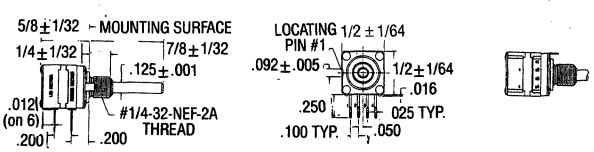
Series
600 = Sleeve-bearing construction with two channel quadrature output
605 = Sleeve-bearing construction with one channel output
610 = Ball-bearing construction with two channel quadrature output
615 = Ball-bearing construction with one channel output

SERIES 688
1/2 INCH SQUARE OPTICAL ENCODER

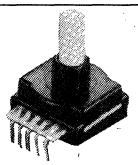


DESCRIPTION:
The Series 688 controls are manually operated, rotary, optical encoders that output two square waves in quadrature at a rate of 64 pulses per channel per revolution as a standard with other resolutions down to 20 pulses available. The outputs are TTL compatible.

Electrical Specifications
INPUT POWER: 5 Volts DC ±5% @ MA max. plus external requirements.
OUTPUT RATE: 64 pulses/revolutions per channel-standard. Other pulses/revolution between 20 and 64 are available.
CHANNELS: Two separate output channels in quadrature, 90° ± 45°.
OUTPUT VOLTAGE: High level voltage—2. 4 volts min. with 10KΩ load to ground. Low level voltage—.4 volt max.



SERIES 500
MECHANICAL ROTARY ENCODER

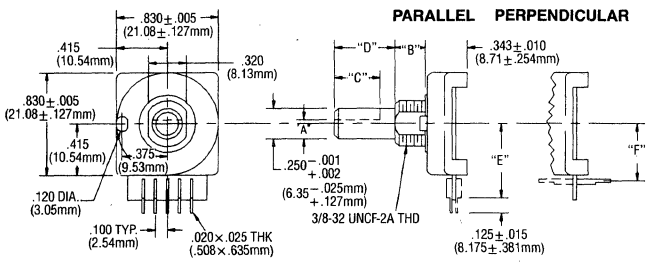


DESCRIPTION:
The Series 500 Controls are manually-operated, rotary, mechanical encoders that provide a 2-bit grey code for relative reference applications and a 4-bit grey code for absolute reference applications. It has a rotational life of more than 100,000 shaft revolutions, a positive detent feel and can be combined with a second modular section in a concentric-shafts construction.

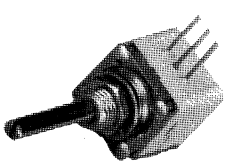
The Series 500 is small-sized (.830 in. sq. × .343 thick) and commonly used in limited-space, panel-mounted applications where the need for costly, front-panel displays can be completely eliminated.

Electrical Specifications
OUTPUT: 2-bit grey code, channel L leads channel R by 90° electrically in the CW direction. 4-bit grey code, absolute electrical position output. (Hexidecimal, B.C.D. and counting codes available upon request see Output Code Table section next page.)
CLOSED CIRCUIT RESISTANCE: 5Ω maximum
OPEN CIRCUIT RESISTANCE: 100kΩ maximum
CONTACT RATING: Resistance load 250 ma @ Vdc maximum
SWITCHING LOADS: 1.5 ma @ 115 Vac; 150 ma @ 14 Vdc
BOUNCE (Jitter): 5 ms/cycle @ 15 RPM
DIELECTRIC WITHSTANDING VOLTAGE: 1000 Vac @ ATM
ELECTRICAL TRAVEL: Continuous (rotational position stops are available upon request)
OPERATING SPEED: 50 RPM maximum

Control Dimensions, Single Control



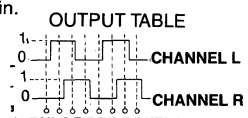
SERIES 388E
TWO BIT GRAY CODE MECHANICAL ENCODER



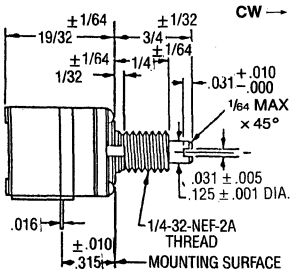
DESCRIPTION:
Only one half inch square, the Series 388E is a direct digital, contacting, mechanical encoder for low resolution limits in such applications as sensing, cursing scanning or robotics. Meets those requirements for a digital output component for limited space applications.

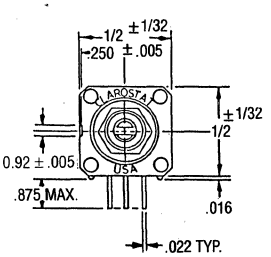
Electrical Specifications
OUTPUT: 2 Bit gray code, channel L leads channel R by 90° electrically in CW direction.
CONTACT RESISTANCE: 2.5K Max.
OPERATIONAL RESISTANCE: 10 Megohm Min.
CONTACT RATING: 5 VDC at 5 ma
INSULATION RESISTANCE: 100 Megohm at 50 VDC
JITTER: 5 Milliseconds/cycle at 15 RPM

OUTPUT TABLE



1/4 PULSE PER DETENT



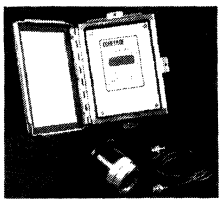


HOW TO ORDER

Cat. No.	Description	Detents	Pluse
388EN-4	4 Pulse/Rev/Chan.	16	1/4/Det.
388EN-6	6 Pulse/Rev.Chan.	24	1/4/Det.
688EN-64	64 Pulse/Rev/Channel	N/A	N/A

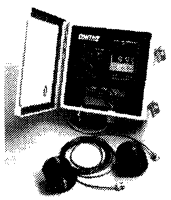
ULTRASONIC LEVEL, DISTANCE & PROXIMITY SENSORS

CONTAQ TECHNOLOGIES CORPORATION



LD1000 **$1499**

The LD1000 ultrasonic linear distance measurement system operates from 2.0 to 10 inches with an effective resolution of .001". Measurement is performed by a remote sensor head and data is presented on LED displays and in 12 bit analog and serial digital form.



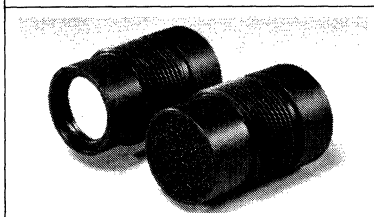
LMU **$879**

The LMU Series of liquid and bulk solid level measurement system operates in the 6 inch to 60' range and is designed for direct control of pump motor logic and continuous control systems. The LMU6000 provides up to six independent set point relays.



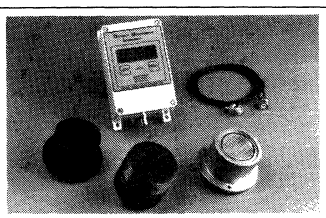
ISU **$199**

The ISU Series of standalone transducers operate in the 6" to 60 ft. range and offer performance extending from single point continuous sensing up to "multi-drop" and "token ring" type of networking capabilities.



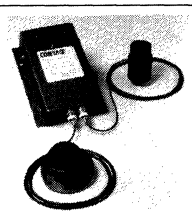
PRX **$99**

The PRX Series is a line of low cost ultrasonic proximity sensor intended for industrial and commercial applications in the 4" and 20' range. the PRX Series includes gain and range control and TTL or relay closure outputs.



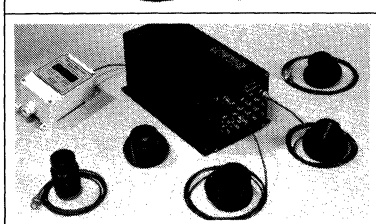
DMI **$299**

The DMI Series of distance measurement instruments operates in the 2" to 100' range with both built-in and remote sensor heads and offers .007" resolution along with a wide variety of options for high rate closed loop control systems.



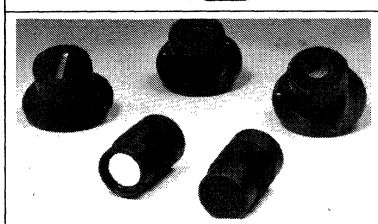
RMU **$545**

The RMU Series of dual channel ultrasonic measurement system offers two fully independent, non-interfering sensor channels operating in the 2" to 100' range and reporting data in either polled or continuous modes over RS232 or RS422 interfaces at 9600 Baud.



UDM **$811**

The UDM Series includes the UDM-PC computer add-in ultrasonic sensor interface board and the UDM-MUXP multiplexer system. The UDM-MUXP multiplexer system is designed to allow sequential selection of 1 to 7 sensors and is compatible with all remote sensor product lines.



TRANSDUCERS **$72**

The UDM Sensor Series includes products including unmounted sensors up to sensors mounted in flange type and National Pipe Thread type of housings. The sensors are provided with reduced aperture and beam spreading options as well as corrosion resistant coatings.

15 MAIN STREET BRISTOL, VERMONT 05443 802/453-3332, FAX 802/453-4250

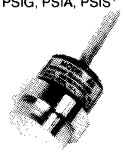
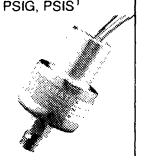
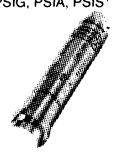
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION
WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
Microwave Components, Product Selection Guide **A**•1746
Military Qualified Products List **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide **B**•1233
Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
Relays, Product Selection Guide **B**•1397
Resistor Color Codes **A**•1924
Resistors, Product Selection Guide **A**•1835
Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
Solenoids, Product Selection Guide **B**•1614
Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

DATA INSTRUMENTS' PRESSURE TRANSDUCERS

Features

- Pressure ranges: 0–5 to 20,000 PSI
- Output: voltage, frequency, or current
- A unique design that puts stainless steel in contact with your pressure media
- Up to 2× rated pressure without damage; up to 10× rated pressure without bursting
- Full calibration and temperature compensation
- Unit-to-unit interchangeability: ± 1%
- Some models rated intrinsically safe

	MEDIAMATE PSIG	**Model AB/HP** PSIG, PSIA, PSIS[1]	**Model AB** PSIG, PSIA, PSIS[1]	**Models EA & EAF** PSIG	**Model SA** PSIA, PSIS[1]	**Model XT** PSIG, PSIA	**DATAMATE** PSIG, PSIS[1]	**Model BL** PSIG, PSIA, PSIS[1]
	 Compact Size	 High Performance[2]	 General Purpose[2]	 OEM Style	 Rugged OEM Style	 High Accuracy Low Cost	 Two-Wire Transmitter	 Two-Wire Transmitter[2]
Pressure Range	0-15, 25, 50, 100, 200, 500, 1000, 2000, 5000	0–6, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000	0–6, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 15,000, 20,000	0–6, 15, 25, 50, 100, 200, 300, 500, 1000, 2000, 5000	0–15, 25, 50, 100, 200, 300, 500, 1000, 3000, 5000	0-7.5, 0-15, 0-30	0–15, 25, 50, 100, 200, 500 1000, 3000, 5000	0–5, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 20,000
Accuracy[3]	± 1% span	To ± 0.25% span	± 1% span	± 1% span	± 1% span	± 0.25% span	± 1% span	± 1% span ± 0.25% as option
Signal Output	0 to 50 mV	0 to 100 mV	0 to 100 mV	1 to 6 Vdc 1 to 6 kHz	1 to 6 Vdc	0.5 to 4.5 Vdc	4 to 20 mA	4 to 20 mA
Excitation Voltage	5 Vdc reg	5 Vdc reg 6 Vdc max	5 Vdc reg 6 Vdc max	8 to 20 Vdc 10 to 20 Vdc	9 to 20 Vdc	5 Vdc	12 to 45 Vdc	14 to 50 Vdc
Operating Temperature Range	– 40°F to 212°F	– 65°F to 200°F	– 65°F to 200°F	– 67°F to 212°F – 40°F to 185°F	– 67°F to 221°F	– 40°F to 257°F	0°F to 212°F	0°F to 200°F
Compensated Temperature Range	30°F to 180°F	30°F to 160°F	30°F to 130°F	30°F to 185°F	30°F to 185°F	50°F to 185°F	30°F to 130°F	30°F to 130°F
Thermal Effect on Zero[4]	Less than ± 1% span	Less than ± 1% span	Less than ± 5% span	Less than ± 1% span	Less than ± 1% span	Less than ± 1% span	Less than ± 1% span	Less than ± 2% span
Thermal Effect on Span[4]	Less than ± 1%	Less than ± 1%	Less than ± 2%	Less than ± 1%	Less than ± 1%	Less than ± 1%	Less than ± 1%	Less than ± 1%

Transducer Instrumentation

Two meters are available: the versatile Intelligent Monitor/control (IMC) and the low-cost PL-1.

IMC

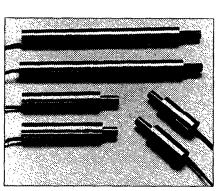
Internal power supply • Models available to match all transducers •Two independent alarm circuits • 4-digit/self-calibaration • Zero and span adjustments • Memory • User access code • Voltage, current, or serial output

PL-1

Used with EA, SA • Low cost • Zero and span adjustments

Talk to us about your special needs in the areas of:
• Gaging • Specifications • Material • Mounting

We'll help you solve your pressure measurement problems.



Also available from DI are a full line of FASTAR™ fast linear displacement transducers.
Call for specifications to meet your needs.

[1]PSIS-pressure measured with reference to an internal chamber sealed at normal atmospheric pressure.
[2]Various adapters with threaded ports available for ease of installation.
[3]Included effects of non-linearity, hysteresis, and repeatability.
[4]Specification applies to any of 100°F range within the compensated temperature range.

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Pressure Sensors:		**1-4**	**5-24**
EPX-10W	Mini 10-32UNF Pressure Sensor	$484.	$459.
EPNL-0300	Low Cost Pressure Sensor	$295.	$295.
PFEPNL-38N	Threaded Fitting for EPNL-0300	$ 49.	$ 49.
EPNM-A38W	"5V Out" Pressure Sensor	$699.	$679.
Load Cells:		**1-9**	**10-24**
ELF-500	Ultraminiature Load Cell	$425.	$399.
ELF-TC500	Ultramini with Threaded Studs	$595.	$565.
ELF-1000	Flatline Washer Load Cell	$450.	$428.
ELF-TC1000	Flatline with Threaded Studs	$595.	$565.
Strain Gages—Semiconductor:		**1-2**	**3-6**
ESB-020	"Bar" Shaped—Matched Set of 4	$ 60.	$ 52.
ESU-025	"U" Shaped—Matched Set of 4	$ 60.	$ 52.
		1-9	**10-24**
ESB-020	"Bar" Shaped—Bulk Box of 10	$ 75.	$ 50.
ESU-025	"U" Shaped—Bulk Box of 10	$ 75.	$ 50.
Power Supplies:		**1-9**	**10-24**
PS-15	15V Adjustable Power Supply	$199.	$185.
PS-30	±15V Adjustable Power Supply	$250.	$235.
PS-30A	Power Supply with Built-In Amplifier	$445.	$425.
Amplifiers:		**1-9**	**10-24**
IMV-15	Sensor Amplifier Module	$195.	$180.
Meters:		**1-9**	**10-24**
MM35	3-1/2 Digit Sensor Readout	$460.	$450.
MM45	4-1/2 Digit Sensor Readout	$495.	$475.

All Entran products are made with first class materials and workmanship. Entran warranties its products for all defects in material or workmanship and will repair or replace without cost, any unit found defective in material or workmanship. Entran's liability under this warranty shall be limited to a period of one (1) year from date of shipment and limited to repair or replacement of the product purchased and from the original point of purchase. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED. ENTRAN SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Entran will not be liable for any consequential damages, loss or expense arising in connection with the use of its product or the data derived therefrom or other consequential loss or damage of any nature arising from any cause whatsoever.

DELIVERY: Generally Stock to 8 Weeks TERMS: 1/2% 10, net 30 to qualified accounts. FOB: Fairfield, NJ

Entran® Devices, Inc.
10 Washington Avenue
Fairfield, NJ 07004, USA
(201) 227-1002, Telex 130361
Fax (201) 227-6865

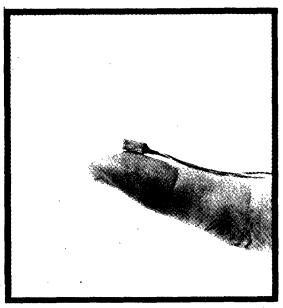
Entran Bulletin P L U S A - 1190

Entran® Direct "Off-The-Shelf"

— Accelerometers —

Other models and ranges available from our full product brochure.

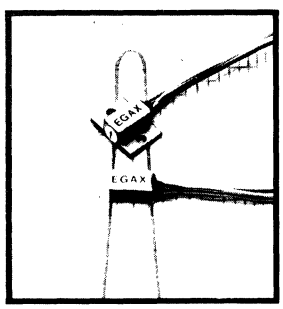
EGA-125-D Miniature Accelerometers



Entran's EGA-125-D accelerometers are a state of the art achievement in miniature design. The EGA offers an optimum combination of characteristics which permit acceleration, vibration and shock measurements where small size and mass are of prime importance. 0.7 cr. nom. damping increases useful range to as high as 50% of resonance with overrange at all frequencies. Functions both steady state and dynamic. Two mounting styles in stock.

MODEL	RANGE	OVERRANGE
EGA-125-10D EGA-125F-10D	±10g	±50g
EGA-125-100D EGA-125F-100D	±100g	±500g
EGA-125-250D EGA-125F-250D	± 250g	± 1250g
EGA-125-1000D	± 1000g	± 3000g

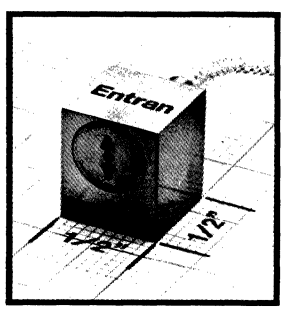
EGAX Miniature Accelerometers — High Overrange



Entran's EGAX accelerometers were developed for applications requiring extremely high overrange capability in a miniature instrument. The EGAX can withstand a 10,000g overload without damage. Damping and overrange stops are standard. The EGAX also functions both steady state and dynamic. In stock in two mounting styles.

MODEL	RANGE	[3]OVERRANGE
EGAX-10 EGAX-F-10	±10g	±10,000g
EGAX-25 EGAX-F-25	±25g	±10,000g
EGAX-100 EGAX-F-100	±100g	±10,000g
EGAX-250 EGAX-F-250	± 250g	± 10,000g
EGAX-1000	± 1000g	± 10,000g

EGC-500DS Miniature Heavy Duty Accelerometers



The EGC-500DS is a heavy duty miniature accelerometer. Created for on-site testing where rugged construction and overload protection is of paramount importance. Damped and fitted with mechanical stops to impede overload response. The EGC-500DS is ideal for static and dynamic acceleration, vibration and shock measurements, the workhorse of test engineers.

MODEL	RANGE	OVERRANGE
EGC-500DS-5	±5g	±50g
EGC-500DS-50	±50g	±500g
EGC-500DS-200	±200g	±2000g

SPECIFICATIONS			
NON—LINEARITY	±1%	INPUT IMPEDANCE nom.	1000 Ω typ., 500 Ω min
TRANSVERSE SENS.	3% max	OUTPUT IMPEDANCE nom.	450 Ω nom.
[1]THERMAL ZERO	±1%F.S./100°F	EXCITATION	15VDC
THERMAL SENS.	±2½%/100°F (+1 to -4%/100°F for EGAX)	COMPENSATED TEMP.	70°F to 170°F (21°C to 77°C)
[2]DAMPING	0.7 cr. .3 cr. min 1 cr. max	OPERATING TEMP.	-40°F to 250°F (-40°C to 121°C)
USEFUL FREQ. RANGE	30% to 50% Res. Freq.	WEIGHT (without leads)	EGA, EGAX: ½ gram nom. EGC-500DS: 20 gms nom.

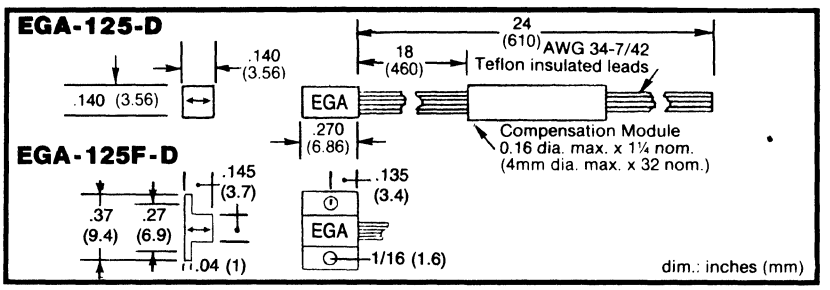
[1]Zero offset of ±15 mV max at 80°F after warm-up. [2]Damping factor is a function of temperature and is specified at 80°F. [3]In sensitive axis only.

This bulletin references Entran's specifications EGAS-187B, EGAXS-187B, EGDAMP-187 and EGC500DS-187B. Refer to Entran's Accelerometer Instruction and Selection Manual for interpretation of all specifications and proper usage.

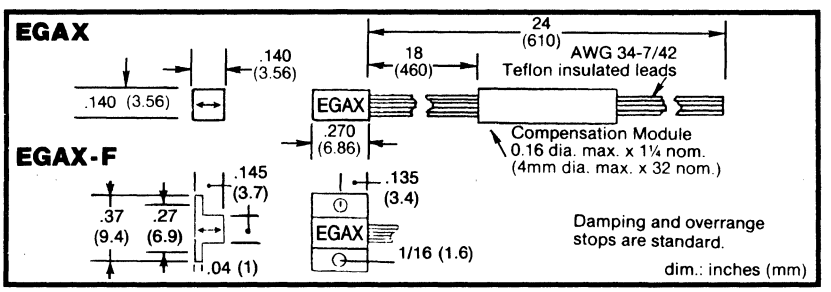
To Order, Call
1-800-635-0650
In N.J. (201) 227-1002

Price List on Page **B**•1893

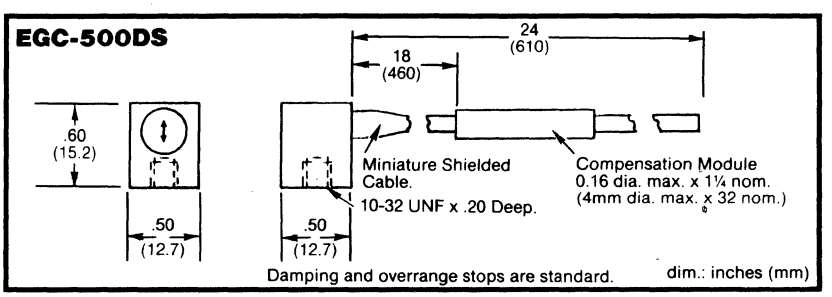
SENSITIVITY nom.	[1]RESONANT FREQ. nom.
12 mV/g	500 Hz
2.5 mV/g	1500 Hz
1 mV/g	2000 Hz
0.25 mV/g	4000 Hz



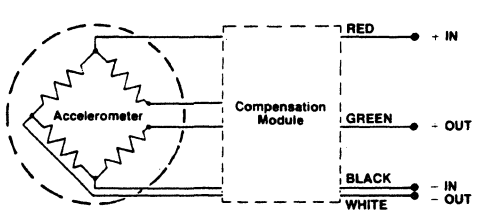
SENSITIVITY nom.	RESONANT FREQ. nom.
8 mV/g	600 Hz
4 mV/g	1200 Hz
2 mV/g	1700 Hz
1 mV/g	2000 Hz
0.25 mV/g	4000 Hz



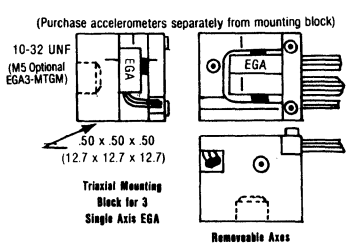
SENSITIVITY nom.	RESONANT FREQ. nom.
25 mV/g	370 Hz
4 mV/g	1500 Hz
1 mV/g	2800 Hz



WIRING



EGA3-MTG Triaxal Mounting Block for EGA and EGAX



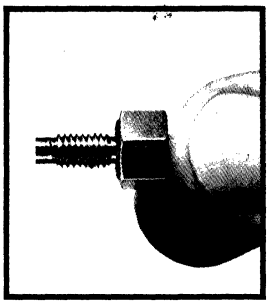
Specifications subject to change without notice.

Entran® Direct "Off-The-Shelf"

— Pressure Transducers —

Other models and ranges available from our full product brochure.

EPX-10W Miniature Pressure Transducers

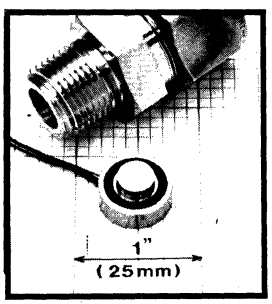


Entran's EPX pressure sensor has a unique design based on mounting ease and flexibility. The EPX offers an optimum combination of characteristics which permit static and dynamic pressure measurements when small size is of prime importance. Its beam welded stainless steel diaphragm, 10-32 UNF thread and built-in O-ring seal allow simple mounting to test objects and use in corrosive media compatible with 304SS, with appropriate O-ring material.

MODEL	RANGE	OVERRANGE
EPX-10W-10	10 psig	50 psig
EPX-10W-50	50 psig	100 psig
EPX-10W-100	100 psig	200 psig
EPX-10W-250	250 psig	500 psig
EPX-10W-500	500 psig	1000 psig
EPX-10W-1000	1000 psig	2000 psig

ALSO AVAILABLE WITH M5x.8 METRIC THREAD IN 3.5, AS MODELS EPX-M5W-3.5, -7, -15, -35 AND -70.

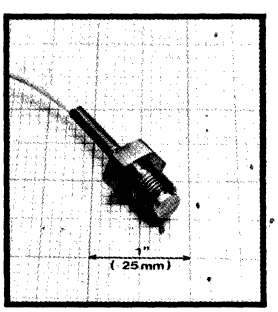
• EPNL-0300 "Low Cost" Pressure Transducer



Entran's EPNL-0300 pressure sensor, although designed to be low cost, has a corrosion resistant stainless diaphragm and many of the features of its higher cost relatives. The standard unit is low in profile and has an O-ring seal for mounting. Its leads may be routed axially or radially. A simple 3/8" NPT adapter fitting (PFEPNL-38N) is available from stock, if you choose to convert the EPNL to a thread mounted style.

MODEL	RANGE	OVERRANGE
EPNL-0300-50	50 psig	100 psig
EPNL-0300-100	100 psig	200 psig
EPNL-0300-250	250 psig	500 psig

EPNM-A38W "5V Output" Pressure Transducers



The EPNM-A38W, manufactured in our International facilities, has been designed to operate with high accuracy under extreme environmental conditions. It contains a built-in hybrid integrated amplifier and high stability foil strain gages offering an output of 5 volts. Its beam welded diaphragm can be used in fluids compatible with APX-4 stainless steel with appropriate ring seal.

MODEL	RANGE	OVERRANGE
EPNM-A38W-200G	200 psig	300 psig
EPNM-A38W-1000G	1000 psig	1500 psig

ALSO AVAILABLE WITH M10x100 METRIC THREAD IN AS MODELS EPNM-AM10W-15, -70 AND -200.

SPECIFICATIONS

	EPX	EPNL	EPNM		EPX	EPNL	EPNM
EXCITATION	10VDC	10VDC	±15VDC	COMPENSATED TEMP.	70°F to 170°F (21°C to 77°C)		32°F to 140°F (0°C to 60°C)
ELECTRICAL INPUT	1200 Ω typ 350 Ω min.	1000 Ω typ 500 Ω min.	15mA max.	OPERATING TEMP.	-40°F to 250°F (-40°C to 121°C)		-40°F to 257°F (-40°C to 125°C)
ELECTRICAL OUTPUT	350 Ω nom.	500 Ω nom.	<1Ω	THERMAL ZERO/100°F	[1] ±1½%FS	±2½%FS	±1%FS
NON LIN & HYST. %FS	50: ±1 100: ±¾ >100psi: ±½	±1%FS	±¾%FS	THERMAL SENS./100°F	±2%FS	±2½%FS	±1%FS
RESOLUTION	Infinite			ZERO OFFSET typ (70°F / 20°C)	±10mV	±15mV	±5%FS

[1] ±1 mV for EPX-10W-10.

This bulletin references Entran's specifications EPXS-187D, FEPNMS-187F and EPNL-490.
Refer to Entran's Pressure Transducer Instruction and Selection manual for interpretation of all specifications and proper usage.

To Order, Call
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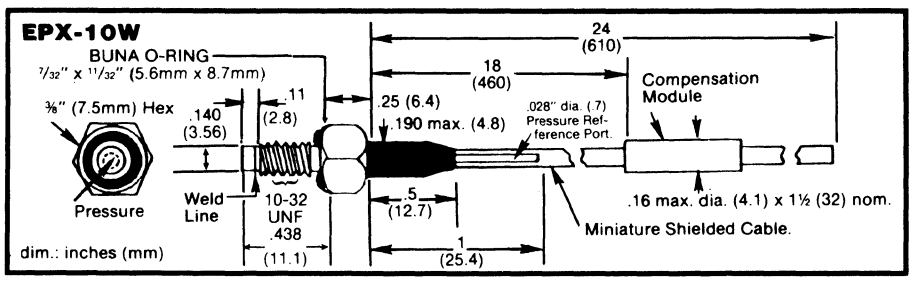
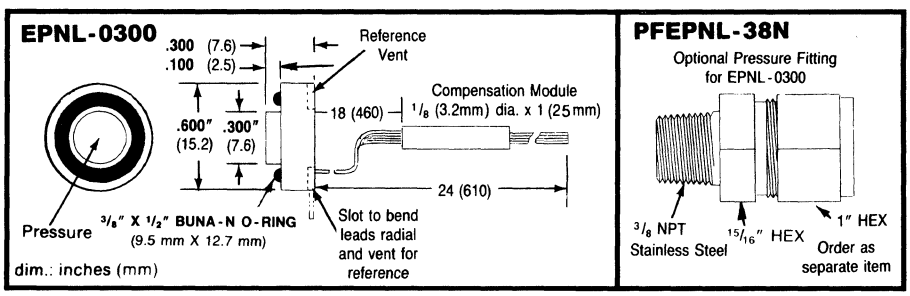
Price List on Page **B•1907**

SENSITIVITY nom.	[1]RESONANT FREQ. nom.
2.5 mV/psi	50 KHz
1.5 mV/psi	75 KHz
1.2 mV/psi	80 KHz
.5 mV/psi	120 KHz
.25 mV/psi	150 KHz
.12 mV/psi	200 KHz

7, 15, 35 AND 70 BAR RANGES

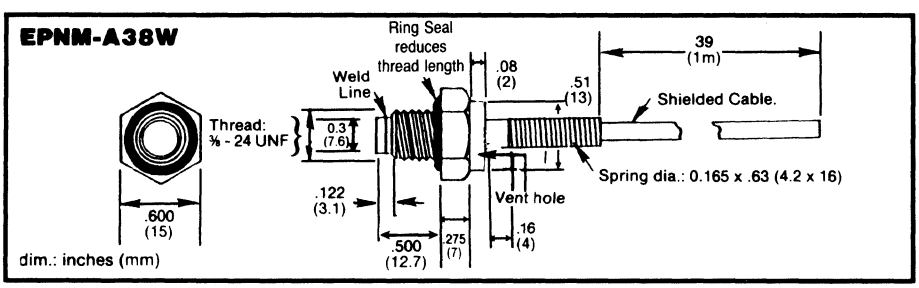


SENSITIVITY nom.	[1]RESONANT FREQ. nom.
2.4 mV/psi	30 KHz
1.2 mV/psi	45 KHz
.5 mV/psi	65 KHz

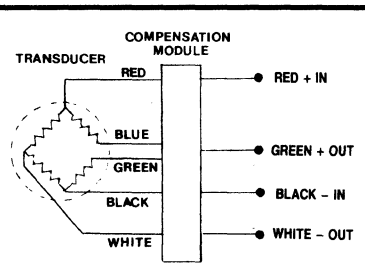


SENSITIVITY nom.	USEFUL FREQ. nom.
5V F.S. nom.	3 KHz
5V F.S. nom.	3 KHz

15, 70 AND 200 BAR RANGES

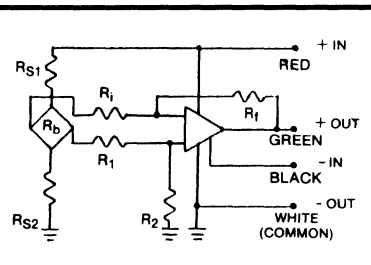


EPX-10W EPNL-0300



INSTALLATION TORQUE EPX	
PRESSURE RANGE	IN-LB
0 to 50 psi	5
60 to 500 psi	10
600 to 5000 psi	15

EPNM-A38W



INSTALLATION TORQUE EPNM	
PRESSURE RANGE	IN-LB
150 to 7500 psi	8

[1] Useful Frequency Range is 20% of Resonant Frequency.

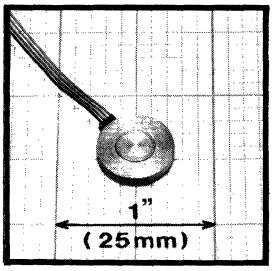
Specifications subject to change without notice.

Entran® Direct "Off-The-Shelf"

— Load Cells —

Other models and ranges available from our full product brochure.

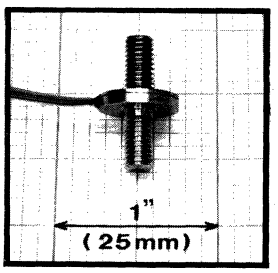
ELF-500 Ultra-Miniature Load Cells



Entran's ELF-500 is the last word in miniaturized load measurement. An incredible 0.11" in thickness with a 0.5" diameter. The ELF-500 measures both steady state and dynamic compression loads. As they are designed for minimum profile, off-axis loading cannot be isolated due to the absence of flexures.

MODEL	[4]RANGE	[2, 4]OVERRANGE
ELF-500-5	5 lb.	10 lb.
ELF-500-10	10 lb.	15 lb.
ELF-500-20	20 lb.	30 lb.
ELF-500-50	50 lb.	75 lb.

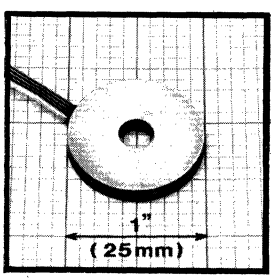
ELF-TC500 Ultra-Miniature Load Cells with Threaded Studs



Entran's ELF-TC500 is the tension/compression stud mounted version of the ELF-500, measuring both static and dynamic loads. Designed for minimum profile, off-axis loading cannot be isolated due to the absence of flexures.
ALSO AVAILABLE WITH M5x.8 METRIC THREADS IN NEWTON RANGES AS MODEL ELF-TC13.

MODEL	[4]RANGE	[2, 4]OVERRANGE
ELF-TC500-5	5 lb.	10 lb.
ELF-TC500-10	10 lb.	15 lb.
ELF-TC500-20	20 lb.	30 lb.
ELF-TC500-100	100 lb.	125 lb.

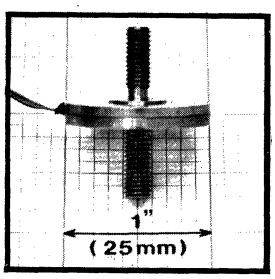
ELF-1000 Flatline Load Cells



Entran's ELF-1000 Flatline Load Cell provides the user with applications flexibility as a flat disc or washer shaped load cell. Its high level output of 250mV measures steady state and dynamic compression loads. Off-axis loading cannot be isolated due to the absence of flexures.

MODEL	[4]RANGE	[2, 4]OVERRANGE
ELF-1000-25	25 lb.	50 lb.
ELF-1000-100	100 lb.	200 lb.
ELF-1000-250	250 lb.	500 lb.

ELF-TC1000 Flatline Load Cells with Threaded Studs



Entran's ELF-TC1000 is the tension/compression stud mounted version of the ELF-1000. The ELF-TC1000 measures both steady state and dynamic loads. Off-axis loading cannot be isolated due to the absence of flexures.
ALSO AVAILABLE WITH M5x.8 METRIC THREAD BELOW 1000 NEWTON RANGE AND M10x1.5 FOR 1000N AND ABOVE, AS MODEL ELF-TC26.

MODEL	[4]RANGE	[2, 4]OVERRANGE
ELF-TC1000-25	25 lb.	50 lb.
ELF-TC1000-100	100 lb.	200 lb.
ELF-TC1000-250	250 lb.	500 lb.

SPECIFICATIONS			
NON-LINEARITY	±1%F.S.	INPUT IMPEDANCE nom.	2000 Ω nom. type. (1000 Ω min.)
HYSTERESIS	±1%F.S.	OUTPUT IMPEDANCE nom.	1000 Ω nom.
THERMAL ZERO	±1%F.S./100°F	EXCITATION	15VDC
THERMAL SENSITIVITY	±2½%F.S./100°F	COMPENSATED TEMP.	70°F to 170°F (21°C to 77°C)
ZERO OFFSET (80°F)	±15mV	OPERATING TEMP.	-40°F to 250°F (-40°C to 121°C)

[1]Useful Frequency range is 20% of Resonant Frequency. [2]Overrange for use within Useful Frequency. [3]Valid for unloaded ELF-500 and ELF-1000 basic units without studs. [4]Must be loaded perpendicular and on center, distributed over loading surface.

This bulletin references Entran's specifications ELF500S-687B and ELF1000S-687B.
Refer to Entran's Load Cell Instruction and Selection Manual for interpretation of all specifications and proper usage.

Price List on Page B•1893

To Order, Call
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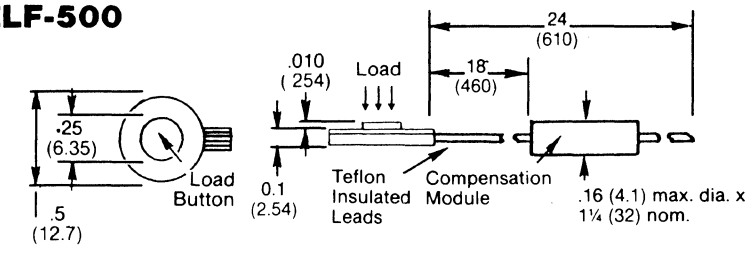
ELF-500

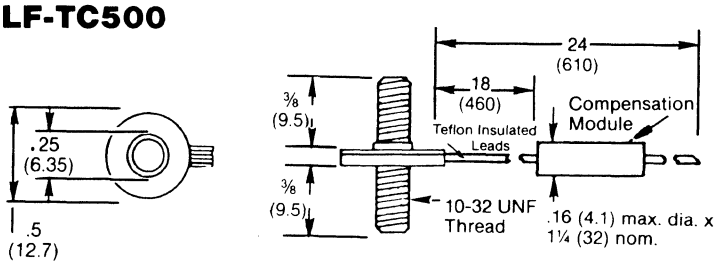
[4]SENSITIVITY nom.	[1, 3]USEFUL FREQ. nom.
40 mV/lb.	0-2800 Hz
25 mV/lb.	0-4000 Hz
12.5 mV/lb.	0-6000 Hz
5 mV/lb.	0-12000 Hz



dim.: inches (mm)

ELF-TC500

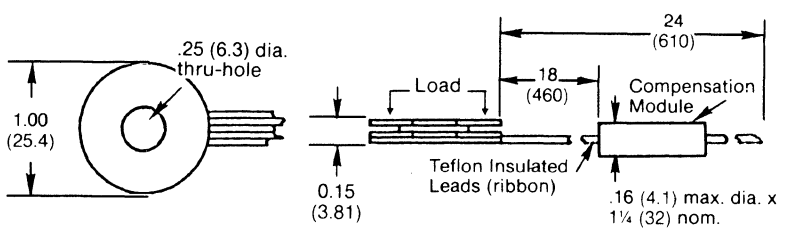
[4]SENSITIVITY nom.	[1, 3]USEFUL FREQ. nom.
40 mV/lb.	0-2800 Hz
25 mV/lb.	0-4000 Hz
12.5 mV/lb.	0-6000 Hz
2.5 mV/lb.	0-20000 Hz



dim.: inches (mm)

ELF-1000

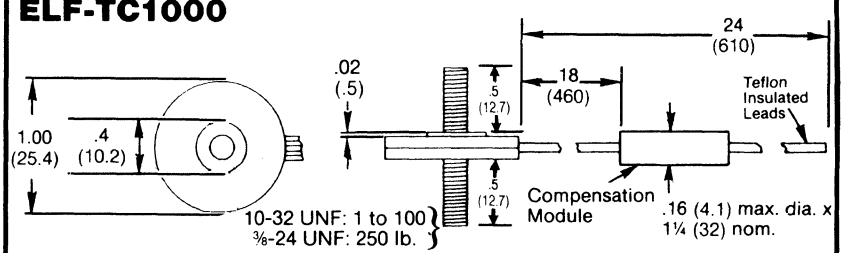
[4]SENSITIVITY nom.	[1, 3]USEFUL FREQ. nom.
10 mV/lb.	0-1000 Hz
2.5 mV/lb.	0-2500 Hz
1 mV/lb.	0-3500 Hz



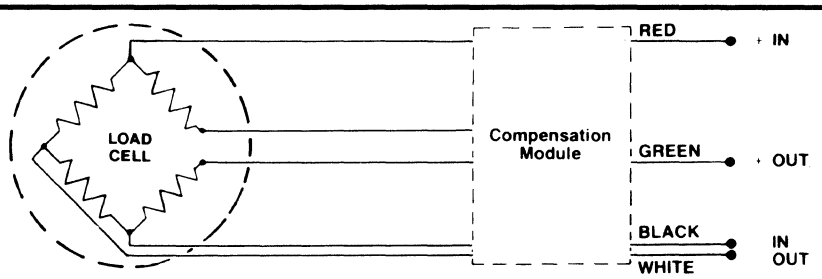
dim.: inches (mm)

ELF-TC1000

[4]SENSITIVITY nom.	[1, 3]USEFUL FREQ. nom.
10 mV/lb.	0-1000 Hz
2.5 mV/lb.	0-2500 Hz
1 mV/lb.	0-3500 Hz



dim.: inches (mm)

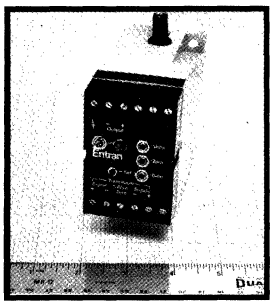


Specifications subject to change without notice.

Entran® Direct "Off-The-Shelf"

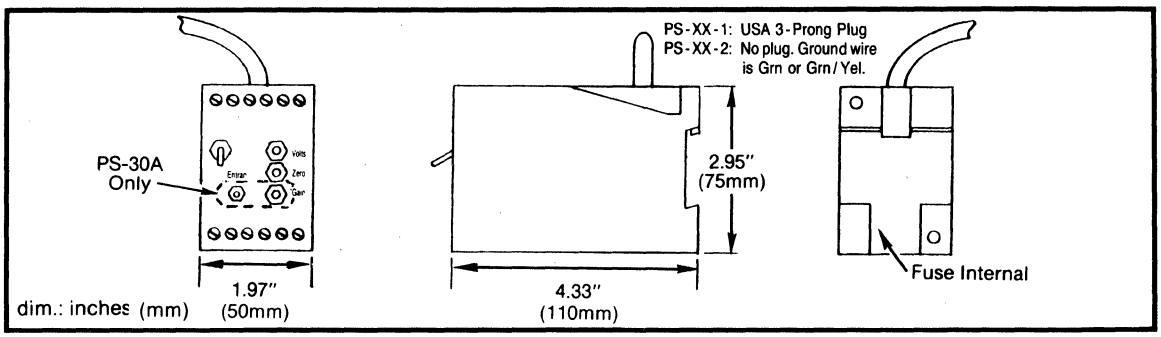
— Power Supplies —

PS Series Transducer Power Supplies with Amplifier Option



Entran's new PS Series Power Supplies are a general purpose excitation source for strain gage bridge transducers and companion amplifiers. The PS Series is an ideal accessory for Entran accelerometers, pressure transducers, and load cells, as well as most standard bridge transducers on the market. Available in single and dual adjustable excitations or with a built-in adjustable gain amplifier, accepting 4-wire closed bridge or 5-wire open bridge configurations. The PS-15 is a single polar supply, the PS-30 is bipolar supply for use with external amplifiers requiring plus/minus excitation and the PS-30A features a built-in instrumentation amplifier. Any PS Series supply or amp can be used with the MM45 meter but use with the MM35 requires factory matching.

MODEL	PS-15-1	PS-15-2	PS-30-1	PS-30-2	PS-30A-1	PS-30A-2
INPUT POWER 50/60 Hz	120 VAC	240 VAC	120 VAC	240 VAC	120 VAC	240 VAC
TRANSDUCER EXCITATION	0.5 TO 15 VDC adjustable		±0.5 to ±15 VDC adjustable		±0.5 to ±7.5 VDC adjustable	
CURRENT	100 mA max.		100 mA max.		100 mA max.	
TRANSDUCER OUTPUT	X1 (not amplified)		X1 (not amplified)		10 to 100X adjustable	
TRANSDUCER ZERO	Adjustable for 5-wire open bridge transducer (50 Ω to either leg)				Adjustable for 4-wire closed and 5-wire open bridge sensor	



OPERATING PROCEDURE

1.) If desired, link the "E-Ground" to "C-Common" terminal on PS-30 or to "Output—" on PS-30A and to "Supply—" on PS-15 for non-isolated operation. Power unit through wall plug, turn on front panel switch, red light should activate.

2.) For PS-15: Connect DVM to Transducer "Supply+" and Transducer "Supply—" terminals and adjust "Volts" potentiometer for desired transducer excitation voltage. For PS-30: Connect DVM to Transducer "Supply+" and "C-Common" (use "Output—" on PS-30A instead of "C-Common" terminal) and adjust "Volts" potentiometer for desired transducer excitation voltage (both+ and —voltages will be adjusted by this action). Move DVM to "Supply—" from "Supply+" to confirm correct voltage on "—" side.

3.) Connect transducer excitation leads to appropriate "Supply" terminals. Confirm that loaded power supply is providing desired voltage with DVM and fine adjust the "Volts" potentiometer if necessary.

4.) WITH STANDARD 4 WIRE BRIDGE TRANSDUCERS: Connect the transducer signal leads to "Signal+" and "Signal—" terminals.

5.) FOR 5 WIRE OPEN BRIDGE TRANSDUCERS (available from Entran): Connect the "Green+" output lead to the "Signal+" terminal and the "Blue+" output lead to the "5 Wire Zero" terminal. This will activate the "Zero" control potentiometer providing 50 Ω zero offset adjustability. Connect the "White—" lead to the "Signal—" terminal.

6.) Connect the "Output" terminals from the front panel to your monitoring or recording equipment.

7.) Adjust the "Zero" potentiometer for "5 Wire" connected transducers to trim the output offset.

8.) FOR USE WITH SEPARATE EXTERNAL AMPLIFIER ON PS-30 ONLY (such as Entran IMV): Connect the amplifier to the "Supply+", "Supply—" and "C-Common" terminals. Power the transducer from IMV or amplifier. Connect "+" output lead from the IMV or amplifier to the "Signal+" terminal and connect the "C-Common" lead to the "Signal—" terminal.

9.) TO SET GAIN OF PS-30A AMPLIFIER: With the transducer supply leads connected to the PS-30A, but before connecting the transducer signal leads, set the gain by utilizing the "SET" button and "GAIN" potentiometer. Determine the Amplifier Output offset by temporarily linking the "Signal+" to "Signal—" terminals and recording the "Output+" to "Output—" voltage. Remove "Signal+" from "Signal—" and connect to "Output—", press/hold the "SET" button. Monitor the test signal (approximately +50mV) which has been internally injected to the "Signal+" and "Signal—" terminals. Then monitoring the amplified test signal at the "Output+" and "Output—" terminals, and subtracting the amplifier output offset to provide the net amplified output, adjust the gain to the desired value with the "GAIN" potentiometer, comparing the net Amplified Output signal to the unamplified test signal on the "Signal" terminals. To confirm and fine adjust the desired gain, re-connect the signal input link and repeat the above procedure until the desired accuracy is achieved and confirmed. After gain is adjusted, release the "SET" button, remove signal link and connect the signal leads of the transducer to the PS-30A.

This bulletin references Entran specification PSS-790.

Specifications subject to change without notice.

Price List on Page **B•1893**

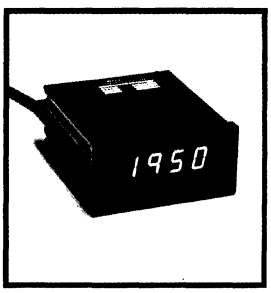
To Order, Call
1-800-635-0650
In N.J. (201) 227-1002

— Meters —

Low Cost Digital Transducer Meters

WITH BUILT-IN TRANSDUCER POWER SUPPLY

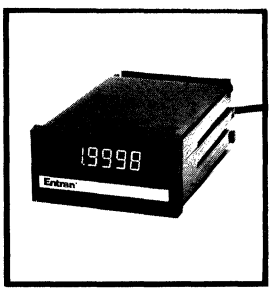
MM35 Series



The MM35 and MM45 Digital Transducer Meters have been manufactured for Entran to complement our line of pressure sensors and load cells, as well as most other sensors on the marketplace. They are both easy and simple to use and in addition to their digital display, provide various levels of excitation so that a transducer can be powered directly from the meter, without use of an external power supply. This is a powerful combination not usually found in digital meters. The MM35 has a 3-1/2 digit display. Its 1999 count can be fully utilized with any input between 1mV/V and 20mV/V and it has two standard transducer excitation voltages. The MM45's 4-1/2 digit display with 19999 counts, can be fully utilized with either a ±200mV or ±2V input signal, and is totally pushbutton programmable from the front panel. It has five standard excitation voltages, selectable by internal connector pins.

CHECK EXCITATION VOLTAGE REQUIREMENT FOR SENSOR TO BE USED.

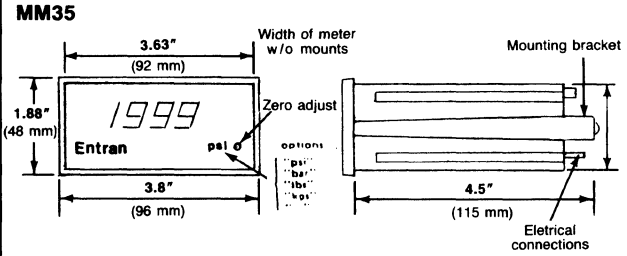
MM45 Series



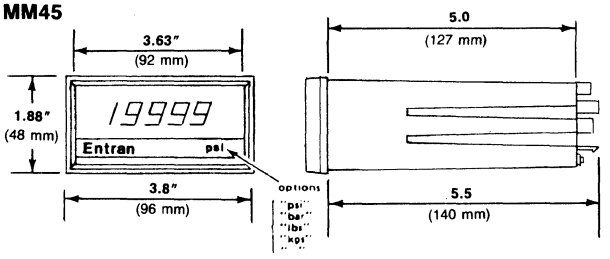
DISPLAY DIGITS	POWER IN	FACEPLATE					
		"psi"	"bar"	"lbs"	"kgs"	"N"	" "
3½, .56" (14.2mm) H	110V, 60 Hz	MM35P-1	MM35B-1	MM35L-1	MM35K-1	MM35N-1	MM35-1
	220V, 50 Hz	MM35P-2	MM35B-2	MM35L-2	MM35K-2	MM35N-2	MM35-2
4½, .50" (12.7mm) H	110VAC/220VAC	MM45P	MM45B	MM45L	MM45K	MM45N	MM45

	MM35	MM45		MM35	MM45
FULL RANGE	±1999	±19999	OPTIONS	-BCD: Multiplexed BCD	-A: Anolog output -HL: Hi/Lo Set +Analog
TRANSDUCER INPUTS ACCEPTABLE	1 to 20mV/V Differential Input	±200mV or ±2V (pin selectable)	SPAN ADJUST & DECIMAL POINT	Internal Resistors and potentiometer	Front panel push-button programmable
ACCURACY OF DISPLAY	±.05%±1 dig.@ 25°C	±.01% of span±1 dig.	ZERO ADJUST	Front panel potentiometer	Front panel push-button programmable
SUPPLY VOLTAGES FOR TRANSDUCERS (VDC)	5V and 10V	5V, 6V, 10V, 12V and 15V	TEMP. SHIFT	50 ppm/°C	20 ppm/°C
SUPPLY CURRENT FOR TRANSDUCERS (MAX.)	50 mA	24 mA	OPERATING TEMP.	32°F to 122°F (0°C to 50°C)	32°F to 140°F (0°C to 60°C)
OUTPUT SIGNAL	Analog 0 to 2 VDC Zero & span adjustable	Option "-A" 0 to 10V front panel prog.	ELECTRICAL CONNECTION	Rear panel solder lugs	Rear panel solder lugs

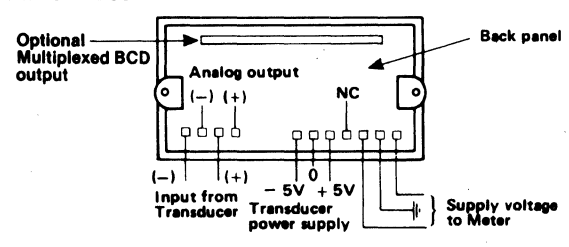
MM35



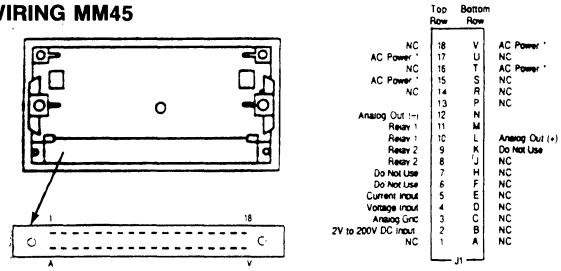
MM45



WIRING MM35

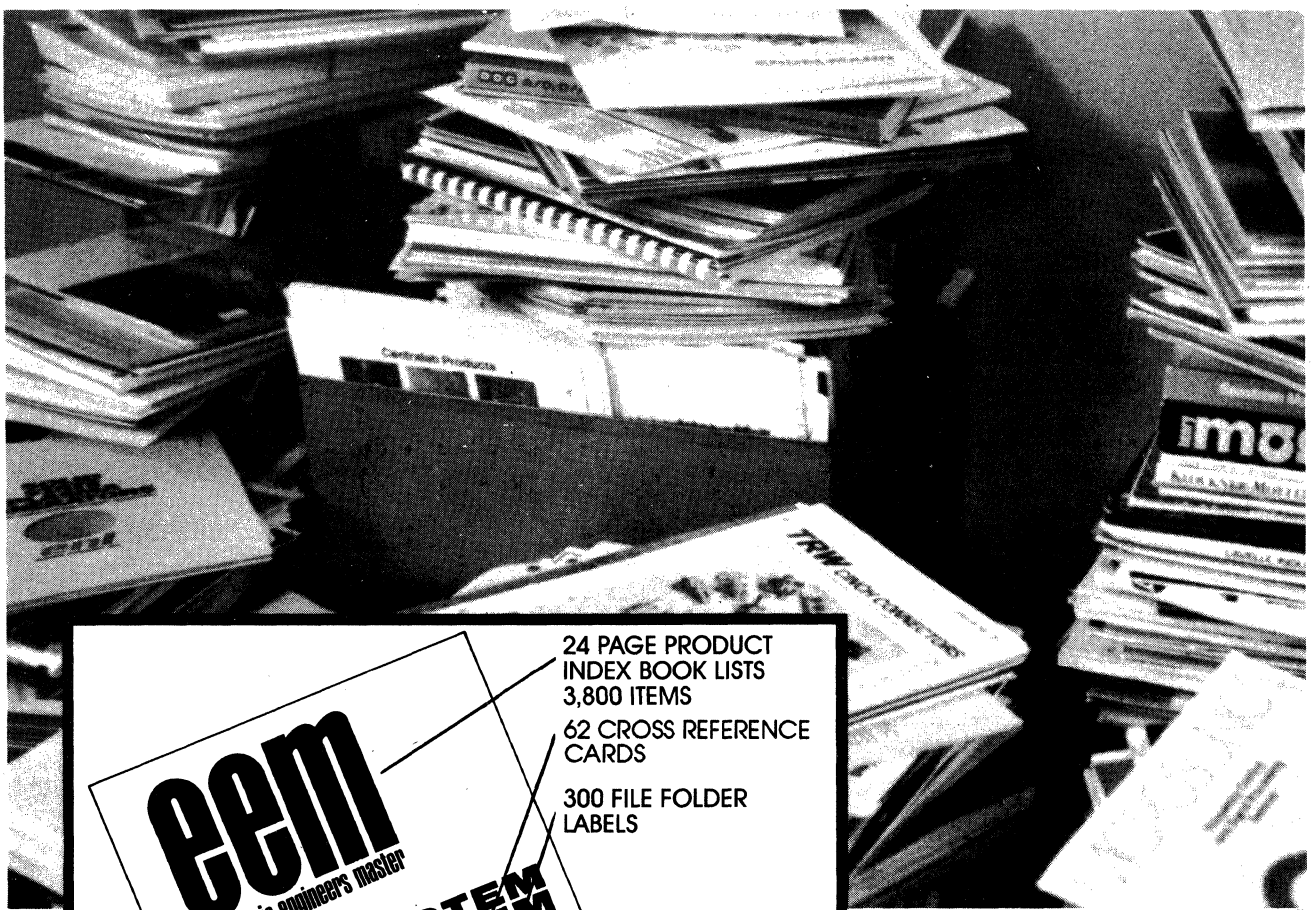


WIRING MM45



This bulletin references specification MM35S-187A, MM45S-790.

Specifications subject to change without notice.



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POSITION SENSORS

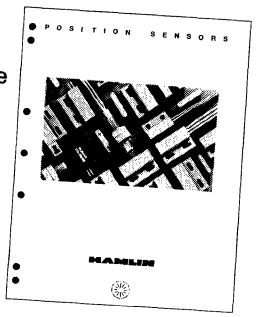
HAMLIN

HAMLIN INC.
612 East Lake Street
Lake Mills, WI 53551 USA
Phone 414/648-3000 • FAX 414/648-3001

The heart of all Hamlin magnetic proximity sensors is a hermetically sealed reed switch, for environmental integrity and dependability. When a magnetic actuator is placed within a prescribed proximity of the sensor, the switch contact changes state. Their cost is far below inductive or capacitive proximity sensors. They require no power to operate and provide a switch closure output.

QUALITY ELECTRONIC COMPONENTS SINCE 1949

For detailed product information request the Hamlin Magnetic Proximity Sensor Catalog. The 16 page brochure provides complete data about Hamlin's broad family of standard Magnetic Proximity Sensors plus application and design recommendations. Also included are dimensions, electrical specifications and operation characteristics.



SPECIFICATIONS

Initial Contact Resistance (Max.)..... 0.200 Ohms
Typical Operate Time..... 1.000ms
Shock W/O False Operation..... 100 G's, 11ms, 1/2 sine wave
Operate & Storage Temp..... -40°C to +105°C
Operation Life (Typical)..... 50,000,000 @ 5Vdc, 10ma
5,000,000 @ 120Vdc, 75ma.

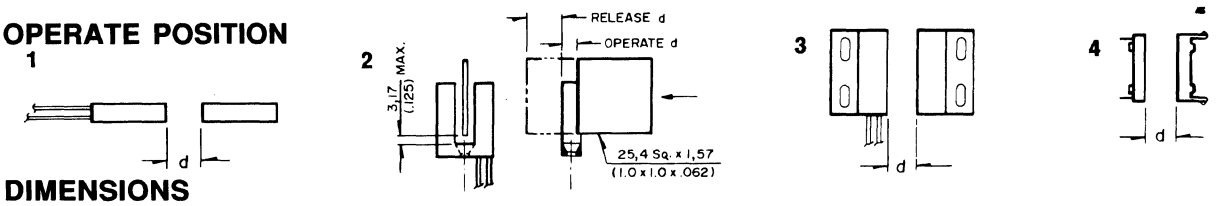
ORDERING INFORMATION

ALL SENSORS

SENSOR NUMBER	OPERATE POSITION	CONTACT RATING	SWITCHING VOLTAGE	MUST OPERATE DISTANCE	MUST RELEASE DISTANCE	TERMINATION OR WIRING	SENSOR LIST PRICE	MATCHING ACTUATOR	ACTUATOR LIST PRICE
59025-010	1	10W	200Vdc	.200	.550	12" PVC Leads	$3.50	57025-000	$2.80
59045-010	4	3W	200Vdc	.110	.275	PCB Pins	3.25	57045-000	2.60
59050-010	4	10W	200Vdc	.200	.450	PCB Pins	3.00	57050-000	2.40
59065-010	1	10W	200Vdc	.200	.550	12" PVC Leads	4.50	57065-000	3.60
59070-010	1	10W	200Vdc	.200	.550	12" PVC Leads	4.50	57070-000	3.60
59085-010	2	10W	200Vdc	.060	1.100	12" PVC Leads	8.75	Vane	N/A
59105-010	3	10W	200Vdc	.225	.500	Connector	4.15	57105-000	3.35
59125-010	3	10W	200Vdc	.225	.500	Pins	4.15	57125-000	3.35
59135-010	3	10W	200Vdc	.400	1.000	12" Teflo Leads	7.35	57135-000	5.80
59140-010	3	10W	200Vdc	.225	.500	12" PVC Leads	5.10	57140-000	4.85
59145-010	3	10W	200Vdc	.275	.600	12" PVC Leads	4.15	57145-000	3.35
59160-010	4	10W	200Vdc	.158	.433	SMD Leads	4.13	57050-000	2.40

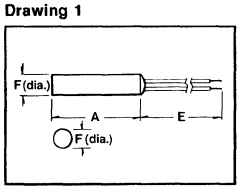
NOTE: All sensors listed are Contact Form A except for Model 59085-010 Vane Sensor.

OPERATE POSITION

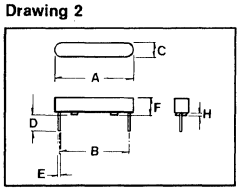


DIMENSIONS

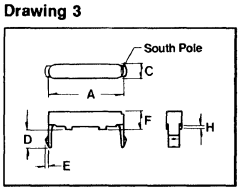
Drawing 1



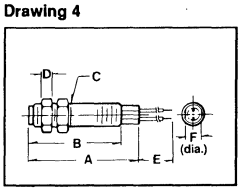
Drawing 2



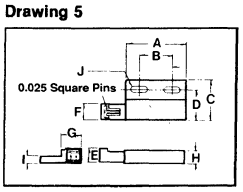
Drawing 3



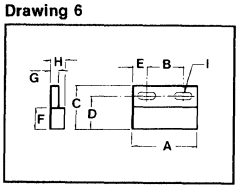
Drawing 4



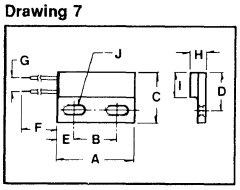
Drawing 5



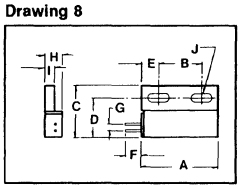
Drawing 6



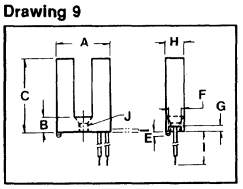
Drawing 7



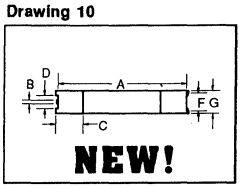
Drawing 8



Drawing 9



Drawing 10



MODEL NUMBER	DESCRIPTION	DWG. NO.	A	B	C	D	E	F	G	H	I	J
59025-010	Sensor	1	1.000	—	—	—	12.0	0.245	—	—	—	—
57025-000	Actuator	1	1.000	—	—	—	—	0.245	—	—	—	—
59045-010	Sensor	2	0.700	0.600	0.130	0.115	0.017	0.170	—	0.025	—	—
57045-000	Actuator	3	0.700	_	0.130	0.160	0.250	0.170	—	0.025	—	—
59050-010	Sensor	2	0.900	0.800	0.180	0.115	0.020	0.200	—	0.025	—	—
57050-000	Actuator	3	0.900	—	0.180	0.160	—	0.200	—	0.025	—	—
59065-010	Sensor	4	1.500	1.250	5/16-24	0.187	12.0	7/32	—	—	—	—
57065-000	Actuator	4	1.500	1.250	5/16-24	0.187	—	7/32	—	—	—	—
59070-010	Sensor	4	1.500	1.250	M8x1,25	0.250	12.0	5,56mm	—	—	—	—
57070-000	Actuator	4	1.500	1.250	M8x1,25	0.250	—	5,56mm	—	—	—	—
59105-010	Sensor	5	1.125	0.625	0.750	0.562	0.260	0.288	0.375	0.250	0.135	0.125x0.308
57105-000	Actuator	6	1.125	0.625	0.750	0.562	0.250	0.375	0.135	0.250	0.125x0.308	—
59125-010	Sensor	8	1.125	0.625	0.750	0.562	0.250	0.236	0.100	0.250	0.135	0.125x0.308
57125-000	Actuator	6	1.125	0.625	0.750	0.562	0.250	0.375	0.135	0.250	0.125x0.308	—
59135-010	Sensor	7	1.125	0.625	0.750	0.562	0.250	12.0	0.200	0.250	0.375	0.125x0.312
57135-000	Actuator	6	1.125	0.625	0.750	0.500	0.250	0.375	0.135	0.250	—	0.312x0.125
59140-010	Sensor	7	0.906	0.551	0.551	0.430	0.177	12.0	—	0.236	0.296	0.126x0.150
57140-000	Actuator	6	0.906	0.551	0.551	0.430	0.177	0.296	0.118	0.236	0.126x.150	—
59145-010	Sensor	7	1.125	0.625	0.750	0.562	0.250	12.0	—	0.385	12.0	0.125x0.308
57145-000	Actuator	6	1.125	0.625	0.750	0.562	0.250	0.375	0.135	0.250	—	0.125x0.308
59085-010	Sensor	9	0.750	0.150	1.000	—	0.062	0.165	0.075	0.250	12.0	4-40 & C'Sunk
59160-010	Surface Mt. Sensor	10	.800	.030	.100	.065	—	.105	.150	—	—	—

HERMETIC SWITCH, INC.

Proximity Sensors

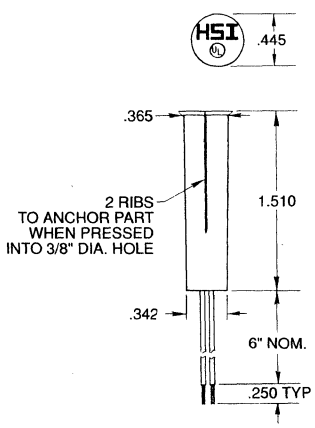
Hermetic Switch, Inc. manufactures a variety of two part magnetic proximity sensors (sensor and actuator). All sensors feature hermetically sealed reed switch contacts that can survive harsh environments. Specially selected epoxy potting materials and rugged plastic cases withstand the impacts and forces of the real world. Many models are listed with Underwriters Laboratories, verifying that they have passed rigorous testing. The sensors listed in our catalog are designed for use in alarm systems, automotive, consumer products, industrial controls, safety interlock, and many other applications. Custom sensors not shown in our catalog may be required for your application. Consult factory for complete operate data, catalogs, and engineering assistance.

Contact Ratings

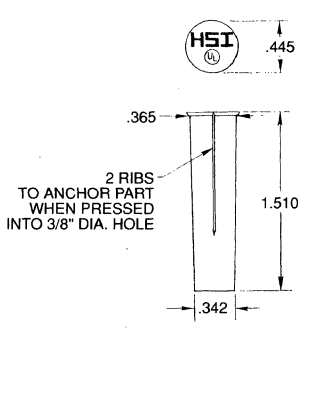
SENSOR MODEL	RECOMMENDED ACTUATOR	CONTACT FORM	SWITCHING RATINGS		
			MAX VOLTS DC	MAX AMPS DC	MAX WATTS DC
1100	1000	SPST-NO	30	.25	3.0
1200	1000	SPST-NC	30	.25	3.0
1300	1000	SPDT	30	.25	3.0
1500	1005	SPST-NO	30	.01	0.25
1600	1006	SPST-NO	100	.25	3.0
1700	1007	SPST-NO	100	.25	7.0
1800	1007	SPST-NC	100	.25	3.0
1900	1007	SPDT	100	.25	3.0
5100	5000	SPST-NO	30	.25	3.0
5200	5000	SPST-NC	30	.25	3.0
5300	5000	SPDT	30	.25	3.0
6100	6000	SPST-NO	30	.25	3.0
6200	6000	SPST-NC	30	.25	3.0
6300	6000	SPDT	30	.25	3.0
8200	8100	SPST-NO	200	.50	10.0
8300	8100	SPDT	100	.25	3.0
8400	8100	SPST-NC	100	.25	3.0
8500	8100	SPST-NO	—	—	360 VA*
8600	8100	SPST-NO	200	.50	10.0

*AC only

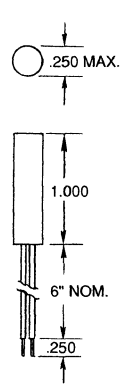
PART # 1100, 1200 or 1300



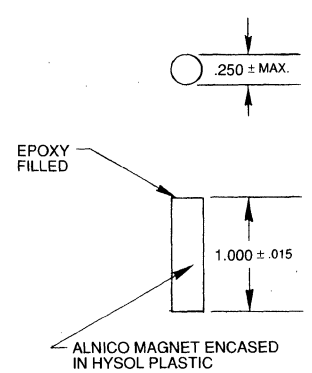
PART # 1000 ACT



PART # 1700, 1800 or 1900



PART # 1007 ACT



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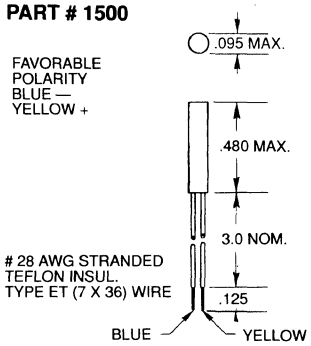
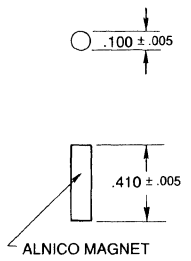
Proximity Sensors

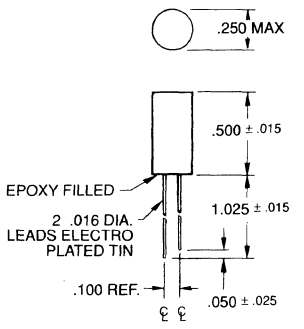
PART # 1500



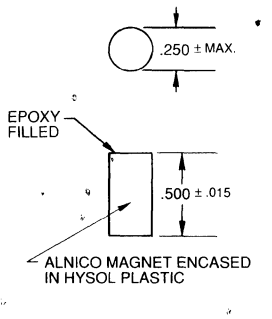
PART # 1005 ACT



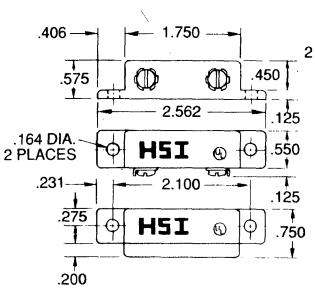
PART # 1600



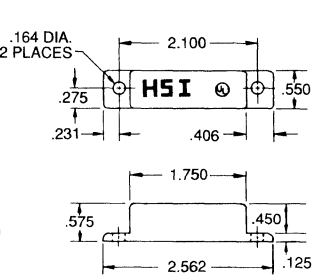
PART # 1006 ACT



PART # 5100, 5200 or 5300



PART # 5000 ACT



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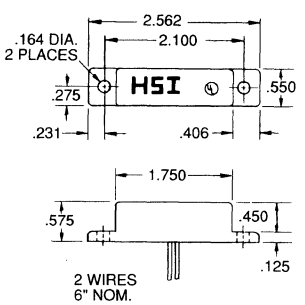
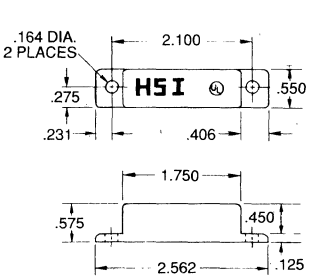
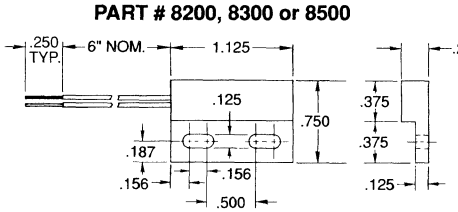


PART # 6000 ACT



PART # 8200, 8300 or 8500



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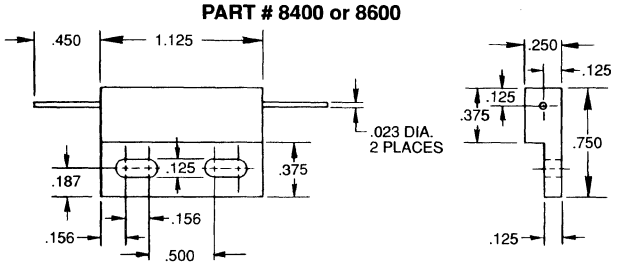
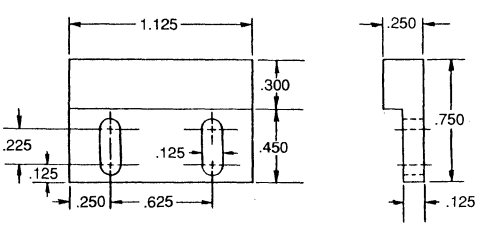


PART # 8100 ACT



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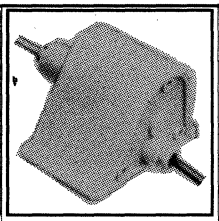
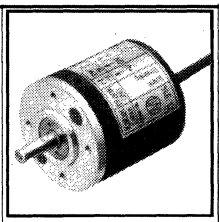
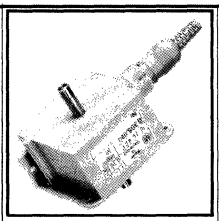
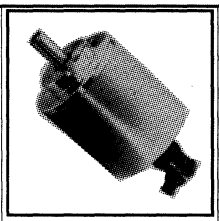
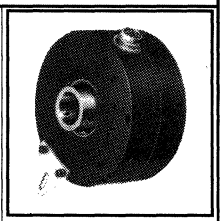
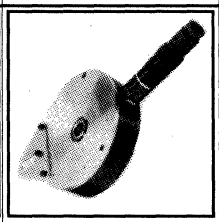
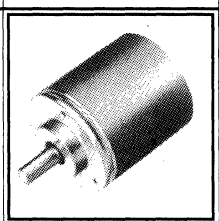
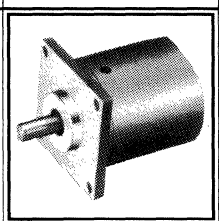
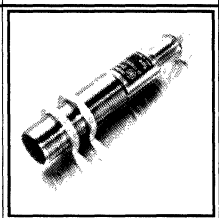
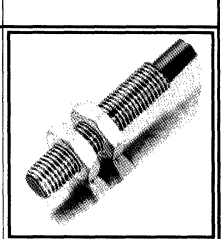
Encoders and Sensors

Applications: *Length and speed measurement, positioning,machine control for OEM's and User's alike*					
Model	Contactor	Light Duty	Low Cost	Medium resolution	Hollow shaft
	G 080	G 314	G 305	G 317 / 327	G 304
Supply voltage	N/A	12-26VDC	10-30VDC, 5V	10-30 VDC, 5V	10-30VDC, 5V
Output current	2 Amp.	20 mA	40 mA	40 mA	40 mA
Output Signals	SPST contact	NPN open Collector	push-pull, TTL	push-pull, TTL	push-pull, TTL
Output frequency	25 imp/sec.	20 kHz	10 kHz	50 kHz	50 kHz
Resolution	20 imp/rev.	1000 imp/rev	120 imp/rev.	2,000 imp/rev x1,2,4	1250 imp/rev x1,2,4
Speed	1,500 rev/min.	6000 rpm	6,000 rpm	6,000 rpm	3000 rpm
Shaft diameter	7 mm	5 mm	7 mm	7/10 mm	max. 22 mm
Housing Ø/length	72 / 92 mm	40 / 42 mm	70 x 62.5 x 36 mm	60 / 65 mm	106 / 50 mm
Price (average)	$ 55.00	$ 150.00	$ 75.00	$ 200.00	$ 300.00
Comments:	Rugged mechanical rotary pulser with various pulse ratios. Use with electric or electronic counters.	Ideal for light industrial applications and office automation equipment.	General purpose low-cost encoder, single pulse or quadrature output.	Options: quadrature and inverted outputs, zero pulse.	Rugged. Options quadrature and inverted outputs zero pulse.

Applications: *Length and speed measurement, positioning,machine control for OEM's and User's alike*					
Model	Incremental G 321	Incremental G 319	Incremental G 329	Inductive G 101	Inductive G 107
Supply voltage	10-30 VDC, 5V	10-30 VDC, 5V	10-30 VDC, 5V	10-30 VDC	80-250 VAC
Output current	40 mA	40 mA	40 mA	200 mA	3-500 mA
Output Signals	push-pull, TTL	push-pull, TTL	push-pull, TTL	open collector	Triac
Output frequency	50 kHz	50 kHz	50 kHz	1,000 Hz	15 Hz
Resolution	5,000 imp/rev.x1,2,4	500 imp/rev. x1,2,4	500 imp/rev. x1,2,4	n/a	n/a
Speed	3,000 rpm	6,000 rpm	6,000 rpm	n/a	n/a
Shaft diameter	max. 12 mm	.375 inch	.375 inch	n/a	n/a
Housing Ø/length	106 / 30 mm	2.36 / 2.56 inch	2.50 / 2.64 inch	8 / 60 mm	18 / 100 mm
Price (average)	$ 300.00	$ 160.00	$ 190.00	$ 33.00	$ 45.00
Comments:	Hollow shaft Options: quadrature and inverted outputs, zero pulse.	Servo mount Options: quadrature and inverted outputs, zero pulse.	Flange mount Options: quadrature and inverted outputs, zero pulse.	Sensing distance 1 mm, short circuit and reverse polarity protection.	Sensing distance 10 mm, with LED indicator. 2 m cable length standard.

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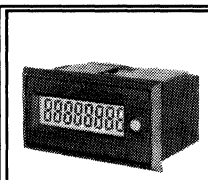
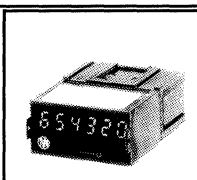
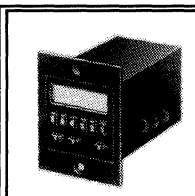
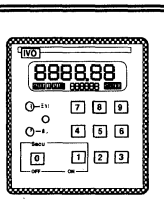
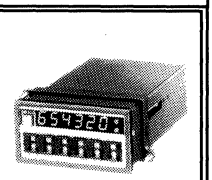
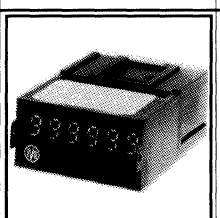
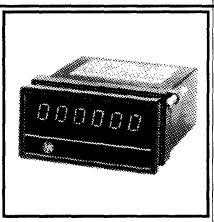
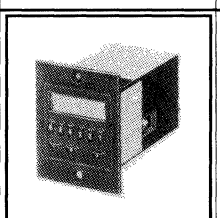
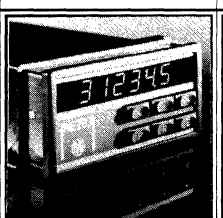
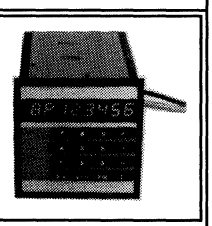
Counters, Tachometers, Indicators, DRO's

programmable limit switches, electronic cam-shaft controllers, batch counters etc.

Applications: *Length measurement, positioning, batching, counting for OEM's and User's alike*					
Model	LCD Counter N 121	LED Counter N 608	LCD Counter NE 102	LCD Counter NE 120	LED Counter NE 624
Supply voltage	Self Powered	5-24 VDC	24-220 VAC	24-220VAC	24VDC,48-220AC
Count speed	18/ 40/ 10,000 cps	10 kHz	800 Hz	9 kHz	10 kHz
Encoder Supply	none	none	24 VDC, 80 mA	12VDC, 50 mA	18VDC, 100 mA
Panel Cutout	24X48/ 25X50mm	25 X 50 mm	50 X 50 mm	45 X 45 mm	45 X 92 mm
Price (List)	$ 39.00	$ 133.00	$ 179.00	$ 150.00	$ 286.00
Comments:	8 digit totalizer with 10 year battery life. Excepts contact closure inputs as well as voltage pulses from 5-220V. Nema 4 front panel. Ideal replacement for E/M counters.	6 digit totalizer, up/ down counting, differential and quadrature counting x1, x2, x4, Two year battery backup, external or front panel reset.	6 digit preset counter, 1 or 2 presets, up/down or quadrature, 2000 hr battery backup, relay outputs, 2 digit scale factor keyboard progr.	6 digit single preset counter, programmable prescaler, quadrature counting, 10 year EEPROM memory, relay and solid state outputs.	6 digit dual preset counter, presets always visible, up/ down, differential or quadrature, relay and transistor outputs, 10 year data backup, many user progr. functions
Applications: *Speed measurement, timing, and machine control for OEM's and User's alike.*					
Model	LED Tachometer N 609	LED Tach/Ratio meter N 662	LCD Tachometer NE 106	LED Tachometer NE 203	LED Controller NE 202
Supply voltage	6VDC,12-24VAC	24-220 VAC	24VDC,24-220AC	24-220 VAC	24VDC24-220AC
Count speed	10 kHz	40 kHz	10 kHz	10 kHz	10 kHz
Encoder Supply	15-30VDC, 60mA	15 VDC, 80 mA	24 VDC, 80 mA	24 VDC, 80 mA	24 VDC, 80 mA
Panel Cutout	25 X 50 mm	45 X 92 mm	51 X 51 mm	45 X 92 mm	92 X 92 mm
Price (List)	$ 130.00	$ 260.00	$ 260.00	$ 260.00	$ 580.00
Comments:	Compact design, Quartz accuracy, programmable decimal point, bright 0.3 inch LED display,	1/8 DIN housing, user programmable time base and decimal point, screw terminal connections, optional multiplexed BCD output.	µProcessor based, upper,lower limit setpoints, user programmable time base and scaling factor, 2000 hr. backup.	µProcessor based, upper / lower limit setpoints, relay outputs, ideal for extremely slow to high speed applications.	µProcessor based, 8/ 16/ 32 presets, scaling, quadrature counting, self prompting menu, 4 function keys, serial interface, self diagnostics.

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SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_O	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_O}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_O	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_O}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_O/I_O
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms A•1114, B•1037, C•1116, D•1068
AC Power Supplies, Product Selection Guide D•2146
ASCII Code D•1086
Batteries, Product Selection Guide D•1427
Batteries & Fuel Cells, Characteristics D•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide C•1003
Capacitors, Basic Formulas A•1078
Capacitors, Miniglossary A•1054
Capacitors, Product Selection Guide A•1003
Coils, Chokes, Inductors, Product Selection Guide A•1155
Conductors, Maximum Current Capacity of Copper & Aluminum C•1825
Connectors, Miniglossary C•1329
Connectors, Terminals & Sockets, Product Selection Guide C•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide A•1300
DC Power Supplies, Product Selection Guide D•1501
Delay Lines, Product Selection Guide A•1493
Dielectrics, Thermal Conductivity C•1709
Discrete Semiconductors, Product Selection Guide A•2082
Displays, Readouts, & CRTs, Product Selection Guide B•1032
EBCDIC Code D•1110
Encapsulation, Miniglossary C•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide C•1601
Fiber Optics, Miniglossary B•1224
Fiber Optics, Product Selection Guide B•1214
Filters, Power, Product Selection Guide A•1609
Filters, Signal, Product Selection Guide A•1651
Instruments, Test & Measuring, Product Selection Guide D•1207
Interconnection Systems, Product Selection Guide C•1678
Keyboards & Keypads, Product Selection Guide B•1794
Lamps, Lights, & Indicators, Product Selection Guide B•1135
Logofinder & Trademark Directories C•901
Microwave Components, Product Selection Guide A•1746
Military Qualified Products List B•1002
Motors, Drives, & Rotating Components, Product Selection Guide B•1233
Opto Semiconductors, Miniglossary B•1334
Oscilloscopes, Product Selection Guide D•1406
Panel Hardware, Product Selection Guide C•1582
Panel Meters, Analog & Digital, Product Selection Guide D•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide A•2013
Power Supplies, Miniglossary D•1522, D•2184
Power Supplies, AC, Product Selection Guide D•2146
Power Supplies, DC, Product Selection Guide D•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide B•1347
Relay Contact Forms B•1550
Relays, Electromechanical, Miniglossary B•1449
Relays, Product Selection Guide B•1397
Resistor Color Codes A•1924
Resistors, Product Selection Guide A•1835
Servo Components, Miniglossary B•1270, D•2244
SI Units, Basic Guide To, A•2080, B•1666, C•1362, D•2246
Solenoids, Product Selection Guide B•1614
Switches, Product Selection Guide B•1639
Symbols—International Authorities A•1139, B•1024, C•1156, D•1090
Thermal Components, Product Selection Guide B•1831
Thermal Conductivity of Dielectrics at Room Temperature C•1709
Thyristors/High Power Diodes, Miniglossary A•1728, A•2084
Timers, Miniglossary B•1409, D•1149
Trademark & Logofinder Directories C•901
Transducers & Encoders, Product Selection Guide B•1872
Transformers, Product Selection Guide A•2131
Wire & Cable, Product Selection Guide C•1705
Wire Gauges—Diameter, Area, Copper Weight C•1864

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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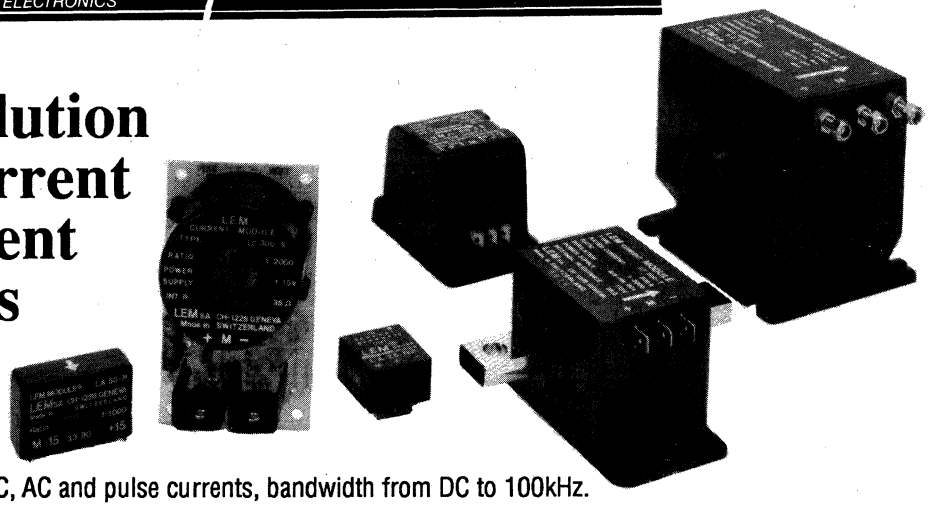
A perfect feed-back system between power current and electronic control

The Successful Solution to Power Current Measurement Problems



- Measures DC, AC and pulse currents, bandwidth from DC to 100kHz.
- High degree of accuracy: 0.2% to 1% typical
- Currents to 500,000 amperes
- Voltages to 6,400 volts
- Instantaneous or True RMS outputs
- Open and closed loop systems
- Excellent Linearity: less than 0.1% typical
- Accuracy, stability and linearity guaranteed for life
- Reliable in hostile environments
- Rapid Response time: better than 1μsecond
- Wide range of current measurement models

FEEDBACK (Closed Loop) TRANSDUCERS- Standard Models

ANALOG CURRENT OUTPUTS

Nominal Current I_n	Model	Measuring Range (+ and -)	Turns Ratio	Control Output @ I_n	Accuracy @ I_n (+ / -)	Dielectric Strength RMS 50 Hz,1 Min.	Aperture Diameter (mm)	Internal Resistance (Ohms)	Supply Voltage (+ and -)	Draw'g Key No.	Dimensions (mm) Height H	Width W	Depth D
25A	LA25-NP①	0 TO 36A	1:1000	25MA	0.6%	2.5KV	NONE	110	10 to 15	1	16	29.2	26
50A	LA50-P	0 TO 70A	1:1000	50MA	0.5%	2KV	12.7 X 6.4	90	15	1	25.5	40.5	18
50A	LA50-P/SP1	0 TO 100A	1:2000	25MA	0.5%	2KV	12.7 X 6.4	160	15	1	25.5	40.5	18
50A	LTA50-P	0 TO 160A	1:1000	50MA	0.5%	3KV	10	25	15	1	28.3	40	17
80A	LT80-P	0 TO 150A	1:1000	80MA	0.5%	3KV	6.5	30	15	1	25	50	35
100A	LC100-S	0 TO 200A	1:1000	100MA	0.5%	3KV	15	25	15	6	90	55	31
100A	LT100-P	0 TO 150A	1:1000	100MA	0.5%	3KV	10	30	15	1	33	45	35
100A	LTA100-P	0 TO 160A	1:1000	100MA	0.5%	3KV	10	25	15	1	28.3	40	17
100A	LT100-S	0 TO 200A	1:1000	100MA	0.5%	5KV	15	25	12 TO 18	3	50	76	48
100A	LT100-T	0 TO 200A	1:1000	100MA	0.5%	5KV	BUSBAR	25	12 TO 18	4	50	76	100
120A	LT120-TP	0 TO 150A	1:1000	120MA	0.5%	3KV	BUSBAR	30	15	2	25	50	67
150A	LT150-TP	0 TO 180A	1:1000	150MA	0.5%	3KV	BUSBAR	30	15	2	32	45	75
200A	LT200-S	0 TO 300A	1:2000	100MA	0.5%	6KV	20	35	12 TO 18	3	52	93	50
200A	LT200-T	0 TO 300A	1:2000	100MA	0.5%	6KV	BUSBAR	35	12 TO 18	4	52	93	112
300A	LC300-S	0 TO 500A	1:2000	150MA	0.5%	3KV	20	35	15	6	95	56	36
300A	LT300-S	0 TO 500A	1:2000	150MA	0.5%	6KV	20	35	12 TO 18	3	52	93	50
300A	LT300-T	0 TO 500A	1:2000	150MA	0.5%	6KV	BUSBAR	35	12 TO 18	4	52	93	112
500A	LC500-S	0 TO 800A	1:5000	100MA	0.3%	3KV	25	80	15	6	110	74	38
500A	LT500-S	0 TO 1000A	1:5000	100MA	0.3%	6KV	25	80	15 TO 24	6	92	116	84
500A	LT500-T	0 TO 1000A	1:5000	100MA	0.3%	6KV	BUSBAR	80	15 TO 24	4	92	116	180
1000A	LC1000-S	0 TO 1500A	1:5000	200MA	0.2%	3KV	40	40	15	6	130	100	38
1000A	LT1000-SI	0 TO 1500A	1:5000	200MA	0.3%	6KV	40	40	15	3	102	160	74
1000A	LT1000-TI	0 TO 1500A	1:5000	200MA	0.3%	6KV	BUSBAR	40	15	4	102	160	180
2000A	LT2000-S	0 TO 3000A	1:5000	400MA	0.2%	6KV	63	25	15 TO 24	3	155	180	118
2000A	LT2000-T	0 TO 3000A	1:5000	400MA	0.2%	6KV	BUSBAR	25	15 TO 24	4	155	180	370

Other models available up to 500,000 amperes ①Designed to provide five current ranges, 5A to 25A.

MULTIPLE OUTPUTS (Current and Voltage)- Standard Models.

50A	LTA50-P/SP1	0 TO 160A 0 TO 50A	1:1000	50MA 5V	0.5% 1%	3KV	10	25	15	1	28.3	40	17
100A	LTA100-P/SP1	0 TO 160A 0 TO 100A	1:1000	100MA 5V	0.5% 1%	3KV	10	25	15	1	28.3	40	17

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Dimensional Drawings

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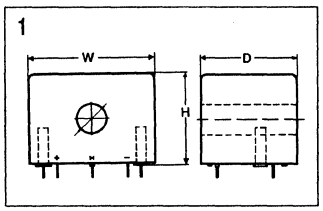

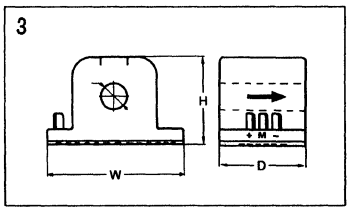

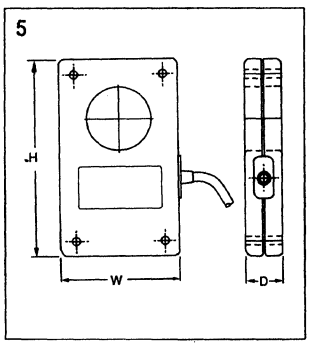

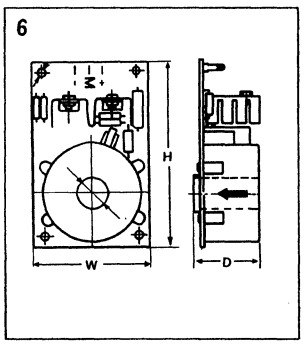

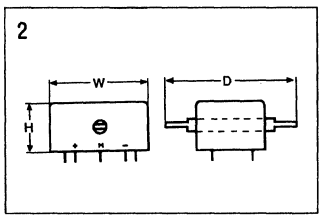

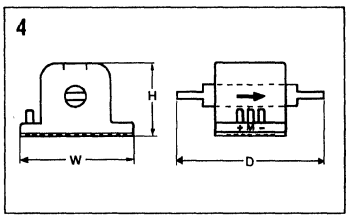

OPEN LOOP CURRENT TRANSDUCERS-Standard Models

INSTANTANEOUS OUTPUTS

I_n Peak	Model	Control Output @ I_n	Measuring Range Peak (+ and -)	Accuracy @ I_n 23 °C (+ and -)	Response Time	Frequency (Small Signal)	Dielectric Strength RMS 50Hz 1 Min.	Supply Voltage	Aperture (mm)	Draw'g Key No.	Dimensions (mm) Height H	Wide W	Depth D
200A	HA200-SU	0V to 10V	200A	1%	1 to 7µs	DC to 25KHz	5KV	15V (+ and -) +15V	35	5	107	64	20
	HA200-SB	-10V to +10V											
	HA200-SI	4mA to 20mA											
300A	HA300-SU	0V to 10V	300A	1%	1 to 7µs	DC to 25KHz	5KV	15V (+ and -) +15V	35				
	HA300-SB	-10V to +10V											
	HA300-SI	4mA to 20mA											
400A	HA400-SU	0V to 10V	400A	1%	1 to 7µs	DC to 25KHz	5KV	15V (+ and -) +15V	35				
	HA400-SB	-10V to +10V											
	HA400-SI	4mA to 20mA											
500A	HA500-SU	0V to 10V	500A	1%	1 to 7µs	DC to 25KHz	5KV	15V (+ and -) +15V	35				
	HA500-SB	-10V to +10V											
	HA500-SI	4mA to 20mA											
1000A	HA1000-SU	0V to 10V	1000A	1%	1 to 7µs	DC to 25KHz	5KV	15V (+ and -) +15V	35				
	HA1000-SB	-10V to +10V											
	HA1000-SI	4mA to 20mA											

Following models have simultaneous use outputs.

2000A	HA2000-S	-50mV to +50mV -10V to +10V -20mA to 20mA	2000A	1%	1 to 7µs	DC to 3KHz	5KV	15V (+ and -)	100	5	290	170	50
3000A	HA3000-S	-50mV to +50mV -10mV to +10mV -20mA to 20mA	3000A	1%	1 to 7µs	DC to 3KHz	5KV	15V (+ and -)	100				

TRUE RMS OUTPUTS

I_n	Model	Output	Range	Accuracy	Avg T.C.	Freq.	Dielectric	Supply	Aperture	Key	Height	Width	Depth
200A	HA200-SRU	0V to 10V	200A	1%	100ms	DC to 25KHz	5KV	15V (+ and -)	35	5	107	64	20
	HA200-SRI	4mA to 20mA											
300A	HA300-SRU	0V to 10V	300A	1%	100ms	DC to 25KHz	5KV	15V (+ and -)	35				
	HA300-SRI	4mA to 20mA											
400A	HA400-SRU	0V to 10V	400A	1%	100ms	DC to 25KHz	5KV	15V (+ and -)	35				
	HA400-SRI	4mA to 20mA											
500A	HA500-SRU	0V to 10V	500A	1%	100ms	DC to 25KHz	5KV	15V (+ and -)	35				
	HA500-SRI	4mA to 20mA											
1000A	HA1000-SRU	0V to 10V	1000A	1%	100ms	DC to 25KHz	5KV	15V (+ and -)	35				
	HA1000-SRI	4mA to 20mA											

Following models have simultaneous use outputs.

2000A	HA2000-SR	0V to 50mVDC 0V to 10VDC 0mA to 20mADC	2000A	1%	100ms	DC to 3KHz	5KV	15V (+ and -)	100	5	290	170	50
3000A	HA3000-SR	0V to 50mVDC 0V to 10VDC 0mA to 20mADC	3000A	1%	100ms	DC to 3KHz	5KV	15V (+ and -)	100				

Other models available up to 16,000 amperes.

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SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States (NEMA) National Electrical Manufacturers Association

United States (ANSI) American National Standards Institute

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

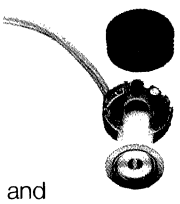
Yugoslavia Federal Institute of Standardization

Lucas Ledex Encoders

Simplify Encoder Selection with Lucas Ledex In-stock Models

Incremental Encoders

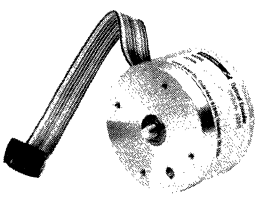
Modular



• Low cost • Install directly on DC servo and stepper motors • Resolution to 2,500 pulses per revolution

Ideal for closed-loop servo and stepper motor systems where low, cost, small size, long-term dependability and performance are significant factors in encoder selection.

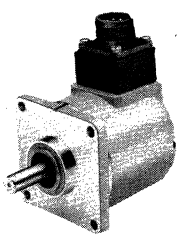
Instrument Grade



• Face or servo mount • Compact, self-contained shaft encoder • Resolutions up to 10,000 pulses per revolution

Four series of instrument grade encoders are available with an extensive selection of resolutions, votage levels and output formats.

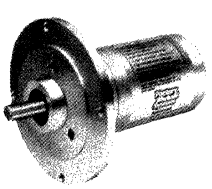
Heavy Duty



• Industrial grade • Available with a NEMA 4 rating • Flange or servo mount • Integrally coupled model • Resolutions up to 10,000 pulses per revolution

Rugged encoders designed for the harshest environments where high temperatures, electrical noise, vibration and fluid contaminants are commonly found.

Explosion Proof



• Factory Mutual approved • Rugged cast aluminum enclosure • Resolutions up to 2,500 pulses per revolution

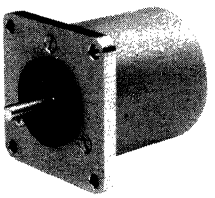
Approved for Class I, Div. 1 and 2, Groups C and D, and Class II, Div. 1, Groups, E, F and G indoor and outdoor (NEMA 4) hazardous locations.

VISA MasterCard

• Use your Visa or Mastercard to save time
• Same day delivery on stock models
• Two-week prototyping service for custom designs

Absolute Encoders

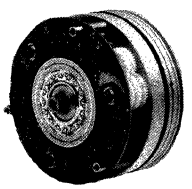
Single Turn

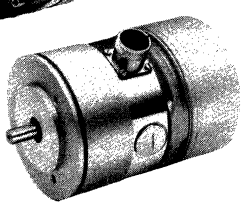


• Tutput codes • Metric mounts: face or servo, optional square flange • 360 or 512 increments per turn

State-of-the-art technology with binary, BCD and gray code formats. Glass code disc for reliability and precision. Four series of encoders.

Multi-Turn

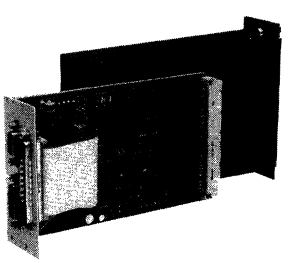




• Modular absolute encoder system • Synchronous serial interface • Resolution 21 bit gray code: 4,096 increments per turn, 512 turns • Complete self-contained unit or basic encoder

A modular encoder system designed to meet 98% of the multi-turn absolute encoder applications. Designed to stand alone or for direct motor mounting. High quality, clock-like precision.

Serial-to-Parallel Converter Module



• Provides parallel data in the programmable output code groups of gray, binary or BCD • Easily programmed • Non-volatile storage

The SPA 2 module converts serial information from the multi-turn absolute encoder to parallel data.

Lucas Ledex

Lucas Ledex Inc.
P.O. Box 427
Vandalia, OH 45377-0427
513/454-2349
FAX: 513/898-8624
TWX: 6874241 Telex: 8674243

MICRO SWITCH
a Honeywell Division

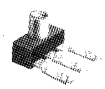
Solid State Hall Sensors

Hall effect sensors respond to a magnetic field, or—in the case of Hall vane sensors—to the interruption of a magnetic field. Hall sensors are not rate sensitive. They operate at extremely high speed and include signal conditioning. They offer high reliability, long life, and compatibility with microprocessors and other electronic circuitry.

Sensors are used in:

- Ignition systems
- Brushless DC motors
- Utility meters
- Water softeners
- Gasoline pumps
- Welding equipment
- Balance scales
- Interlocks
- Flowmeters
- Magnetic card readers
- Vending machines
- Home appliances
- Computer equipment
- Medical instruments
- Copy machines
- Laboratory equipment

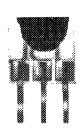
MAGNETIC POSITION SENSORS

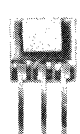


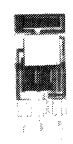



Listing	Actual Size **513SS16**	Actual Size **613SS4**	Actual Size **8SS3**	Actual Size **91SS12-2**
Operation	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet
Supply Voltage	6 to 24 VDC	6 to 24 VDC	6 to 24 VDC	8 to 16 VDC
Construction	Molded plastic package Threaded flux concentrator	Molded plastic package	Ceramic hybrid circuit	Ceramic hybrid circuit
Termination	Solder/quick connect	Printed circuit board	Printed circuit board	Printed circuit board
Operating Speed	0 to over 100 kHz	0 to over 100 kHz	0 to 100 kHz	5 µ seconds (Res. Time)
Operating Gauss (25°C typical) Rel.	230 170	330 245	400 300	span (−400 to +400) 6V.
Output Type	Digital, current sink 20mA	Digital, current sink 10mA	Digital, current sink 20mA	Linear, current source
Other options— Request Catalog 20	4.5 to 5.5 VDC supply. Bipolar magnetics. Source output.	4.5 to 5.5 VDC supply. Current source or analog output.	4.5 to 5.5 VDC supply.	

MAGNETIC POSITION SENSORS







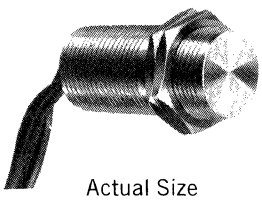
Listing	Actual Size **SS22PE**	Actual Size **SS31EA** **SS83CA**	Actual Size **SS41**	Actual Size **SS94A1**
Operation	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet
Supply Voltage	6 to 24 VDC	4.5 to 24 VDC	4.5 to 24 VDC	6.6 to 12.6 VDC
Construction	Ceramic hybrid circuit	Ceramic hybrid circuit	Molded plastic	Ceramic hybrid circuit
Termination	Printed circuit board	Printed circuit board	Printed circuit board	Printed circuit board
Operating Speed	0-100 kHz	0 to over 100 kHz	0 to over 100 kHz	3 µ seconds (Res. Time)
Operating Gauss (25°C typical) Rel.	15 11	40 15 −40 −15	40 −40	Span (−500 to +500) .63Vs.
Output Type	Digital, current sink 20mA	Digital, current sink 10mA	Digital, current sink 10mA	Linear, current sinking or sourcing
Other options— Request Catalog 20	4.5 to 5.5 VDC supply.	Pinout options.	Operating gauss.	

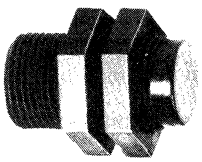
MICRO SWITCH
a Honeywell Division

Solid State Hall Sensors

MAGNETIC POSITION SENSORS



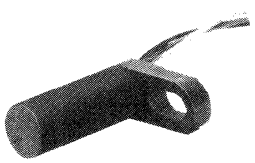




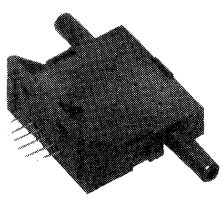


Listing	Actual Size **SS 11**	Actual Size **SR1G-A1**	Actual Size **SR3B-A1**	Actual Size **413SR10**
Operation	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet
Supply Voltage	4.5 to 24 VDC	4.5 to 24 VDC	4.5 to 24 VDC	6 to 24 VDC
Construction	Molded plastic SOT 89 style	Threaded aluminum housing	Thermoplastic	Molded plastic housing (Can be gang mounted)
Termination	Printed circuit board	Leadwires	Leadwires	Solder/quick-connect
Operating Speed	0 to over 100 kHz	0 to over 100 kHz	0 to over 100 kHz	0 to over 100 kHz
Operating Gauss (25°C typical) Rel.	40 −40	350 275	90 −90	400 300
Output Type	Digital, current sink 10mA	Digital, current sink 20mA	Digital, current sink 10mA	Digital, current sink 20mA
Other options— Request Catalog 20	Unipolar, Latching magnetics.	Threaded stainless steel housing. Bipolar magnetics.	Unipolar magnetics.	Bipolar magnetics.

GEAR TOOTH SENSOR



AIRFLOW SENSORS



Listing	1.38×1.14×.46 **GTO1GA**	**AWM 3100V**	2.14×1.24×.61 **AWM 2100V**
Operation	Ferrous metal	Mass airflow	Mass airflow
Supply Voltage	4.5 to 24 VDC	10 VDC	10 VDC
Construction	Thermoplastic	Thermoplastic	Thermoplastic
Termination	Leadwires	Printed circuit board	Printed circuit board
Operating Speed	0.01 to over 100 kHz	Response time 3m SEC max.	Response time 3m SEC max.
Sensing gap min. max.	— .060	Sensitivity 0 to 200 sccm	Sensitivity 0 to 200 sccm
Output Type	Digital, current sink 20mA	Ratio metric 1 to 5 VDC Signal Conditioned	Ratio metric 0 to 45mV

SALES AND SERVICE

MICRO SWITCH serves its customers through a worldwide network of sales offices and distributors. For ordering, application assistance, pricing or name of nearest Authorized Distributor, contact a nearby MICRO SWITCH sales office. See the EEM Yellow Pages or contact:

MICRO SWITCH
11 W. Spring St.
Freeport, Illinois 61032
Tel. 815/235-6600

MICRO SWITCH
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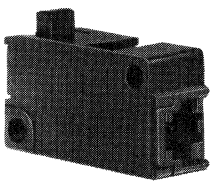
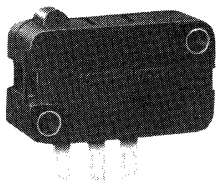
MECHANICALLY OPERATED HALL EFFECT SWITCHES

VANE SENSORS



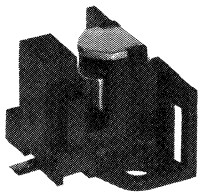
1.14 × .40 × .62H.

Listing **VX12-A1**



1.09 × .40 × .97H.

47XL31-01



Actual Size

1AV2A



Actual Size

4AV12A

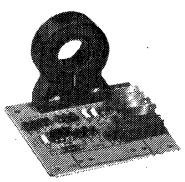
Operation	Mechanical plunger	Mechanical plunger	Ferrous vane	Ferrous vane
Supply Voltage	4.5 to 24 VDC	6 to 24 VDC	6 to 24 VDC	6 to 24 VDC
Construction	Plastic housing	Plastic housing	Molded plastic housing	Molded plastic housing
Termination	Plug-in connectors (molex type)	Solder/quick-connect	Leadwires	Leadwires
Operating Speed	Depends on actuator	Depends on actuator	0 to over 100 kHz	0 to over 100 kHz
Temperature Range	–40 to 70°C	–40 to 100°C	–40 to 125°C	–40 to 125°C (4AV)
Output Type	Digital, current sink Normally high 10mA	Digital, current sink Normally high 20mA	Digital, current sink 20mA	Digital, current sink 20mA
Other options— Request Catalog 20	Normally low output. Many actuator types. AMP connectors.	Normally low output. Many actuator types.	Solder/QC terminals. Source output.	PC Board term. Connector block.

CURRENT SENSORS

TEMPERATURE SENSORS



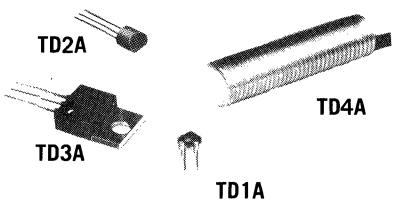
CS Holder Assemblies CSLA2CD



CS Adjustable Linear Sensors CSLF4AD



CS Digital Sensors CSDDIED



TD Temperature Sensors

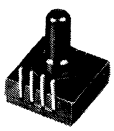
Listing

Operation	Current sensor	Current sensor	Current sensor	Proximity to temperature
Supply Voltage	6 to 12 VDC	10.5 to 24 VDC	4.5 to 24 VDC	1mA (Supply Current)
Construction	Plastic housing	Plastic housing	Plastic housing	Ceramic, plastic or aluminum
Termination	PC board	PC board Quick conn.	PC board	Printed circuit board, leadwire or connector compatible
Operating Speed	3μ sec.	8μ sec	150μ sec.	Depends on packaging
Sensed Current max.	72a AC/DC	57a DC	3.5a operate 2.6a release	–40 to 150°C Temp. Range
Output Type	Linear, voltage ratio metric	Linear 4-20mA	Digital sinking 40mA	Analog
Other options Request Catalog 20	up to 950a sensing. Side mount.	1-5 V output. AC or DC sensing. Enclosed versions.	5V or 6-16V supply. Thru hole design. 1.3 to 22a sensing.	Various packages and materials.

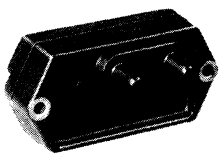
MICRO SWITCH
a Honeywell Division

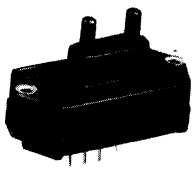
PIEZORESISTIVE PRESSURE SENSORS

Piezoresistive pressure sensors convert air or liquid pressure to an analog signal. Overall, MICRO SWITCH pressure sensors are small, low cost and reliable. They feature excellent repeatability, high accuracy, and reliability under varying environmental conditions. In addition, they feature highly consistent operating characteristics from one sensor to the next and interchangeability without recalibration. Low cost to keep your systems costs down.

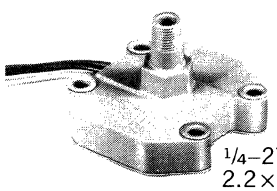




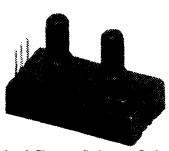




Listing	136PC15G1	236PC100GW	142PC15D	162PC01D
	0.64 sq. × .82H.	1/4-18 NPTF port 1 inch hex.	2.35 × 1.18 × 1.12H.	2.35 × 1.18 × 1.32H.
Operation	Deflection of silicon diaphragm	Deflection of silicon diaphragm	Deflection of silicon diaphragm	Deflection of silicon diaphragm
Supply Voltage	10 VDC or 2 mA typ.	10 VDC or 2mA typ.	8 VDC typ.	8 VDC typ.
Construction	Plastic package	Stainless steel housing	Thermoplastic	Thermoplastic
Termination	PCB	Cable	PCB	PCB
Temperature Range	– 40 to 85 °C	– 30 to 70 °C	– 40 to 85 °C	– 40 to 85 °C
Output Type F.S.O. typical	Low level, 100 mV Linear, proportional to pressure	Low level, 100 mV Linear, proportional to pressure	High level, 5 Volts	High level, 5 Volts
Pressure Range	0 to 15 psi gage	0 to 100 psi gage	0 to 15 psi differential	0 to 27.68" H_2O differential
Other options— Request Catalog 15	0-5 to 0-100 psi. Absolute versions.	0-5 to 0-150 psi.	Various in 0 to 30 psi and ± 15 psi ranges. Absolute and gage versions.	Various in 0 to 10" and ± 5" H_2O. Gage and vacuum versions.







Listing	242PC100G	16PC15GF	184PC15D
	1/4–27 NPT Port 2.2 × 2.3 × 1.57H.	.6 × .5 × .91H	1.15 × .64 × .84H.
Operation	Deflection of silicon diaphragm	Deflection of silicon diaphragm	Deflection of silicon diaphragm
Supply Voltage	8 VDC typ.	10 VDC	8 VDC typ.
Construction	Die-cast aluminum housing Buna N seal	Plastic package	Plastic package
Termination	Leadwires	PCB	PCB
Temperature Range	– 40 to 85 °C	– 40 to 85 °C	– 40 to 85 °C
Output Type F.S.O. typical	High level, 5 Volts Linear, proportional to pressure	Low level, 100 mV Linear, proportional to pressure	High level, 5 Volts Linear, proportional to pressure
Pressure Range	0 to 100 psi gage	0 to 15 psi gage	0 to 15 psi vacuum gage
Other options— Request Catalog 15	Various in ± 2.5 to 0-250 psi ranges.	0-5 and 0-30 psi. Differential and absolute versions.	0-5 and 0-30 psi. Differential versions. Terminal or housing mount.

SALES AND SERVICE

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MICRO SWITCH
11 W. Spring St.
Freeport, Illinois 61032
Tel. 815/235-6600

Micro Mo®

MINIATURE ELECTRIC DRIVE SYSTEMS AND ROTARY
POWER TRANSMISSION COMPONENTS UP TO 1 H.P.

■ Special resolutions & integrated motor-encoder packages available. ■ Built-in circuitry available on most models.

INCREMENTAL ENCODER STYLE SELECTOR

SERIES	CASE (mm)	DIAMETER (in.)	OPERATION	STD. RESOLUTION (PPR)	OUTPUT
02A	22	.866	OPTICAL	15	2 CHANNEL QUASISINUSOIDAL
03B	22	.866	OPTICAL	15	2 CHANNEL; SQUARE
09A	22	.866	OPTICAL	180	2 CHANNEL QUASISINUSOIDAL
10A	22	.866	OPTICAL	100	2 CHANNEL QUASISINUSOIDAL
10B	22	.866	OPTICAL	100	2 CHANNEL; SQUARE
HE	10,12,15 OR 16	.393-630	MAGNETIC	10,12,15,16	2 CHANNEL;SINE OR SQUARE
PREX	40	1.575	OPTICAL	100,200,250,300 360,400,500,600	2 CHANNEL + INDEX; SQUARE
HEDS-5000	28	1.102	OPTICAL	100,192,200,256, 360,400,500,512	2 CHANNEL + INDEX;SQUARE
HED5-5500	30 x 41.1	1.18 x 1.62	OPTICAL	96,100,192 400,500,512	2 CHANNEL + INDEX; SQUARE
HEDS-6000	56	2.205	OPTICAL	192,200,400,500, 512,1000,1024	2 CHANNEL + INDEX; SQUARE

MCX-02 MOTOR CONTROL SERIES

SERIES	PRODUCT	FEATURES	OPTION
MCX-02X	MAIN CONTROLLER BOARD	2 AXES	SERVO; SELECT BLDC & STEP
MCX-02D	DAUGHTER BOARD	2 AXES/BOARD	MAX = 8 AXES/SET
MCX-02M	CONTROLLER MANUAL		
MCX-02J	JOYSTICK		
MCX-02A	AMPLIFIER	5,10,30 AMP	PWM
MCX-02P	EPROM PROGRAMMER BOARD		
MCX-02S	CUSTOM SOFTWARE		
MCX100	SPECIAL DESIGN CONTROL BOARD		

- Ask about our "Guaranteed Stock Program" with expedited sample delivery
- Ship-from-Stock Program available for OEM Blanket Orders.

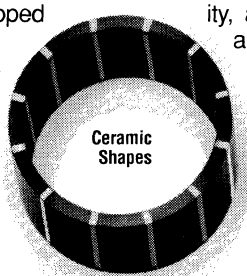
Micro Mo ELECTRONICS INC.
742 Second Avenue S. / St. Petersburg, Florida 33701 / Phone: 813/822-2529 / Telex: 807-982 / Fax: 813/821-6220

For full catalog & latest data sheets, call (813) 822-2529

Electronic components and piezo ceramics. Over 50 years of innovation.

Design Engineers can rely on us to produce a complete line of standard and custom piezo ceramic shapes for a variety of commercial, industrial and military applications.

We've been making innovations in electronic components and piezo ceramics since 1938. And we're still doing it. Take a look at some of our accomplishments in modern ceramic shapes. We've developed discs, blocks, rings, plates, cylinders, tubes and many custom shapes for sonar use, as ultrasonic, hydrophonic, and as torpedo transducers, and in accelerometers and high voltage generators.

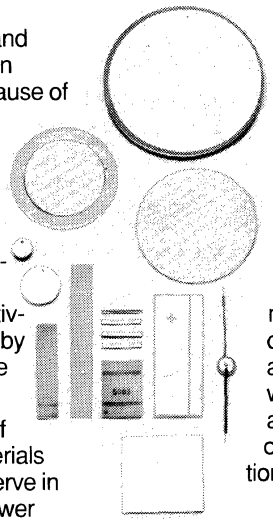


Ceramic Shapes

Our PZT®-4 is recommended for use in high voltage generators and high power acoustic radiating transducers because of its ability to withstand high levels of electrical excitation and mechanical stress.

PZT-8 was developed to provide a material with the ultimate in power handling capability. This composition has reduced piezoelectric activity at low to moderate excitation levels.

PZT-5A is recommended for use in receiver or generator type transducers such as hydrophones, fuses, accelerometers, and vibration pickups in general, etc., because of its high sensitivity, permittivity and time stability

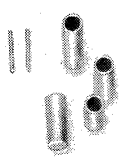


PZT-5H is better suited to low frequency applications because of increased permittivity, accompanied by a reduced Curie point.

The family of PZT-5 materials may also serve in very low power motor-type transducers because of high motion sensitivity.

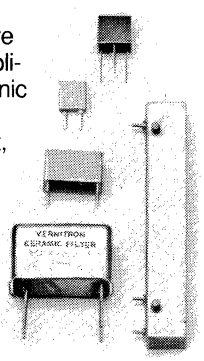
We've also developed lead metaniobate materials, PMN-1 and PMN-2, for diverse applications that feature higher Curie points. And, we are the originators of Unimorphs and Bimorphs to serve as compact transducers for audio tones.

Unimorphs, Bimorphs



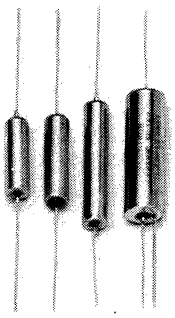
Ink Jet and Ceramic Tubes

Bandpass Filters and Resonators



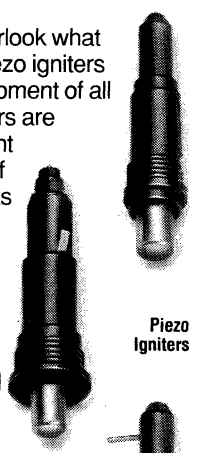
The above compositions are used in such applications as ultrasonic cleaners, kidney dialysis equipment, heart pacemakers, ink jets, ultrasound scanners, gyros, sonobuoys, automatic erasers and a variety of noisemakers. Also in laser positioning and as motion sensors.

Innovation is also our "hallmark" in bandpass filters, ladder filters, and ceramic resonators. We offer light weight, stable, fixed tuned, miniature ceramic filters and resonators with varieties for almost any kind of communications equipment: consumer— commercial— military.



Ceramic Ladder Filters

And don't overlook what we've done in piezo igniters for gas fired equipment of all types. Our igniters are original equipment in many makes of barbeque grills, as well as in furnaces, water heaters and camping lanterns. Our igniters are the industry standard worldwide.



Piezo Igniters

So if you're working with piezo ceramics, in alarms, speakers, lasers, sonar, ink jet printing data processing, communications, telephone development, gyros, or hydrophones, pacemakers or gas-fired equipment, give us a call and put our 50 plus years of innovation and experience to work.

Morgan Matroc Inc

Vernitron Division

232 Forbes Road
Bedford, Ohio 44146 USA
Telephone: (216) 232-8600
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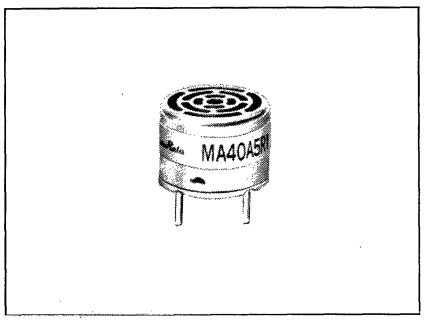
Morgan

MATROC
Leaders in ceramic technology

ultrasonic ceramic microphones

MURATA ERIE NORTH AMERICA



MA40A5

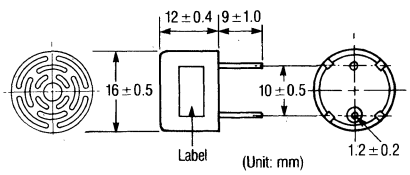
FEATURES

- High sensitivity, small sized and light weight
- Excellent in humidity resistance and fine temperature characteristics
- Excellent vibration and shock resistance
- Large operation range

APPLICATIONS

- Remote control of television, air conditioner or other electronic equipment
- Sensor of burglar alarm system, range finder, etc.
- Sensor for counter

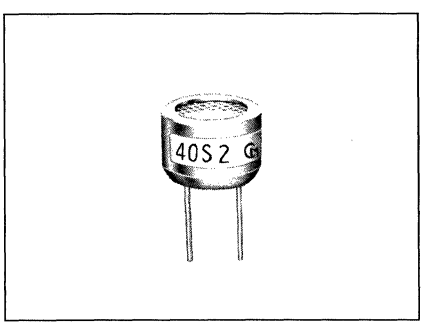
DIMENSIONS



SPECIFICATIONS

		MA40A5R/S
Nominal Frequency	(KHz)	40
Sensitivity	(dB)	−67 min.
Sound Pressure	(dB)	112 min.
Directivity	(deg)	50°
Capacitance	(pF)	2000
Allowable Input Voltage	(Vrms)	20
Operating Temp. Range	(°C)	−20 to +85
Detectable Range	(m)	0.2 to 6
Resolution	(mm)	9

*Sensitivity: 0 dB = 1 V/μ Bar, Sound Pressured at 30 cm, 0 dB = 2 × 10^{-4} μ Bar



MA40S2R/S

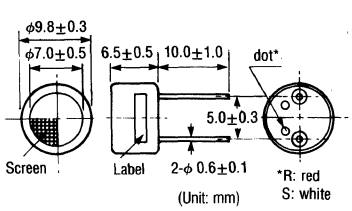
FEATURES

- Subminiature type
- High sensitivity and excellent temperature characteristics
- Excellent humidity resistance, vibration resistance and shock resistance

APPLICATIONS

- Range finder, adjacent switch or burglar alarm system
- Remote control of air conditioner or other electronic equipment
- Sensor for counter or human body

DIMENSIONS



SPECIFICATIONS

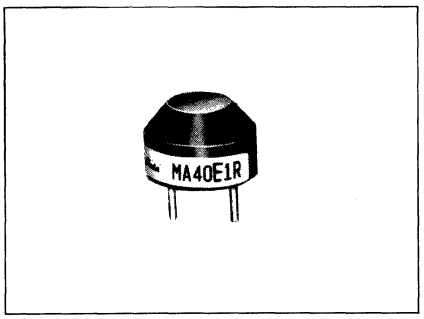
		MA40S2R/S
Nominal Frequency	(KHz)	40
Sensitivity	(dB)	−74 min.
Sound Pressure	(dB)	100 min.
Directivity	(deg)	100°
Capacitance	(pF)	1600
Allowable Input Voltage	(Vrms)	10
Operating Temp. Range	(°C)	−30 to +85
Detectable Range	(m)	0.2 to 4
Resolution	(mm)	9

*Sensitivity: 0 dB = 1 V/μ Bar, Sound Pressured at 30 cm, 0 dB = 2 × 10^{-4} μ Bar

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

ultrasonic ceramic microphones

MURATA ERIE NORTH AMERICA



MA40E1R/S

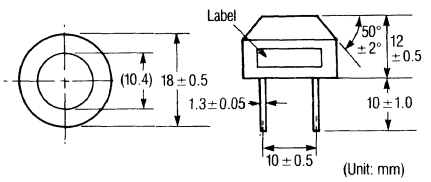
FEATURES

- Can be used outdoors because of its waterproof structure
- Excellent ambient temperature
- High sensitivity and excellent temperature characteristics

APPLICATIONS

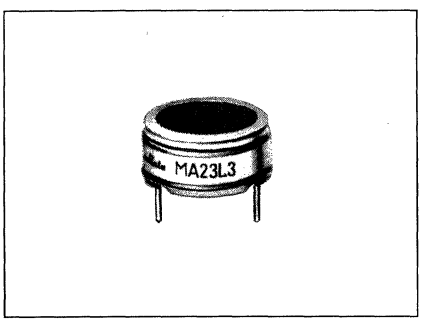
- Automobile back up sensors
- Rear obstructives detection for cars
- Distance measurement or object detection outdoors
- Water level or liquid level memter

DIMENSIONS



SPECIFICATIONS

		MA40E1R/S
Nominal Frequency	(KHz)	40
Sensitivity	(dB)	—74 min.
Sound Pressure	(dB)	106 min.
Directivity	(deg)	100
Capacitance	(pF)	2200
Allowable Input Voltage	(Vms)	10
Operating Temp. Range	(°C)	—30 to +85
Detectable Range	(m)	0.2 to 3
Resolution	(mm)	9



MA23L3

FEATURES

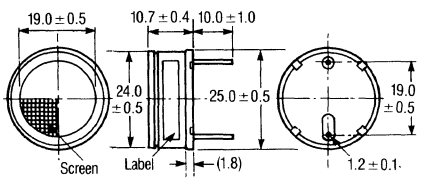
- A special structure provides broad band use
- High sensitivity and large operating range
- Excellent humidity resistance and fine temperature characteristics
- Excellent vibration and shock resistance

APPLICATIONS

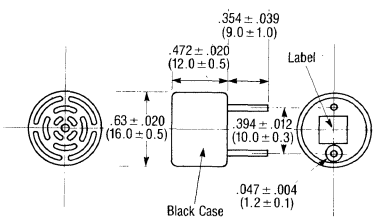
- Remote control of television, etc.
- Burglar alarm system

DIMENSIONS

MA23L3



MA40B5/MA40B6

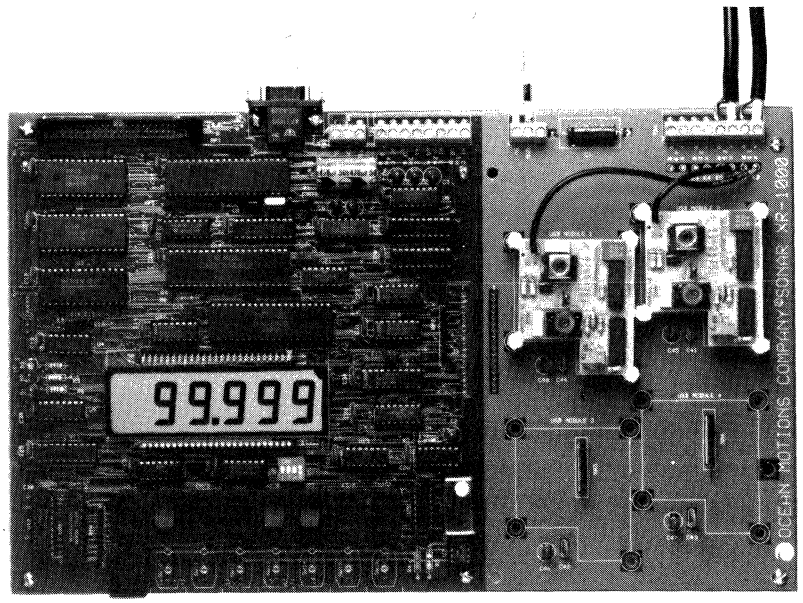


SPECIFICATIONS

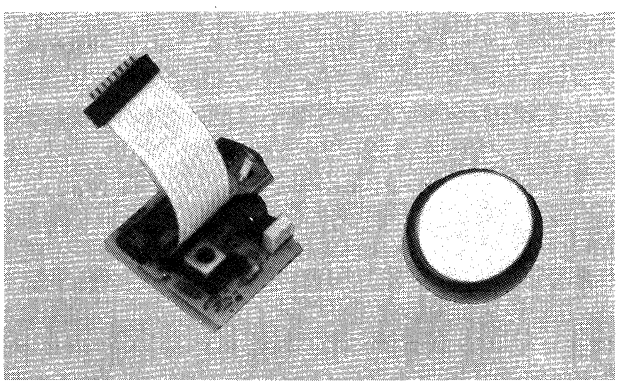
		MA23L3	MA40B6
Nominal Frequency	(KHz)	23	40
Sensitivity	(dB)	−70 min.	−54 min. (at 30 cm)
Sound Pressure	(dB)	(102)	
Directivity	(deg)	80°	40°
Capacitance	(pF)	2800	1100
Allowable Input Voltage	(Vrms)	20	20
Operating Temp. Range	(°C)	−20 to +60	−20 to +85
Detectable Range	(m)	0.2 to 6	0.2 to 4
Resolution	(mm)	15	9

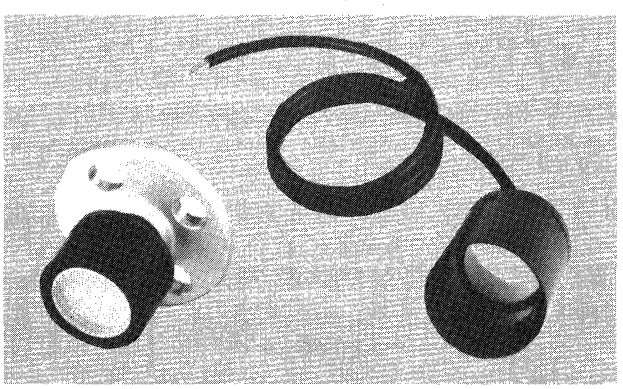
*Sensitivity: 0 dB = 20 Vpp

thickness and distances ultrasonically



- 0.0003" absolute resolution, 0.05% F.S. accuracy
- programmable firing rate, sequence, near range
- programmable units M/mm:FT/in, HI/LO set points per transducer
- multiplexes 1-256 transducers
- remote operation via RS232 or stand alone by observing 6 digit LCD





- acoustic horns - beam focusing
- acoustic pencils - 'pin point' target
- acoustic lances - 'see' between obstacles
- environmentally hardened transducer elements

OCEAN MOTIONS COMPANY
POB 130 BARRINGTON RHODE ISLAND USA 02806
TEL : 401-246-1394 FAX : 401-246-0075

WATT TRANSDUCERS

AC WATT TRANSDUCER — MODEL PC5

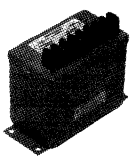
SINGLE PHASE 50/60 HERTZ

FEATURES

- Accurate regardless of phase, voltage unbalance, current unbalance, or power factor.
- Output is proportional to true power delivered to a load; P=EI(COS θ). Provides bi-directional operation.
- **Calibrated with standards traceable to NIST.**

APPLICATIONS

- Equipment power consumption
- For use with SCR controls, chopped waveforms, or where harmonic components exist.
- Standard outputs provide signal for interface with meters, recorders, or data acquisition equipment.



MODELS WITH INTEGRAL CURRENT SENSOR (SINGLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 1.0	100	N	103A	103B	103C	103D	103E	103E2	103CX5	103X5
	0 to 2.5	250	O	106A	106B	106C	106D	106E	106E2	106CX5	106X5
	0 to 5.0	500	T	001A	001B	001C	001D	001E	001E2	001CX5	001X5
	0 to 10.0	1000		010A	010B	010C	010D	010E	010E2	010CX5	010X5
	0 to 15.0	1500		019A	019B	019C	019D	019E	019E2	019CX5	019X5
	0 to 20.0	2000	A	117A	117B	117C	117D	117E	117E2	117CX5	117X5
0 to 300	0 to 1.0	200	P	104A	104B	104C	104D	104E	104E2	104CX5	104X5
	0 to 2.5	500	P	107A	107B	107C	107D	107E	107E2	107CX5	107X5
	0 to 5.0	1000	L	002A	002B	002C	002D	002E	002E2	002CX5	002X5
	0 to 10.0	2000	I	011A	011B	011C	011D	011E	011E2	011CX5	011X5
	0 to 15.0	3000	C	020A	020B	020C	020D	020E	020E2	020CX5	020X5
	0 to 20.0	4000	A	110A	110B	110C	110D	110E	110E2	110CX5	110X5
0 to 600	0 to 1.0	500	B	105A	105B	105C	105D	105E	105E2	105CX5	105X5
	0 to 2.5	1000	L	108A	108B	108C	108D	108E	108E2	108CX5	108X5
	0 to 5.0	2000	E	003A	003B	003C	003D	003E	003E2	003CX5	003X5
	0 to 10.0	4000		012A	012B	012C	012D	012E	012E2	012CX5	012X5
	0 to 15.0	6000		021A	021B	021C	021D	021E	021E2	021CX5	021X5
	0 to 20.0	8000		111A	111B	111C	111D	111E	111E2	111CX5	111X5

Highlighted models, (5A), can be used with customer's existing current transformers.

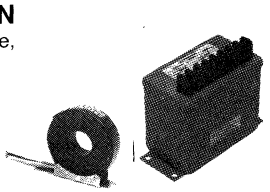
*Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models

**4-20mA loop-powered unit, (15-40Vdc).
All others require 85-135VAC instrument power, (50-400Hz.).

MILLIVOLT OUTPUTS AVAILABLE- CONSULT FACTORY

ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output.
PC5-001CX5



MODELS SUPPLIED WITH EXTERNAL SENSOR (SINGLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 100	10K	W	058A	058B	058C	058D	058E	058E2	058CX5	058X5
	0 to 200	20K	W	067A	067B	067C	067D	067E	067E2	067CX5	067X5
	0 to 400	40K	X	076A	076B	076C	076D	076E	076E2	076CX5	076X5
	0 to 600	60K	X	085A	085B	085C	085D	085E	085E2	085CX5	085X5
	0 to 1000	100K	Y	094A	094B	094C	094D	094E	094E2	094CX5	094X5
0 to 300	0 to 100	20K	W	059A	059B	059C	059D	059E	059E2	059CX5	059X5
	0 to 200	40K	W	068A	068B	068C	068D	068E	068E2	068CX5	068X5
	0 to 400	80K	X	077A	077B	077C	077D	077E	077E2	077CX5	077X5
	0 to 600	120K	X	086A	086B	086C	086D	086E	086E2	086CX5	086X5
	0 to 1000	200K	Y	095A	095B	095C	095D	095E	095E2	095CX5	095X5
0 to 600	0 to 100	40K	W	060A	060B	060C	060D	060E	060E2	060CX5	060X5
	0 to 200	80K	W	069A	069B	069C	069D	069E	069E2	069CX5	069X5
	0 to 400	160K	X	078A	078B	078C	078D	078E	078E2	078CX5	078X5
	0 to 600	240K	X	087A	087B	087C	087D	087E	087E2	087CX5	087X5
	0 to 1000	400K	Y	096A	096B	096C	096D	096E	096E2	096CX5	096X5

CONTACT FACTORY FOR FREE COPY OF COMPLETE PRODUCT CATALOG

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TO PLACE AN ORDER: 1-800-537-6732

WATT TRANSDUCERS

AC WATT TRANSDUCER — MODEL PC5

THREE PHASE-THREE WIRE 50/60 HERTZ

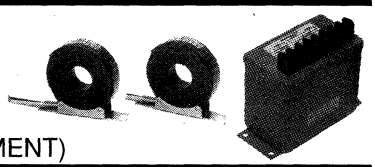


MODELS WITH INTEGRAL CURRENT SENSOR (DOUBLE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODELNUMBER PC5-STANDARDOUTPUTS							
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	1K	NOT APPLICABLE	004A	004B	004C	004D	004E	004E2	004CX5	004X5
	0 to 10	2K		013A	013B	013C	013D	013E	013E2	013CX5	013X5
	0 to 15	3K		022A	022B	022C	022D	022E	022E2	022CX5	022X5
	0 to 20	4K		112A	112B	112C	112D	112E	112E2	112CX5	112X5
0 to 300	0 to 5	2K		005A	005B	005C	005D	005E	005E2	005CX5	005X5
	0 to 10	4K		014A	014B	014C	014D	014E	014E2	014CX5	014X5
	0 to 15	6K		023A	023B	023C	023D	023E	023E2	023CX5	023X5
	0 to 20	8K		113A	113B	113C	113D	113E	113E2	113CX5	113X5
0 to 600	0 to 5	4K		006A	006B	006C	006D	006E	006E2	006CX5	006X5
	0 to 10	8K		015A	015B	015C	015D	015E	015E2	015CX5	015X5
	0 to 15	12K		024A	024B	024C	024D	024E	024E2	024CX5	024X5
	0 to 20	16K		114A	114B	114C	114D	114E	114E2	114CX5	114X5

Highlighted models, (5A), can be used with customer's existing current transformers.
150V models may be used with single-phase, three wire, 120V Edison systems.
**4-20mA loop-powered unit (15-40Vdc).

* Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models



MODELS SUPPLIED WITH EXTERNAL SENSORS (DOUBLE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 100	20K	W	061A	061B	061C	061D	061E	061E2	061CX5	061X5
	0 to 200	40K	W	070A	070B	070C	070D	070E	070E2	070CX5	070X5
	0 to 400	80K	X	079A	079B	079C	079D	079E	079E2	079CX5	079X5
	0 to 600	120K	X	088A	088B	088C	088D	088E	088E2	088CX5	088X5
	0 to 1000	200K	Y	097A	097B	097C	097D	097E	097E2	097CX5	097X5
0 to 300	0 to 100	40K	W	062A	062B	062C	062D	062E	062E2	062CX5	062X5
	0 to 200	80K	W	071A	071B	071C	071D	071E	071E2	071CX5	071X5
	0 to 400	160K	X	080A	080B	080C	080D	080E	080E2	080CX5	080X5
	0 to 600	240K	X	089A	089B	089C	089D	089E	089E2	089CX5	089X5
	0 to 1000	400K	Y	098A	098B	098C	098D	098E	098E2	098CX5	098X5
0 to 600	0 to 100	80K	W	063A	063B	063C	063D	063E	063E2	063CX5	063X5
	0 to 200	160K	W	072A	072B	072C	072D	072E	072E2	072CX5	072X5
	0 to 400	320K	X	081A	081B	081C	081D	081E	081E2	081CX5	081X5
	0 to 600	480K	X	090A	090B	090C	090D	090E	090E2	090CX5	090X5
	0 to 1000	800K	Y	099A	099B	099C	099D	099E	099E2	099CX5	099X5

MODEL PC5 SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 48 to 70 Hz.
RESPONSE (Transient 90%):
With integral sensors: Less than 100 microSeconds
With current transformers W,X, and Y: 1mS
BURDEN:
Voltage: 1.25VA
Current: 1.25VA
Optional output amplifier: 2 Watts
CURRENT OVERLOAD:
2 times full scale (cont.); 6 times full scale (10 Sec.)
DIELECTRIC TEST (Input/Output/Case): 1500VAC (RMS)
SURGE: Withstands IEEE SWC test

OUTPUT

OUTPUT RIPPLE: Less than 1%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
E-E2: 0-1.5K
CX5-X5: Greater than 2K
RESPONSE TIME (90%): 250 mS
FIELD ADJUSTABLE CAL.: +/- 10%

ACCURACY +/- 0.5%

Includes combined effects of power factor, linearity, repeatability, and current sensor.
TEMPERATURE EFFECT (-10° to 60°C):
+/- 1.0% of reading
+/- 0.1% F.S. output

CONTACT FACTORY FOR FREE COPY OF COMPLETE PRODUCT CATALOG

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PHONE: (614) 486-9561 FAX: (614) 486-0743
TO PLACE AN ORDER: 1-800-537-6732

WATT TRANSDUCERS

AC WATT TRANSDUCER — MODEL PC5

THREE PHASE-FOUR WIRE 50/60 HERTZ



MODELS WITH INTEGRAL CURRENT SENSOR (THREE ELEMENT)

INPUTS VOLTAGE	INPUTS CURRENT	F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER PC5- STANDARD OUTPUTS 0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	1.5K	NOT	007A	007B	007C	007D	007E	007E2	007CX5	007X5
	0 to 5	1.5K		7.5A	7.5B	7.5C	7.5D	7.5E	7.5E2	7.5CX5	7.5X5
	0 to 10	3.0K	APP	016A	016B	016C	016D	016E	016E2	016CX5	016X5
	0 to 15	4.5K		025A	025B	025C	025D	025E	025E2	025CX5	025X5
	0 to 20	6.0K	LI	115A	115B	115C	115D	115E	115E2	115CX5	115X5
0 to 300	0 to 5	3.0K		008A	008B	008C	008D	008E	008E2	008CX5	008X5
	0 to 5	3.0K	CA	8.5A	8.5B	8.5C	8.5D	8.5E	8.5E2	8.5CX5	8.5X5
	0 to 10	6.0K		017A	017B	017C	017D	017E	017E2	017CX5	017X5
	0 to 15	9.0K	BL	026A	026B	026C	026D	026E	026E2	026CX5	026X5
	0 to 20	12K	E	116A	116B	116C	116D	116E	116E2	116CX5	116X5
NOTE: PART NUMBERS 7.5 AND 8.5 DENOTE 2 1/2 ELEMENT UNITS											

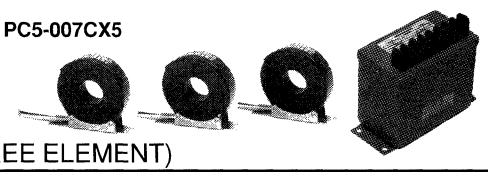
ADDITONAL OUTPUTS AVAILABLE- CONSULT FACTORY

Highlighted models, (5A), can be used with customer's existing current transformers.
All voltage specifications are **line-to-neutral voltage**.
*Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models
**4-20mA loop-powered unit (15-40Vdc).
All others require 85-135VAC instrument power, (50-400Hz.).

ORDERING INFORMATION

Example: Self-powered, three phase-four wire, 120V, 5A input with 0-5Vdc output.

PC5-007CX5



MODELS SUPPLIED WITH EXTERNAL SENSORS (THREE ELEMENT)

INPUTS VOLTAGE	INPUTS CURRENT	F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER PC5- STANDARD OUTPUTS 0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 100	30K	W	064A	064B	064C	064D	064E	064E2	064CX5	064X5
	0 to 200	60K	W	073A	073B	073C	073D	073E	073E2	073CX5	073X5
	0 to 400	120K	X	082A	082B	082C	082D	082E	082E2	082CX5	082X5
	0 to 600	180K	X	091A	091B	091C	091D	091E	091E2	091CX5	091X5
	0 to 1000	300K	Y	100A	100B	100C	100D	100E	100E2	100CX5	100X5
0 to 300	0 to 100	60K	W	065A	065B	065C	065D	065E	065E2	065CX5	065X5
	0 to 200	120K	W	074A	074B	074C	074D	074E	074E2	074CX5	074X5
	0 to 400	240K	X	083A	083B	083C	083D	083E	083E2	083CX5	083X5
	0 to 600	360K	X	092A	092B	092C	092D	092E	092E2	092CX5	092X5
	0 to 1000	600K	Y	101A	101B	101C	101D	101E	101E2	101CX5	101X5

MODEL PC5 SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 48 to 70 Hz.
RESPONSE (Transient 90%):
With integral sensors: Less than 100 microSeconds
With current transformers W,X, and Y: 1mS
BURDEN:
Voltage: 1.25VA
Current: 1.25VA
Optional output amplifier: 2 Watts
CURRENT OVERLOAD:
2 times full scale (cont.); 6 times full scale (10 Sec.)
DIELECTRIC TEST (Input/Output/Case): 1500VAC (RMS)
SURGE: Withstands IEEE SWC test

OUTPUT

OUTPUT RIPPLE: Less than 1%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
E-E2: 0-1.5K
CX5-X5: Greater than 2K
RESPONSE TIME (90%): 250 mS
FIELD ADJUSTABLE CAL.: +/- 10%

ACCURACY +/- 0.5%

Includes combined effects of power factor, linearity, repeatability, and current sensor.
TEMPERATURE EFFECT (-10° to 60°C):
+/- 1.0% of reading
+/- 0.1% F.S. output

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PHONE: (614) 486-9561 FAX: (614) 486-0743
TO PLACE AN ORDER: 1-800-537-6732

WATT TRANSDUCERS

PRECISION AC WATT TRANSDUCER MODEL GW5

ACCURATE TO 0.2% OF READING

FEATURES

- Accurate regardless of variations in voltage,current, power factor, or load.
- Available with 1, 2, 2 1/2, or 3 element configurations. Provides bi-directional operation.
- Accuracy maintained over wide temperature range, **factory calibration traceable to NIST.**

APPLICATIONS

- Equipment monitoring for process control.
- Integration into energy management systems, or a variety of sub-metering applications.
- Measurement using direct-connection, current tranformers, or potential transformers.



AC WATT TRANSDUCER-INTEGRAL CURRENT SENSOR

INPUTS		F.S. IN (WATTS)	PHASE CONFIG.	MODEL NUMBER GW5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	500	1 Ph.-2W	001A	001B	001C	001D	001E	001E2	001CX5	001X5
		1000	3Ph.-3W	004A	004B	004C	004D	004E	004E2	004CX5	004X5
		1500	3Ph.-4W	007A	007B	007C	007D	007E	007E2	007CX5	007X5
		1500	3Ph.-4W	7.5A	7.5B	7.5C	7.5D	7.5E	7.5E2	7.5CX5	7.5X5
	0 to 10	1000	1Ph.-2W	010A	010B	010C	010D	010E	010E2	010CX5	010 X5
		2000	3Ph.-3W	013A	013B	013C	013D	013E	013E2	013CX5	013 X5
		3000	3Ph.-4W	016A	016B	016C	016D	016E	016E2	016CX5	016 X5
	0 to 20	2000	1Ph.-2W	019A	019B	019C	019D	019E	019E2	019CX5	019 X5
		4000	3Ph.-3W	022A	022B	022C	022D	022E	022E2	022CX5	022 X5
		6000	3Ph.-4W	025A	025B	025C	025D	025E	025E2	025CX5	025 X5
0 to 300	0 to 5	1000	1Ph.-2W	002A	002B	002C	002D	002E	002E2	002CX5	002 X5
		2000	3Ph.-3W	005A	005B	005C	005D	005E	005E2	005CX5	005 X5
		3000	3Ph.-4W	008A	008B	008C	008D	008E	008E2	008CX5	008 X5
	0 to 10	2000	1Ph.-2W	011A	011B	011C	011D	011E	011E2	011CX5	011 X5
		4000	3Ph.-3W	014A	014B	014C	014D	014E	014E2	014CX5	014 X5
		6000	3Ph.-4W	017A	017B	017C	017D	017E	017E2	017CX5	017 X5
	0 to 20	4000	1Ph.-2W	020A	020B	020C	020D	020E	020E2	020CX5	020 X5
		8000	3Ph.-3W	023A	023B	023C	023D	023E	023E2	023CX5	023 X5
		12000	3Ph.-4W	026A	026B	026C	026D	026E	026E2	026CX5	026 X5
0 to 600	0 to 5	2000	1Ph.-2W	003A	003B	003C	003D	003E	003E2	003CX5	003 X5
		4000	3Ph.-3W	006A	006B	006C	006D	006E	006E2	006CX5	006 X5
	0 to 10	4000	1Ph.-2W	012A	012B	012C	012D	012E	012E2	012CX5	012 X5
		8000	3Ph.-3W	015A	015B	015C	015D	015E	015E2	015CX5	015 X5
	0 to 20	8000	1Ph.-2W	021A	021B	021C	021D	021E	021E2	021CX5	021 X5
		16000	3Ph.-3W	024A	024B	024C	024D	024E	024E2	024CX5	024 X5

Highlighted models, (6.25A), can be used with customer's existing current transformers.

*Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models

**4-20mA loop-powered unit, (15-40Vdc).

All others require 85-135VAC instrument power.

ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output.
GW5-001CX5

OPTIONAL 50 Hz. OPERATION- CONSULT FACTORY

MODEL GW5 SPECIFICATIONS

INPUT

SEE TABLE FOR VOLTAGE AND CURRENT RANGES
FREQUENCY RANGE: 58 to 62 Hz.
POWER FACTOR: Any
BURDEN:
Voltage: Less than 0.1VA
Current: Less than 0.28VA per element
OVERLOAD:
Voltage (cont.): Consult factory
Current (cont.): Consult factory
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT

OUTPUT RIPPLE: Less than 0.5%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
E-E2: 0-500
CX5-X5: Greater than 2K
RESPONSE TIME (99%): Less than 400 mS
COMPLIANCE VOLTAGE: 12Vdc min.
OPEN CIRCUIT VOLTAGE: +/- 15Vdc
ACCURACY +/- 0.2% RDG. +/- 0.05% F.S.
TEMPERATURE EFFECT (-20° to 60°C): +/- 0.005%/°C

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UL LISTED TRANSDUCERS

WATT/WATT HOUR TRANSDUCER — MODEL AGH

UL LISTED, ACCURATE TO 0.2% OF READING

FEATURES

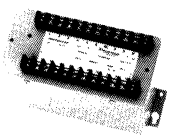
- Accurate regardless of variations in voltage,current, power factor, or load.
- Dual outputs. 0-1mA proportional to instantaneous Watts, relay closure proportional to Watt Hours.

APPLICATIONS

- Designed for applications which require UL listed devices.
- Integration into energy management systems, or a variety of sub-metering applications.

5 YEAR WARRANTY

LISTED 87 X 9
Energy Management
Equipment Accessory
E134941



INPUTS		PHASE CONNECTION	NO. OF ELEMENTS	WATTS		WATT HOUR		PART NUMBER
VOLTAGE	CURRENT			F.S. INPUT	OUTPUT	OUTPUT	COUNTS/HR.	
0 to 150	0 to 5	1 phase, 2 wire	1	500	0 to 1mA dc	NORMALLY OPEN SPST RELAY CONTACT CLOSURE	500	AGH-001B
0 to 150	0 to 5	3 phase, 3 wire	2	1000	0 to 1mA dc		1000	AGH-004B
0 to 150	0 to 5	3 phase,4 wire	3	1500	0 to 1mA dc		1500	AGH-007B

4-20mA OR 0-10Vdc ANALOG WATT OUTPUTS AVAILABLE-CONSULT FACTORY

AC CURRENT TRANSDUCER — MODEL ACT5

UL LISTED AC CURRENT TRANSDUCER

FEATURES

- Accurate, reliable current measurement over a wide frequency range.

APPLICATIONS

- Can be used with **OSI** line of **UL listed** current transformers.

5 YEAR WARRANTY

AC CURRENT INPUT (AMPERES)		MODEL ACT5-001A OUTPUT
RANGE	NOMINAL	
0 to 5	5	0 to 1mA dc

LISTED 87 X 9
Energy Management
Equipment Accessory
E134941

Unit is self-powered from measured AC input line.

AC VOLTAGE TRANSDUCER — MODEL AVT

UL LISTED AC VOLTAGE TRANSDUCER

FEATURES

- Accurate, reliable voltage measurement over a wide frequency range.

APPLICATIONS

- Can be used with potential transformers.

5 YEAR WARRANTY

AC VOLTAGE INPUT		MODEL AVT-120A OUTPUT
RANGE	NOMINAL	
0 to 150	85-135	0 to 1mA dc

LISTED 87 X 9
Energy Management
Equipment Accessory
E134941

Unit is self-powered from measured AC input line.

CONTACT FACTORY FOR COMPLETE SPECIFICATIONS

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WATT-HOUR TRANSDUCERS

WATT/WATT-HOUR TRANSDUCER — MODEL W

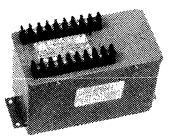
SINGLE PHASE 50/60 HERTZ

FEATURES

- Accurate regardless of phase, voltage unbalance, current unbalance, or power factor.
- Standard Analog outputs for Watts, relay contact or 5V pulse to indicate Watt-Hours.
- **Calibrated with standards traceable to NIST.**

APPLICATIONS

- Equipment power consumption.
- Can be easily integrated into building management systems.
- Pulse outputs interface with electronic or mechanical counters for accumulation of Watt-Hours.



MODELS WITH INTEGRAL CURRENT SENSOR (SINGLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 1.0	100	N O T A P P L I C A B L E	103A	103B	103C	103D	103CX5	103X5
	0 to 2.5	250		106A	106B	106C	106D	106CX5	106X5
	0 to 5.0	500		001A	001B	001C	001D	001CX5	001X5
	0 to 10.0	1000		010A	010B	010C	010D	010CX5	010X5
	0 to 15.0	1500		019A	019B	019C	019D	019CX5	019X5
	0 to 20.0	2000		117A	117B	117C	117D	117CX5	117X5
0 to 300	0 to 1.0	200		104A	104B	104C	104D	104CX5	104X5
	0 to 2.5	500		107A	107B	107C	107D	107CX5	107X5
	0 to 5.0	1000		002A	002B	002C	002D	002CX5	002X5
	0 to 10.0	2000		011A	011B	011C	011D	011CX5	011X5
	0 to 15.0	3000		020A	020B	020C	020D	020CX5	020X5
	0 to 20.0	4000		110A	110B	110C	110D	110CX5	110X5
0 to 600	0 to 1.0	500		105A	105B	105C	105D	105CX5	105X5
	0 to 2.5	1000		108A	108B	108C	108D	108CX5	108X5
	0 to 5.0	2000		003A	003B	003C	003D	003CX5	003X5
	0 to 10.0	4000		012A	012B	012C	012D	012CX5	012X5
	0 to 15.0	6000		021A	021B	021C	021D	021CX5	021X5
	0 to 20.0	8000		111A	111B	111C	111D	111CX5	111X5

MAX. COUNT PER HR	WATT HR. OUTPUTS	
	CONTACT	5V PULSE
100	STANDARD OUTPUT FOR WATT HOURS. N/O SPST RELAY CONTACT	TTL OUTPUT FOR WATT HOURS. 5Vdc PULSE. ADD SUFFIX "-T" TO PART NUMBER
250		
5000		
1000		
1500		
2000		
200		
500		
1000		
2000		
3000		
4000		
500		
1000		
2000		
4000		
6000		
8000		

Highlighted models, (5A), can be used with customer's existing current transformers.

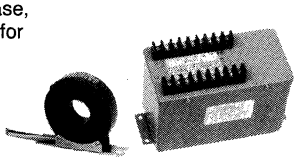
*Denotes self-powered unit, limiting input voltage ranges to:
103-135 for 150V models
215-280 for 300V models
395-550 for 600V models

All others require 103-135VAC instrument power, (50-400Hz.).
Optional 220VAC instrument power-Add suffix "**-22**" to part number.

CUSTOM COUNT RATES AVAILABLE- CONSULT FACTORY

ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output for watts, TTL pulse for watt hours.
W-001CX5-T



MODELS SUPPLIED WITH EXTERNAL SENSOR (SINGLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 100	10K	W	058A	058B	058C	058D	058CX5	058X5
	0 to 200	20K	W	067A	067B	067C	067D	067CX5	067X5
	0 to 400	40K	X	076A	076B	076C	076D	076CX5	076X5
	0 to 600	60K	X	085A	085B	085C	085D	085CX5	085X5
	0 to 1000	100K	Y	094A	094B	094C	094D	094CX5	094X5
0 to 300	0 to 100	20K	W	059A	059B	059C	059D	059CX5	059X5
	0 to 200	40K	W	068A	068B	068C	068D	068CX5	068X5
	0 to 400	80K	X	077A	077B	077C	077D	077CX5	077X5
	0 to 600	120K	X	086A	086B	086C	086D	086CX5	086X5
	0 to 1000	200K	Y	095A	095B	095C	095D	095CX5	095X5
0 to 600	0 to 100	40K	W	060A	060B	060C	060D	060CX5	060X5
	0 to 200	80K	W	069A	069B	069C	069D	069CX5	069X5
	0 to 400	160K	X	078A	078B	078C	078D	078CX5	078X5
	0 to 600	240K	X	087A	087B	087C	087D	087CX5	087X5
	0 to 1000	400K	Y	096A	096B	096C	096D	096CX5	096X5

MAX. COUNT PER HR	WATT HR. OUTPUTS	
	CONTACT	5V PULSE
10000	STANDARD OUTPUT FOR WATT HOURS. N/O SPST RELAY CONTACT	TTL OUTPUT FOR WATT HOURS. 5Vdc PULSE. ADD SUFFIX "-T" TO PART NUMBER
2000		
4000		
6000		
1000		
2000		
4000		
8000		
1200		
2000		
4000		
8000		
1600		
2400		
4000		

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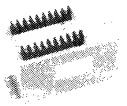
WATT-HOUR TRANSDUCERS

OSI WATT/WATT-HOUR TRANSDUCER MODEL W

THREE PHASE-THREE WIRE 50/60 HERTZ



MODELS WITH INTEGRAL CURRENT SENSOR (DOUBLE ELEMENT)

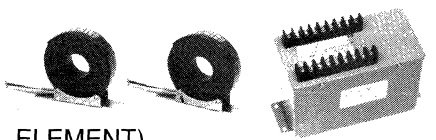
INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	1K	NOT APPLICABLE	004A	004B	004C	004D	004CX5	004X5
	0 to 10	2K		013A	013B	013C	013D	013CX5	013X5
	0 to 15	3K		022A	022B	022C	022D	022CX5	022X5
	0 to 20	4K		112A	112B	112C	112D	112CX5	112X5
0 to 300	0 to 5	2K		005A	005B	005C	005D	005CX5	005X5
	0 to 10	4K		014A	014B	014C	014D	014CX5	014X5
	0 to 15	6K		023A	023B	023C	023D	023CX5	023X5
	0 to 20	8K		113A	113B	113C	113D	113CX5	113X5
0 to 600	0 to 5	4K		006A	006B	006C	006D	006CX5	006X5
	0 to 10	8K		015A	015B	015C	015D	015CX5	015X5
	0 to 15	12K		024A	024B	024C	024D	024CX5	024X5
	0 to 20	16K		114A	114B	114C	114D	114CX5	114X5

MAX. COUNT PER HR	WATT HR. OUTPUTS	
	CONTACT	5V PULSE
1000	STANDARD OUTPUT FOR WATT HOURS. N/O SPST RELAY CONTACT	TTL OUTPUT. 5Vdc PULSE. ADD SUFFIX "-T" TO PART NUMBER
2000		
3000		
4000		
2000		
4000		
6000		
8000		
4000		
8000		
12000		
16000		

Highlighted models, (5A), can be used with customer's existing current transformers.

150V models may be used with single-phase, three wire, 120V Edison systems.

* Denotes self-powered unit, limiting input voltage ranges to:
103-135 for 150V models
215-280 for 300V models
395-550 for 600V models



MODELS SUPPLIED WITH EXTERNAL SENSORS (DOUBLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 100	20K	W	061A	061B	061C	061D	061CX5	061X5
	0 to 200	40K	W	070A	070B	070C	070D	070CX5	070X5
	0 to 400	80K	X	079A	079B	079C	079D	079CX5	079X5
	0 to 600	120K	X	088A	088B	088C	088D	088CX5	088X5
	0 to 1000	200K	Y	097A	097B	097C	097D	097CX5	097X5
0 to 300	0 to 100	40K	W	062A	062B	062C	062D	062CX5	062X5
	0 to 200	80K	W	071A	071B	071C	071D	071CX5	071X5
	0 to 400	160K	X	080A	080B	080C	080D	080CX5	080X5
	0 to 600	240K	X	089A	089B	089C	089D	089CX5	089X5
	0 to 1000	400K	Y	098A	098B	098C	098D	098CX5	098X5
0 to 600	0 to 100	80K	W	063A	063B	063C	063D	063CX5	063X5
	0 to 200	160K	W	072A	072B	072C	072D	072CX5	072X5
	0 to 400	320K	X	081A	081B	081C	081D	081CX5	081X5
	0 to 600	480K	X	090A	090B	090C	090D	090CX5	090X5
	0 to 1000	800K	Y	099A	099B	099C	099D	099CX5	099X5

MAX. COUNT PER HR	WATT HR. OUTPUTS	
	CONTACT	5V PULSE
2000	STANDARD OUTPUT FOR WATT HOURS. N/O SPST RELAY CONTACT	TTL OUTPUT FOR WATT HOURS. 5Vdc PULSE. ADD SUFFIX "-T" TO PART NUMBER
4000		
8000		
1200		
2000		
4000		
8000		
1600		
2400		
4000		
8000		
1600		
3200		
4800		
8000		

MODEL W SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 50 to 70 Hz.
POWER FACTOR: Unity to lead or lag 0
RESPONSE (Transient 90%):
With integral sensors: Less than 100 microSeconds
With current transformers W,X, and Y: 1mS
BURDEN:
Voltage: 1.25VA
Current: 1.25VA
Optional output amplifier: 2 Watts
CURRENT OVERLOAD:
2 times full scale (cont.); 6 times full scale (10 Sec.)
DIELECTRIC TEST (Input/Output/Case): 1500VAC (RMS)
SURGE: Withstands IEEE SWC test

OUTPUT

WH RELAY: N/O SPST; 150VAC, 0.5A
CONTACT CLOSURE PERIOD: 100mS
OUTPUT RIPPLE: Less than 1%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
CX5-X5: Greater than 2K
RESPONSE TIME (90%): 250 mS
FIELD ADJUSTABLE CAL.: +/- 10%

ACCURACY +/- 0.5%

Includes combined effects of power factor, linearity, repeatability, and current sensor.
TEMPERATURE EFFECT (-10° to 60°C):
+/- 1.0% of reading
+/- 0.1% F.S. output

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WATT-HOUR TRANSDUCERS

WATT/WATT-HOUR TRANSDUCER MODEL W

THREE PHASE-FOUR WIRE 50/60 HERTZ



MODELS WITH INTEGRAL CURRENT SENSOR (THREE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	1500	N/A	007A	007B	007C	007D	007CX5	007X5
	0 to 10	3000		016A	016B	016C	016D	016CX5	016X5
	0 to 15	4500		025A	025B	025C	025D	025CX5	025X5
	0 to 20	6000		115A	115B	115C	115D	115CX5	115X5
0 to 300	0 to 5	3000		008A	008B	008C	008D	008CX5	008X5
	0 to 10	6000		017A	017B	017C	017D	017CX5	017X5
	0 to 15	9000		026A	026B	026C	026D	026CX5	026X5
	0 to 20	12000		116A	116B	116C	116D	116CX5	116X5

MAX. COUNT PER HR	WATT HR. OUTPUTS	
	CONTACT	5V PULSE
1500	STANDARD OUTPUT N/O SPST RELAY CONTACT	TTL ADD SUFFIX "-T" TO PART NUMBER
3000		
4500		
6000		
3000		
6000		
9000		
12000		

Highlighted models, (5A), can be used with customer's existing current transformers.
Al l voltage specifications are **line-to-neutral voltage**.
*Denotes self-powered unit, limiting input voltage ranges to:
103-135 for 150V models
215-280 for 300V models
395-550 for 600V models
All others require 103-135VAC instrument power, (50-400Hz.).
Optional 220Vac instrument power-Add suffix "**-22**" to part number.

CUSTOM COUNT RATES AVAILABLE- CONSULT FACTORY

ORDERING INFORMATION

Example: Self-powered, three phase-four wire, 120V, 5A input with 0-5Vdc output for watts, TTL pulse for watt hours.

W-007CX5-T



MODELS SUPPLIED WITH EXTERNAL SENSORS (THREE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 100	30K	W	064A	064B	064C	064D	064CX5	064X5
	0 to 200	60K	W	073A	073B	073C	073D	073CX5	073X5
	0 to 400	120K	X	082A	082B	082C	082D	082CX5	082X5
	0 to 600	180K	X	091A	091B	091C	091D	091CX5	091X5
	0 to 1000	300K	Y	100A	100B	100C	100D	100CX5	100X5
0 to 300	0 to 100	60K	W	065A	065B	065C	065D	065CX5	065X5
	0 to 200	120K	W	074A	074B	074C	074D	074CX5	074X5
	0 to 400	240K	X	083A	083B	083C	083D	083CX5	083X5
	0 to 600	360K	X	092A	092B	092C	092D	092CX5	092X5
	0 to 1000	600K	Y	101A	101B	101C	101D	101CX5	101X5

MAX. COUNT PER HR	WATT HR. OUTPUTS	
	CONTACT	5V PULSE
3000	STANDARD OUTPUT FOR WATT HOURS. N/O SPST RELAY CONTACT	TTL OUTPUT. 5Vdc PULSE. ADD SUFFIX "-T" TO PART NUMBER
6000		
1200		
1800		
3000		
6000		
12000		
2400		
3600		
6000		

MODEL W SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 50 to 70 Hz.
POWER FACTOR: Unity to lead or lag 0
RESPONSE (Transient 90%):
With integral sensors: Less than 100 microSeconds
With current transformers W,X, and Y: 1mS
BURDEN:
Voltage: 1.25VA
Current: 1.25VA
Optional output amplifier: 2 Watts
CURRENT OVERLOAD:
2 times full scale (cont.); 6 times full scale (10 Sec.)
DIELECTRIC TEST (Input/Output/Case): 1500VAC (RMS)
SURGE: Withstands IEEE SWC test

OUTPUT

WH RELAY: N/O SPST; 150VAC, 0.5A
CONTACT CLOSURE PERIOD: 100mS
OUTPUT RIPPLE: Less than 1%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
CX5-X5: Greater than 2K
RESPONSE TIME (90%): 250 mS
FIELD ADJUSTABLE CAL.: +/- 10%

ACCURACY +/- 0.5%

Includes combined effects of power factor, linearity, repeatability, and current sensor.
TEMPERATURE EFFECT (-10° to 60°C):
+/- 1.0% of reading
+/- 0.1% F.S. output

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WATT TRANSDUCERS

VARIABLE FREQUENCY WATT TRANSDUCER MODEL PC8

SINGLE PHASE DC TO 400 HERTZ

FEATURES

- **Calibrated with standards traceable to NIST.**
- Input/output isolation.
- Real-time indication of power, response time **less than 50 microseconds**.

APPLICATIONS

- Accurate monitoring of power that contains dc and non-sinusoidal AC components.
- Ideal for use in SCR and other AC or dc switching circuitry.
- Bi-directional output.



SINGLE PHASE-VARIABLE FREQUENCY (SINGLE ELEMENT)

INPUT VOLTAGE	
RANGE	DESIGNATION
0- 25	001
0- 50	002
0-150	003
0-300	004
0-400	005
0-500	006
0-600	007

INPUT CURRENT		SENSOR SIZE
RANGE	DESIGNATION	
0- 5	08	INTEGRAL
0- 100	01	C
0- 200	02	D
0- 300	03	D
0- 400	04	D
0- 600	05	E
0-1000	06	E
0-2000	07	E

MODEL PC8 STANDARD OUTPUTS				
+/-1mA	+/-10Vdc	4-20mA	4-12-20mA	+/-5Vdc
ADD SUFFIX "B" TO PART NUMBER	ADD SUFFIX "D" TO PART NUMBER	ADD SUFFIX "E" TO PART NUMBER	ADD SUFFIX "EM" TO PART NUMBER	ADD SUFFIX "X5" TO PART NUMBER

Highlighted models, (5A), can be used with customer's existing current transformers.
All units require 85-135VAC instrument power.
Full scale power (Watts) can be determined by the product of full scale input voltage and full scale input current.

OPTIONAL SPLIT-CORE CURRENT SENSOR AVAILABLE WITH UNITS OF 100 AMPS OR GREATER-ADD SUFFIX "S". LOWER CURRENT RANGES AVAILABLE-CONSULT FACTORY

ORDERING INFORMATION

Example: 120V, 100A input with split-core sensor and +/-5Vdc output.
PC8-003-01-X5-S

MODEL PC8 SPECIFICATIONS

INPUT
VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: dc to 400 Hz.
POWER FACTOR: Any
RESPONSE (Transient 90%): Less than 50 microSeconds
BURDEN (OHMS):
Voltage:
Less than 50V: Greater than 100K.
Greater than 50V: Greater than 1M.
OVERLOAD:
Voltage: 2 times full scale.
Current:
Using integral sensor: 2 times full scale.
Using sensors C, D, E: 50 times full scale.
DIELECTRIC TEST (Input/Output/Case): 1000Vdc
SURGE: Withstands IEEE SWC test

OUTPUT
OUTPUT RIPPLE: Less than 1.0% at 60 Hz.
OUTPUT LOADING (OHMS):
Option: B: 0-10K
D: Greater than 2K
E-Em: 0-500
X5: Greater than 2K
RESPONSE TIME (90%):
Less than 250 mS.
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 1.0% F.S.
Includes combined effects of voltage, current, load and power factor.
TEMPERATURE EFFECT (0°C to 40°C):
+/- 0.1% F.S.
+/- 1.0% RDG.
INSTRUMENT POWER:
85-135VAC, (50 to 400 Hz.)

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VAR TRANSDUCERS

PRECISION VAR TRANSDUCER — MODEL GV5

ACCURATE TO 0.2% OF READING

FEATURES

- Accurate regardless of variations in voltage,current, power factor, or load.
- Available with 1, 2, 2 1/2, or 3 element configurations. Provides bi-directional operation.
- Accuracy maintained over wide temperature range, calibration traceable to **NIST.**

APPLICATIONS

- Equipment monitoring for process control.
- Integration into energy management systems, or a variety of sub-metering applications.
- Measurement using direct-connection, current tranformers, or potential transformers.



VAR TRANSDUCER-INTEGRAL CURRENT SENSOR

INPUTS		F.S. IN (VAR)	PHASE CONFIG.	MODEL NUMBER GV5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	500	1 Ph.-2W	001A	001B	001C	001D	001E	001E2	001CX5	001X5
		1000	3Ph.-3W	004A	004B	004C	004D	004E	004E2	004CX5	004X5
		1500	3Ph.-4W	007A	007B	007C	007D	007E	007E2	007CX5	007X5
		1500	3Ph.-4W	7.5A	7.5B	7.5C	7.5D	7.5E	7.5E2	7.5CX5	7.5X5
	0 to 10	1000	1Ph.-2W	010A	010B	010C	010D	010E	010E2	010CX5	010X5
		2000	3Ph.-3W	013A	013B	013C	013D	013E	013E2	013CX5	013X5
		3000	3Ph.-4W	016A	016B	016C	016D	016E	016E2	016CX5	016X5
	0 to 20	2000	1Ph.-2W	019A	019B	019C	019D	019E	019E2	019CX5	019X5
		4000	3Ph.-3W	022A	022B	022C	022D	022E	022E2	022CX5	022X5
		6000	3Ph.-4W	025A	025B	025C	025D	025E	025E2	025CX5	025X5
0 to 300	0 to 5	1000	1Ph.-2W	002A	002B	002C	002D	002E	002E2	002CX5	002X5
		2000	3Ph.-3W	005A	005B	005C	005D	005E	005E2	005CX5	005X5
		3000	3Ph.-4W	008A	008B	008C	008D	008E	008E2	008CX5	008X5
	0 to 10	2000	1Ph.-2W	011A	011B	011C	011D	011E	011E2	011CX5	011X5
		4000	3Ph.-3W	014A	014B	014C	014D	014E	014E2	014CX5	014X5
		6000	3Ph.-4W	017A	017B	017C	017D	017E	017E2	017CX5	017X5
	0 to 20	4000	1Ph.-2W	020A	020B	020C	020D	020E	020E2	020CX5	020X5
		8000	3Ph.-3W	023A	023B	023C	023D	023E	023E2	023CX5	023X5
		12000	3Ph.-4W	026A	026B	026C	026D	026E	026E2	026CX5	026X5
0 to 600	0 to 5	2000	1Ph.-2W	003A	003B	003C	003D	003E	003E2	003CX5	003X5
		4000	3Ph.-3W	006A	006B	006C	006D	006E	006E2	006CX5	006X5
	0 to 10	4000	1Ph.-2W	012A	012B	012C	012D	012E	012E2	012CX5	012X5
		8000	3Ph.-3W	015A	015B	015C	015D	015E	015E2	015CX5	015X5
	0 to 20	8000	1Ph.-2W	021A	021B	021C	021D	021E	021E2	021CX5	021X5
		16000	3Ph.-3W	024A	024B	024C	024D	024E	024E2	024CX5	024X5

Highlighted models, (6.25A), can be used with customer's existing current transformers.

*Denotes self-powered unit, limiting input voltage ranges to:

85-135 for 150V models
200-280 for 300V models
380-550 for 600V models

**4-20mA loop-powered unit, (15-40Vdc).

All others require 85-135VAC instrument power (60 Hz).

ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output.
GV5-001CX5

OPTIONAL 50 Hz. OPERATION- CONSULT FACTORY
CONTACT FACTORY FOR COMPLETE PRODUCT CATALOG

MODEL GV5 SPECIFICATIONS

INPUT

SEE TABLE FOR VOLTAGE AND CURRENT RANGES
FREQUENCY RANGE: 60 Hz.
POWER FACTOR: Any
BURDEN:
Voltage: Less than 0.1VA
Current: Less than 0.28VA per element
OVERLOAD:
Voltage (cont.): Consult factory
Current (cont.): Consult factory
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT

OUTPUT RIPPLE: Less than 0.5%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
E-E2: 0-500
CX5-X5: Greater than 2K
RESPONSE TIME (99%): Less than 400 mS
COMPLIANCE VOLTAGE: 12Vdc min.
OPEN CIRCUIT VOLTAGE: +/- 15Vdc

ACCURACY +/- 0.2% RDG.

TEMPERATURE EFFECT (-20° to 60°C): +/- 0.005%/°C

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VOLTAGE TRANSDUCERS

AC VOLTAGE TRANSDUCER — MODEL VT

LOW COST AC VOLTAGE TRANSDUCER

FEATURES

- Accuracy reliable voltage measurement over a wide frequency range.
- Input/output isolation.

APPLICATIONS

- Designed for use in OEM applications where inexpensive voltage measurement is required.
- Line voltage monitoring.

INPUT	MODEL NUMBER VT- OPTIONAL OUTPUTS			
AC VOLTAGE	0-1mA	4-20mA	0-10Vdc	0-5Vdc
0 to 150 0 to 300 0 to 600	120A 240A 480A	120E 240E 480E	ORDER WITH OSI RESISTOR MODEL LRB-10000	ORDER WITH OSI RESISTOR MODEL LRB-5000



Units with 0-1mA output are self-powered from measured voltage line.
Units with 4-20mA output require 85-135VAC instrument power.
Models VT480A and VT480E include **OSI** 226-145 potential transformer.
NOTE: LOAD RESISTOR MUST BE ORDERED SEPARATELY.

ORDERING INFORMATION
Example: Single phase120VAC input with 4-20mA output.
VT-120E

RMS VOLTAGE TRANSDUCER — MODEL VTR

ACCURATE TO 0.25% FULL SCALE

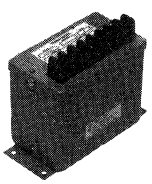
FEATURES

- Accurate measurement of the true RMS value of input signals over a wide frequency range.

APPLICATIONS

- For use in applications where measurement of non-sinusoidal waveforms is required.

INPUT	MODEL NUMBER VTR- OPTIONAL OUTPUTS			
AC VOLTAGE	0-1mA	4-20mA	0-10Vdc	0-5Vdc
0 to 150 0 to 300 0 to 600	001B 002B 004B	001E 002E 004E	001D 002D 004D	ORDER WITH OSI RESISTOR MODEL LRB-5000



All units require 85-135VAC instrument power, (50-400Hz.).
NOTE: LOAD RESISTOR MUST BE ORDERED SEPARATELY.

ORDERING INFORMATION
Example: Single phase120VAC input with 0-10Vdc output.
VTR-001D

MODEL VT, VTR SPECIFICATIONS

INPUT
VOLTAGE: See tables
FREQUENCY RANGE: 50 to 400 Hz.
BURDEN:
Voltage: 2.8VA F.S.
Current: 1.0VA F.S.
OVERLOAD:
Voltage: Full scale rating.
DIELECTRIC TEST (Input/Output/Case): 1500VAC
INSTRUMENT POWER: 85-135VAC (50-400Hz.).

OUTPUT
OUTPUT RIPPLE: Less than 1.0% F.S.
OUTPUT LOADING (OHMS):
Option: A: 0-10K
E: 0-1.5K
RESPONSE: 400mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.5% F.S. (at 25°C)
Includes effects of linearity.
TEMPERATURE EFFECT (-20°C to 60°C):
+/- 1.0% RDG.

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VOLTAGE TRANSDUCERS

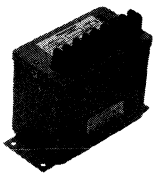
AC/DC VOLTAGE TRANSDUCER — MODEL VT7

DC TO 5000 HERTZ FREQUENCY RESPONSE

FEATURES
- Provides instantaneous output which is directly proportional to AC or dc input signal.

APPLICATIONS
- Designed for use in applications which require directly analogous voltage measurement.

INPUT	MODEL NUMBER VT7- STANDARD OUTPUTS			
DC VOLTAGE	0-1mA	4-20mA	0-10V	0-5V
0 to 0.050	015B	015E	015D	015X5
0 to 0.100	016B	016E	016D	016X5
0 to 10	001B	001E	001D	001X5
0 to 25	002B	002E	002D	002X5
0 to 50	003B	003E	003D	003X5
0 to 100	004B	004E	004D	004X5
0 to 150	005B	005E	005D	005X5
0 to 250	006B	006E	006D	006X5
0 to 300	007B	007E	007D	007X5
0 to 400	008B	008E	008D	008X5
0 to 500	009B	009E	009D	009X5
0 to 600	010B	010E	010D	010X5
0 to 700	011B	011E	011D	011X5
0 to 800	012B	012E	012D	012X5
0 to 900	013B	013E	013D	013X5
0 to 1000	014B	014E	014D	014X5



Highlighted models will be supplied with an externally mounted resistance box.

All units require 85-135VAC instrument power, (50-70Hz.).

ORDERING INFORMATION
Example: 120VAC/dc input with 0-10V output.
VT7-005D

RMS VOLTAGE TRANSDUCER — MODEL VT8

DC TO 5000 HERTZ FREQUENCY RANGE

FEATURES
- Provides dc output which is directly proportional to RMS value of AC and/or dc input signal.
- Input/output isolation.

APPLICATIONS
- Accurate measurement of voltage that contains dc and non-sinusoidal AC components.
- Monitoring of RMS voltage.

ORDERING INFORMATION
Select input voltage range and output required from table shown above, (model VT7).
Example: 120VAC/dc input with
4-20mA output proportional to RMS value of input.
VT8-005E

MODEL VT7, VT8 SPECIFICATIONS

INPUT
VOLTAGE: See tables
FREQUENCY RANGE: dc to 5000Hz.
BURDEN (OHMS): Greater than 100K
OVERLOAD:
.05-700V: 2 times full scale rating.
800-1000V: 1500V
DIELECTRIC TEST (Input/Output/Case): 1500VAC
INSTRUMENT POWER: 85-135VAC, (50-70Hz.).

OUTPUT
OUTPUT LOADING (OHMS):
Option: B: 0-10K
D-X5: Greater than 2.0K
E: 0-1.5K
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.5% F.S.
Includes effects of linearity and repeatability.
TEMPERATURE EFFECT (-10°C to 60°C): +/- 1.0% RDG.

CONTACT FACTORY FOR FREE COPY OF COMPLETE PRODUCT CATALOG

OHIO SEMITRONICS, INC.
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212-2287
PHONE: (614) 486-9561 FAX: (614) 486-0743
TO PLACE AN ORDER: 1-800-537-6732

CURRENT TRANSDUCERS

AC CURRENT TRANSDUCER — MODEL CT5

LOW COST AC CURRENT TRANSDUCER

FEATURES

- Accurate, reliable current measurement over a wide frequency range.

APPLICATIONS

- Designed for use in OEM applications which require inexpensive current measurement.



MODELS WITH INTEGRAL CURRENT SENSOR

INPUT AC CURRENT	SENSOR SIZE	MODEL CT5- OPTIONAL OUTPUTS				
		0-1mA	4-20mA	4-20mA*	0-10Vdc	0-5Vdc
0 to 1.0	N/A	001A	001E	001E2	ORDER WITH OSI RESISTOR MODEL LRB-10000	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 5.0		005A	005E	005E2		
0 to 10.0		010A	010E	010E2		
0 to 20.0		020A	020E	020E2		

Highlighted modes, (5A), can be used with customer's current transformers.

Units with 0-1mA output are self-powered from measured line.

Units with standard 4-20mA output require 85-135VAC instrument power.

*4-20mA loop-powered unit, (15-40Vdc).

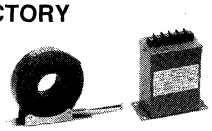
NOTE: LOAD RESISTOR MUST BE ORDERED SEPARATELY.

ORDERING INFORMATION

Example: 20Amp AC input with 4-20mA output.

CT5-020E

AVAILABLE WITH UP TO THREE UNITS IN A SINGLE ENCLOSURE CONSULT FACTORY



MODELS SUPPLIED WITH EXTERNAL CURRENT SENSOR

INPUT AC CURRENT	SENSOR SIZE	MODEL CT5- OPTIONAL OUTPUTS				
		0-1mA	4-20mA	4-20mA*	0-10Vdc	0-5Vdc
0 to 50	W	050A	050E	050E2	ORDER WITH OSI RESISTOR MODEL LRB-10000	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 100	W	100A	100E	100E2		
0 to 200	W	200A	200E	200E2		
0 to 300	W	300A	300E	300E2		
0 to 400	X	400A	400E	400E2		
0 to 600	X	600A	600E	600E2		
0 to 1000	Y	1000A	1000E	1000E2		

MODEL CT5 SPECIFICATIONS

INPUT

CURRENT: See tables
FREQUENCY RANGE: 50 to 400 Hz.
BURDEN:
Voltage: 2.8VA F.S.
Current: 1.0VA F.S.
CURRENT OVERLOAD:
2 times full scale rating (continuous), except 20A model.
20A model: 1.25 times full scale rating.
50 times full scale (1 Sec. transient).
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT

OUTPUT RIPPLE: Less than 1.0% F.S.
OUTPUT LOADING (OHMS):
Option: A: 0-10K
E-E2: 0-1.5K
RESPONSE: 400mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.5% F.S. (at 25°C)
Includes effects of linearity.
TEMPERATURE EFFECT (-20°C to 60°C):
+/- 1 0% RDG.

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TO PLACE AN ORDER: 1-800-537-6732

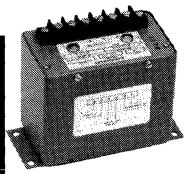
CURRENT TRANSDUCERS

RMS CURRENT TRANSDUCER — MODEL CTR

ACCURATE TO 0.25% FULL SCALE

FEATURES
- Accurate measurement of the true RMS value of input signals over a wide frequency range.

APPLICATIONS
- For use in applications where measurement of non-sinusoidal waveforms is required.



INPUT	MODEL NUMBER CTR- OPTIONAL OUTPUTS			
CURRENT (AMPS)	0-1mA	4-20mA	0-10Vdc	0-5Vdc
0 to 1.0	001B	001E	001D	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 5.0	005B	005E	005D	
0 to 10.0	010B	010E	010D	
0 to 15.0	015B	015E	015D	
0 to 20.0	020B	020E	020D	

Highlighted 5 Amp models are **non-isolated** (input/output).

ORDERING INFORMATION
Example: 15 Amp AC input with 0-10Vdc output.
CTR-015D

MODEL CTR SPECIFICATIONS

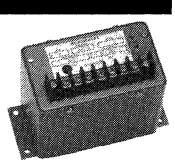
INPUT
CURRENT: See tables
FREQUENCY RANGE: 48 to 420 Hz.
BURDEN:
Voltage: 0.12VA F.S.
Current: 0.28VA F.S.
OVERLOAD:
Current: 50A (10Sec. transient)
250A (1 Sec. transient), isolated models only
DIELECTRIC TEST (Input/Output/Case): 1500VAC
INSTRUMENT POWER:
85-135VAC (50-400Hz.).

OUTPUT
OUTPUT RIPPLE: Less than 1.0% F.S.
OUTPUT LOADING (OHMS):
Option: B: 0-10K
D: Greater than 2.0K
E: 0-500
RESPONSE: 100mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.25% F.S. (at 60Hz.)
Includes effects of linearity.
+/- 0.5% over entire frequency range
TEMPERATURE EFFECT (-20°C to 60°C): +/- 1.0% RDG.

SETPOINT RELAYS

SETPOINT RELAY — MODEL CRC

ADJUSTABLE SETPOINT RELAYS



FEATURES
- Provides adjustable setpoint from 0-110% of rated full scale input.

APPLICATIONS
- Designed for use with **OSI** current, voltage, and Watt transducers.

MODEL CRC-005B, 0-mA INPUT SPECIFICATIONS

INPUT
SETPOINT RANGE: 0-1.1mA dc
RESOLUTION: 2.0 microAmperes
MAX. OVERLOAD (without damage): 10mA
ISOLATION (Input/Output/Case): 1000VAC
INSTRUMENT POWER: 115VAC (+/-10%) 50-400Hz.

OUTPUT
RELAY: SPDT, 120VAC, 3Amp
TEMPERATURE EFFECT (-10°C to 70°C): 0.01%/°C

MODEL CRC-005D, 0-11Vdc INPUT SPECIFICATIONS

INPUT
SETPOINT RANGE: 0-11Vdc
RESOLUTION: 20mV
MAX. OVERLOAD (without damage): 100V
ISOLATION (Input/Output/Case): 1000VAC
INSTRUMENT POWER: 115VAC (+/-10%) 50-400Hz.

OUTPUT
RELAY: SPDT, 120VAC, 3Amp
TEMPERATURE EFFECT (-10°C to 70°C): 0.01%/°C

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TO PLACE AN ORDER: 1-800-537-6732

CURRENT TRANSFORMERS

CURRENT TRANSFORMERS

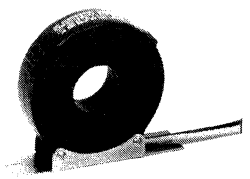
FREQUENCY RANGE 50 TO 400 HERTZ

FEATURES

- Manufactured to meet reqirements of UL1244 and revisions.
- Flexible leads are UL1015 105°C CSA approved.

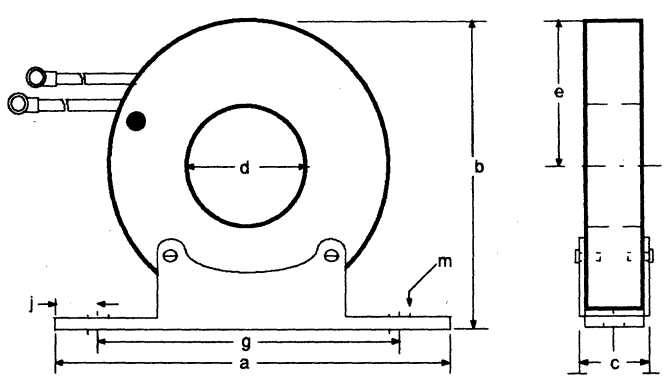
APPLICATIONS

- For use with **OSI** Watt, Watt/VAR, current and Watt/Watt-Hour transducers.
- Ideal for use with Ammeters, relays and watt transducers.



50 TO 400 HERTZ CURRENT TRANSFORMER

CURRENT RATIO	ACCURACY AT 60HZ. (%)	BURDEN AT 60HZ. (VA)	PART NUMBER	WT. (LBS)	TRANSFORMER DIMENSIONS (INCHES)							
					A	B	C	D	E	G	J	M
50:5	3.0	2.5	10418	1.22	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
100:5	2.0	2.5	12276	1.29	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
	1.5	5.0	10424	1.28	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X .044
150:5	1.0	7.5	10421	1.35	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X .044
	1.0	5.0	12474	1.32	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
200:5	1.0	12.5	10425	1.37	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	5.0	12277	1.35	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
250:5	1.0	20.0	12271	1.39	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	5.0	12475	1.38	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
300:5	1.0	25.0	10417	1.41	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	12.5	12278	1.41	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
400:5	1.0	30.0	12272	1.43	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	15.0	10420	1.47	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
500:5	1.0	25.0	12273	1.13	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	25.0	12279	1.53	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
600:5	1.0	30.0	12274	1.17	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	30.0	10422	1.59	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
750:5	1.0	40.0	12478	1.22	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	30.0	12476	1.60	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
800:5	1.0	45.0	12275	1.25	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	35.0	12280	1.61	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
1000:5	1.0	35.0	12281	1.29	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
	1.0	20.0	10423	0.65	6.63	4.63	1.0	3.00	2.38	5.75	0.44	0.28
1200:5	1.0	40.0	12282	1.38	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
	1.0	25.0	11014	0.73	6.63	4.63	1.0	3.00	2.38	5.75	0.44	0.28
1500:5	1.0	50.0	12283	1.50	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
	1.0	30.0	10998	0.86	6.63	4.63	1.0	3.00	2.38	5.75	0.44	0.28
2000:5	1.0	40.0	12284	1.10	6.63	4.63	1.0	3.00	2.38	5.75	0.44	0.28



TRANSFORMER SPECIFICATIONS

FREQUENCY: 50 to 400Hz.
INSULATION CLASS: 0.6KV BIL 10KV full wave
LEADS: UL1015 105°C CSA approved, #16 AWG, 24In. length.
TERMINALS: No. 8 ring terminal.

CONTACT FACTORY FOR FREE COPY OF COMPLETE PRODUCT CATALOG

OHIO SEMITRONICS, INC. 1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212-228
PHONE: (614) 486-9561 FAX: (614) 486-074
TO PLACE AN ORDER: 1-800-537-673

CURRENT TRANSDUCERS

CURRENT TRANSDUCERS MODEL CTL

FREQUENCY RANGE DC TO 1000 HERTZ

FEATURES AND APPLICATIONS

- 5000 Volt line-to-output isolation.
- DC to 5000 Hertz response.
- Bi-directional operation.
- Available in split-core configurations.
- Response time less than 50 microSeconds.
- Output is proportional in **direction and magnitude** to the current flow through the window.
- Overload capability to **50 times rating** (at 60 Hz.).
- Stability maintained during severe vibration.
- Easy installation.
- Replaces shunts.
- No insertion loss.
- For use with **OSI** model CTA signal conditioners.
- Ideal for use on AC systems with dc components and/or chopped waveforms.



CIRCULAR WINDOW MODELS (0.5% LINEARITY)

RMS CURRENT (A)	EXCITATION (mA)	OUTPUT (mV)	TEMPERATURE		RESISTANCE (OHMS)		SENSOR SIZE	PART NUMBER
			EFFECTS	RANGE (°C)	INPUT	OUTPUT		
50	100	30	-0.15% /°C	-40 to 65	4.0	3.0	A	CTL-50
	100	20	+/- 1.0%	0 to 40	4.0	25.0	A	CTL-50TT
	100	20	+/- 1.0%	-40 to 65	4.0	25.0	A	CTL-50T
100	100	50	-0.15% /°C	-40 to 65	4.0	3.0	C	CTL-100
	100	50	+/- 1.0%	0 to 40	4.0	25.0	C	CTL-100TT
	100	50	+/- 1.0%	-40 to 65	4.0	25.0	C	CTL-100T
200	100	75	-0.15% /°C	-40 to 65	4.0	3.0	D	CTL-200
	100	50	+/- 1.0%	0 to 40	4.0	25.0	D	CTL-200TT
	100	50	+/- 1.0%	-40 to 65	4.0	25.0	D	CTL-200T
400	100	50	-0.15% /°C	-40 to 65	4.0	3.0	D	CTL-400
	100	50	+/- 1.0%	0 to 40	4.0	25.0	D	CTL-400TT
	100	50	+/- 1.0%	-40 to 65	4.0	25.0	D	CTL-400T
600	100	75	-0.15% /°C	-40 to 65	25.0	6.0	E	CTL-600
	100	50	+/- 1.0%	0 to 40	25.0	25.0	E	CTL-600TT
	100	50	+/- 1.0%	-40 to 65	25.0	25.0	E	CTL-600T
1000	200	75	-0.15% /°C	-40 to 65	25.0	6.0	E	CTL-1000
	200	50	+/- 1.0%	0 to 40	25.0	25.0	E	CTL-1000TT
	200	50	+/- 1.0%	-40 to 65	25.0	25.0	E	CTL-1000T
2000	200	150	-0.15% /°C	-40 to 65	25.0	6.0	E	CTL-2000
	200	100	+/- 1.0%	0 to 40	25.0	25.0	E	CTL-2000TT
	200	100	+/- 1.0%	-40 to 65	25.0	25.0	E	CTL-2000T

OPTIONAL SPLIT-CORE-ADD SUFFIX "S" TO PART NUMBER (50 Amp models not available in split-core configuration)

RECTANGULAR WINDOW (BUS BAR) MODELS (1.0% LINEARITY)

PEAK CURRENT (A)	EXCITATION (mA)	OUTPUT (mV)	TEMPERATURE		RESISTANCE (OHMS)		SENSOR SIZE	PART NUMBER
			EFFECTS	RANGE (°C)	INPUT	OUTPUT		
1000	100	75	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-1000HT
1200	100	75	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-1200HT
2000	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-2000HT
2200	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-2200HT
3000	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-3000HT
4000	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-4000HT
	200	150	+/- 1.0%	-40 to 65	25.0	25.0	G	CTL-4000T
5000	100	75	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-5000HT
	200	150	+/- 1.0%	-40 to 65	25.0	25.0	G	CTL-5000T
8000	200	75	+/- 1.0%	-40 to 65	12.0	25.0	H	CTL-8000T

ORDERING INFORMATION

EXAMPLE: 200 Amp split-core current transducer requiring 100mA excitation, with output of 75mV.
CTL-200-S

TO ORDER WITH OSI MODEL CTA SIGNAL CONDITIONER

Locate transducer model number in first column of table on following page. Specify model CTA signal conditioner model number based on required analog output. **The transducer and signal conditioner must be ordered as separate items although supplied as a calibrated set.**

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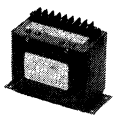
SIGNAL CONDITIONERS

OSI SIGNAL CONDITIONER MODEL CTA

FOR USE WITH OSI MODEL CTL CURRENT TRANSDUCERS



DIRECT MEASUREMENT MODELS

- Provide output which is directly proportional to **amplitude of AC and/or dc** input waveform.

RMS MODELS

- Provide output which is proportional to **RMS value of AC and/or dc** input waveform.

MODEL CTL CURRENT TRANSDUCER (FROM PG. 46)	TRANSDUCER INPUT CURRENT RANGE	DIRECT MODELS OUTPUT PROPORTIONAL TO AC/DC INPUT			RMS MODELS OUTPUT PROPORTIONAL TO RMS OF AC/DC INPUT			
		STANDARD AC/DC OUTPUTS			STANDARD DC OUTPUTS			
		+/-5V	+/-10V	4-20mA	0-5Vdc	0-10Vdc	4-20mA	0-1mA
CTL-50	0 to 50	CTA101	CTA201	CTA212	CTA113	CTA213	CTA215	CTA214
CTL-50TT		CTA101	CTA201	CTA212	CTA113	CTA213	CTA215	CTA214
CTL-50T		CTA101	CTA201	CTA212	CTA113	CTA213	CTA215	CTA214
CTL-100	0 to 100		CTA101	CTA112		CTA113	CTA115	CTA114
CTL-100TT			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-100T			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-200	0 to 200		CTA101H	CTA112H		CTA113H	CTA115H	CTA114H
CTL-200TT			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-200T			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-400	0 to 400		CTA101	CTA112		CTA113	CTA115	CTA114
CTL-400TT			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-400T			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-600	0 to 600		CTA101H	CTA112H		CTA113H	CTA115H	CTA114H
CTL-600TT			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-600T			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-1000	0 to 1000		CTA201H	CTA212H		CTA213H	CTA215H	CTA214H
CTL-1000TT			CTA201	CTA212		CTA213	CTA215	CTA214
CTL-1000T			CTA201	CTA212		CTA213	CTA215	CTA214
CTL-1000HT			CTA101H	CTA112H				
CTL-1200HT	0 to 1200		CTA101H	CTA112H				
CTL-2000	0 to 2000		CTA201K	CTA212K		CTA213K	CTA215K	CTA214K
CTL-2000TT			CTA201P	CTA212P		CTA213P	CTA215P	CTA214P
CTL-2000T			CTA201P	CTA212P		CTA213P	CTA215P	CTA214P
CTL-2000HT			CTA101P	CTA112P				
CTL-2200HT	0 to 2200		CTA101P	CTA112P				
CTL-3000HT	0 to 3000		CTA101P	CTA112P				
CTL-4000TT	0 to 4000		CTA201K	CTA212K				
CTL-4000T			CTA201K	CTA212K				
CTL-4000HT			CTA101P	CTA112P				
CTL-5000TT	0 to 5000		CTA201K	CTA212K				
CTL-5000T			CTA201K	CTA212K				
CTL-5000HT			CTA101H	CTA112H				
CTL-8000TT	0 to 8000		CTA201H	CTA212H				
CTL-8000T			CTA201H	CTA212H				

ORDERING INFORMATION

Locate model CTL part number in first column. Determine type of output required, (direct or RMS). Locate model CTA signal conditioner part number in corresponding output column. **Order as separate items.**

EXAMPLE: 200 Amp split-core current transducer. Output from signal conditioner of 0-10Vdc proportional to 0-200A.

ITEM 1: CTL-200-S ITEM 2: CTA113H

MODEL CTA SPECIFICATIONS

INPUT

VOLTAGE: See tables
FREQUENCY RANGE: dc to 5000 Hz.
INSTRUMENT POWER: 115VAC (+/-10%) 50-400 Hz.

OUTPUT

OUTPUT RIPPLE: Less than 0.25% F.S.
FIELD ADJUSTABLE GAIN: 25%
OUTPUT LOADING (OHMS):
1mA: 0-10K
10V, 5V: 2K min.
4-20mA: 0-500
RESPONSE (90%): Direct models: 40 microSeconds
RMS Models: 200 milliSeconds

LINEARITY +/- 0.1% F.S.

TEMPERATURE EFFECT (0°C to 70°C): +/- 0.005%/°C

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TO PLACE AN ORDER: 1-800-537-6732

INTEGRATION DEVICES

ANALOG-TO-PULSE INTEGRATOR WITH DISPLAY — MODEL PA

INTEGRATES ANY DC PROCESS VARIABLE ANALOG

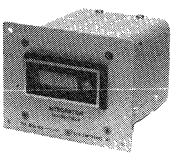
FEATURES

- Displays time integral of analog input signal.
- Current or voltage inputs.
- Count rates from 200 to 100000 counts/Hour.

APPLICATIONS

- Can be used with **OSI** Watt, VAR, or current transducers.
- Accumulate Watt-Hours, VAR-Hours, Amp-Hours, volume, weight, or distance.

INPUT		COUNTS PER HOUR AT FULL SCALE INPUT	COUNTER RESET OPTIONS	
RANGE	DESIGNATION		STANDARD	REMOTE
0 to 50mV	001	SPECIFY REQUIRED COUNTS PER HOUR, FROM 200 TO 100000. ADD SUFFIX "/(COUNT RATE)" TO PART NUMBER. FOR COUNT RATES GREATER THAN 999 SPECIFY USING K, (e.g. 2000=/2K).	STANDARD UNIT SUPPLIED WITH BOTH REMOTE AND PANEL RESET	FOR REMOTE RESET ONLY
0 to 100mV	002			
0 to 150mV	003			
0 to 250mV	004			
0 to 1mA	005			
0 to 20mA	008			
4 to 20mA	010			
0 to 5Vdc	007			
1 to 5Vdc	009			
0 to 10Vdc	006			



ORDERING INFORMATION

Example: Full scale input of 10Vdc. Count rate of 5500 cts./Hr., Remote reset only.
PA-006/5.5K-G

MODEL PA SPECIFICATIONS

INPUT

VOLTAGE: See table
CURRENT: See table
BURDEN (OHMS):
Voltage input models: Greater than 100K
0-1mA input models: Less than 1K
20mA input models: Less than 100
OVERLOAD: 1.25 times full scale
INSTRUMENT POWER:
Std.: 115VAC, +/- 10% (50-400Hz)

DISPLAY

COUNTER: 8 digit, 0.32 In. LCD
COUNTER BATTERIES: Internal Lithium
BATTERY LIFE: 8 yrs. (nom.)
RESET: Manual and/or remote
ACCURACY +/- 0.25% F.S.
LINEARITY: +/- 0.1% F.S.
TEMPERATURE EFFECT (-20°C to 60°C):
+/- 0.005%/°C

PRECISION INTEGRATOR — MODEL VFC

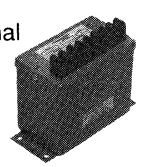
CONVERTS DC INPUT TO TIME-INTEGRATED PULSE

FEATURES

- Provides relay closure count which is proportional to the integral of the input signal.

APPLICATIONS

- Designed for use with dc, pulsating dc, or dc with AC components.



INPUT RANGE	CLOSURE RATE (COUNTS/HR.)	PART NUMBER
0 to 50mV	0 to 10000	VFC-010
0 to 100mV	0 to 10000	VFC-020
0 to 150mV	0 to 10000	VFC-030
0 to 250mV	0 to 10000	VFC-040
0 to 1mA	0 to 10000	VFC-050
0 to 10V	0 to 10000	VFC-060

MODEL VFC SPECIFICATIONS

INPUT
VOLTAGE: See table
OVERLOAD: 10Vdc max.
IMPEDANCE (Ohms):
Voltage input models: Greater than 1M
Current input models: Less than 200
FREQUENCY: dc with up to 100% ripple at 120 Hz. or higher.
OUTPUT
RELAY: N/O SPST, 120V, 0.5A contact rating
RELAY CLOSURE PERIOD: 200mS
ACCURACY +/- 0.25% F.S.
LINEARITY: +/- 0.1% F.S.
TEMPERATURE EFFECT (-10° to 60°C): +/- 0.5%
INSTRUMENT POWER: 115VAC+/- 10%, 50-400Hz.

CUSTOM COUNT RATES AVAILABLE-CONSULT FACTORY

CONTACT FACTORY FOR FREE COPY OF COMPLETE PRODUCT CATALOG

OHIO SEMITRONICS, INC. 1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212-2287
PHONE: (614) 486-9561 FAX: (614) 486-0743
TO PLACE AN ORDER: 1-800-537-6732

FREQUENCY TRANSDUCERS

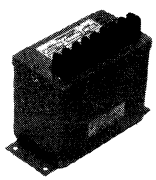
FREQUENCY TRANSDUCER — MODEL FT

ACCURATE TO 0.2% OF FULL SCALE

FEATURES
- Provides analog output which is proportional to the instantaneous frequency of the input signal.

APPLICATIONS
- For use on any application that requires indication or collection of frequency variations.

INPUT FREQUENCY (Hz)	MODEL NUMBER FT- STANDARD OUTPUTS		
	0-1mA	0-10Vdc	0-5Vdc
45 to 55	050B	050D	050X5
55 to 65	060B	060D	060X5
375 to 400	400B	400D	400X5



ADDITIONAL FREQUENCY RANGES AVAILABLE
CONSULT FACTORY

ORDERING INFORMATION
Example: 55-65Hz. input, with 0-5Vdc output
FT-060X5

MODEL FT SPECIFICATIONS

INPUT
FREQUENCY RANGE: See table
VOLTAGE RANGE: 95-135V
BURDEN : 4.0VA
OVERLOAD: 150V
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT
OUTPUT LOADING (Ohms): 0-10K
RESPONSE TIME: 400mS
ACCURACY +/- 0.2% F.S.
TEMPERATURE EFFECT (-20°C to 60°C):
+/- 0.005%/°C

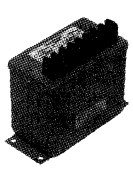
SIGNAL CONVERTERS

PRECISION CURRENT CONVERTER — MODEL SCE

ACCURATE TO 0.1% OF FULL SCALE

FEATURES
- Converts dc current or voltage input to 4-20mA output.

APPLICATIONS
- Interface with **OSI** transducers, or any with output signals listed in the table below.



DC INPUT	OUTPUT (mA)	BURDEN (OHMS)	PART NUMBER
0 to 1mA	4 to 20	1K	SCE-001
0 to 10V	4 to 20	10K	SCE-002
0 to 50mV	4 to 20	Grtr. than 100K	SCE-003
0 to 100mV	4 to 20	Grtr. than 100K	SCE-004
0 to 150mV	4 to 20	Grtr. than 100K	SCE-005

MODEL SCE SPECIFICATIONS

INPUT
VOLTAGE: See table
CURRENT: See table
OVERLOAD: 10 times F.S. input
ISOLATION: Input is not isolated from output
OUTPUT
OUTPUT: 4 to 20mA
OUTPUT LOADING: 0-1500 Ohms
RESPONSE TIME (99%): 100 mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.1% F.S.
Includes effects of linearity.
TEMPERATURE EFFECT (-20° to 65°C):
+/- 1.0% F.S.
INSTRUMENT POWER: 115VAC+/- 10%, 50-400Hz.

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HALL EFFECT PROBES

PRECISION HALL EFFECT SENSOR — MODELS HR, HS

HALLTRON MAGNETIC FIELD SENSOR

FEATURES
- High accuracy, low noise.

APPLICATIONS
- Magnetic field sensing applications.

HALL OUTPUT* MILLIVOLTS (+/- 25%)	NOMINAL CONTROL CURRENT Ic, (mA)	OHMIC RESIDUAL, (mV) FIELD=0 Ic=10mA	OHMIC RESIDUAL, (mV) FIELD=0 Ic=100mA	NOMINAL INPUT RESISTANCE (OHMS)	NOMINAL OUTPUT RESISTANCE (OHMS)	DIMENSIONS (INCHES) L	W	T	LEAD INSUL. MAT'L.	TEMP. COEFF. % OUTPUT PER °C	MODEL NUMBER
350	350		0.15	1.5	1.5	0.625	0.375	0.028	PVC	-0.10	HR36
200	25	0.2		8.0	8.0	0.625	0.375	0.028	PVC	-0.25	HR38
500	200		0.50	5.0	4.0	0.200	0.250	0.028	Enamel	-0.15	HR66
340	200		0.50	2.0	2.0	0.200	0.250	0.028	PVC	-0.10	HR70
700	100	0.2		9.0	6.0	0.200	0.250	0.028	Enamel	-0.25	HR72
550	100		1.00	10.0	10.0	0.200	0.250	0.030	Enamel	-0.25	HR77
100	100		0.50	2.5	2.0	0.200	0.250	0.028	Enamel	-0.05	HR125A
250	100		0.50	1.2	1.0	0.500	0.375	0.025	PVC	-----	HS55

*** OUTPUT SPECIFIED WITH FIELD OF 10KG, AND CONTROL CURRENT AS LISTED IN TABLE.**
OPERATING TEMPERATURE RANGE: -65 TO 85°C

CURRENT CONVERTER

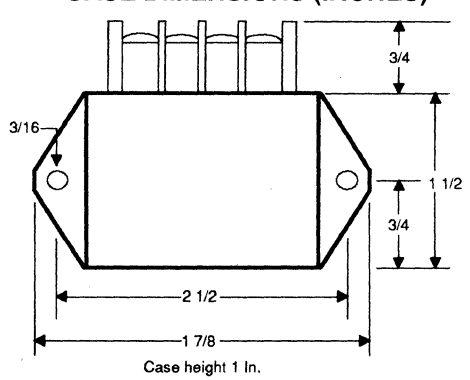
TRANSMITTER OUTPUT CONVERTER — MODEL PI

CONVERTS 4-20mA TO 0-1mA, OR 0-1V OUTPUT

INPUT	OUTPUT	PART NUMBER
4-20mA	0 to 1mA	PI8300B
4-20mA	0 to 1Vdc	PI8300D

NO EXTERNAL POWER REQUIRED

CASE DIMENSIONS (INCHES)

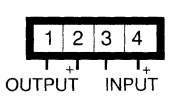


Case height 1 In.

MODEL PI SPECIFICATIONS

INPUT
CURRENT: See table
LOAD ON INPUT: 400 Ohms
OUTPUT
PI8300B: 0-1mA
PI8300D: 0-1Vdc
OUTPUT LOADING (Ohms):
0-1mA: 0-4K
0-10V: Greater than 10K
ACCURACY +/- 0.25% F.S.
Includes effects of linearity.
TEMPERATURE EFFECT (-20° to 65°C): +/- 0.005%/°C
GROUNDING: Converter is non-isolated. Ground either input or output, not both. If the 4-20mA loop is grounded, float both input and output.

CONNECTION DIAGRAM



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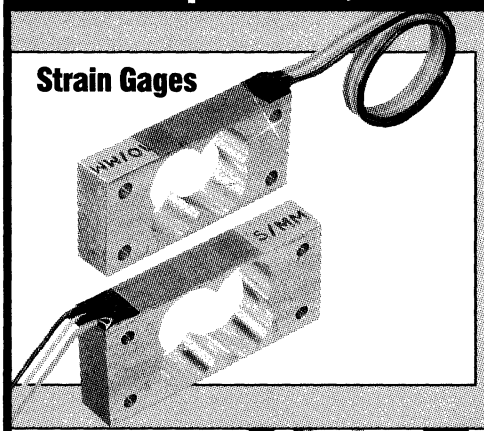
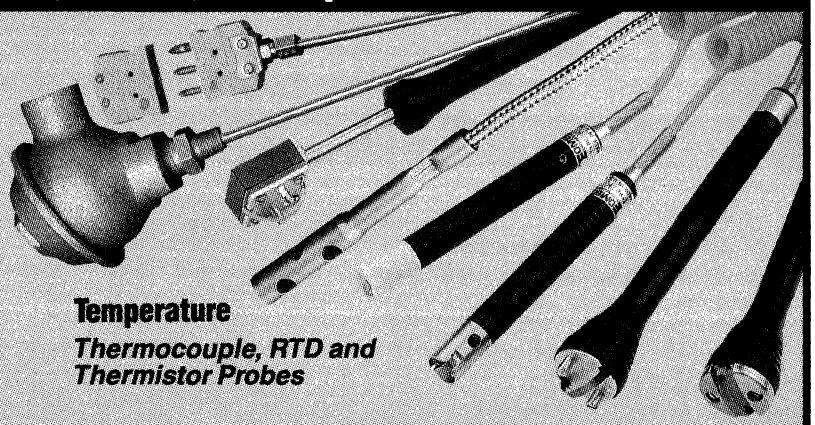
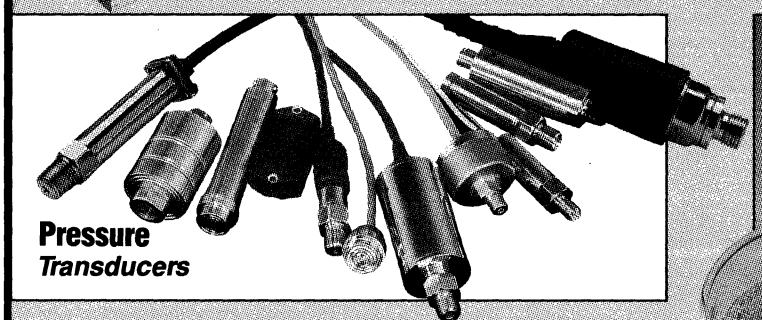
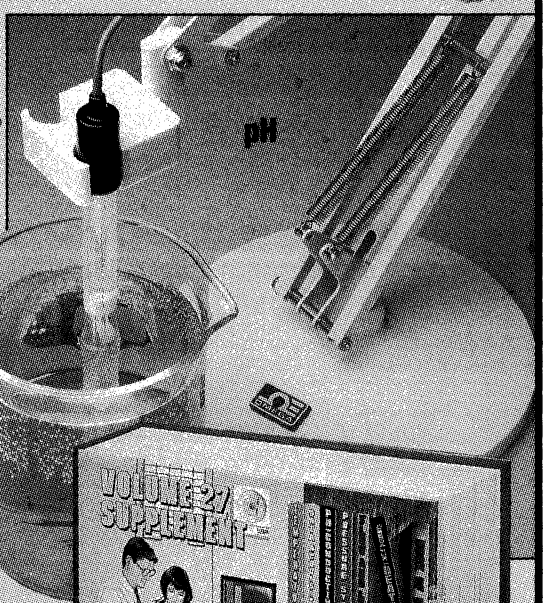
TRANSDUCERS AND ENCODERS

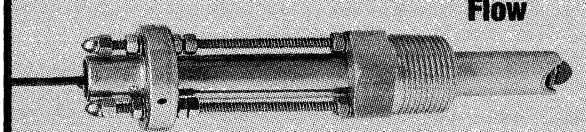
For Temperature, Pressure, Strain, Flow, pH and Other Processes











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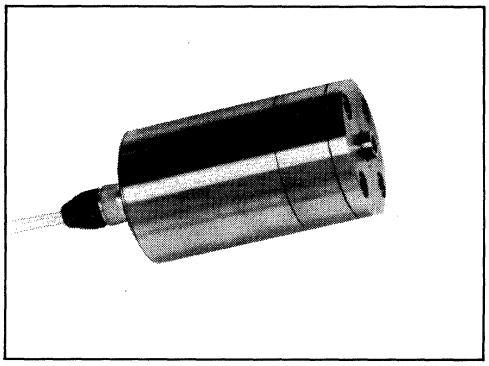
TRANSDUCERS & SYSTEMS

Specialists in transducers and systems for low range force/weight measurements

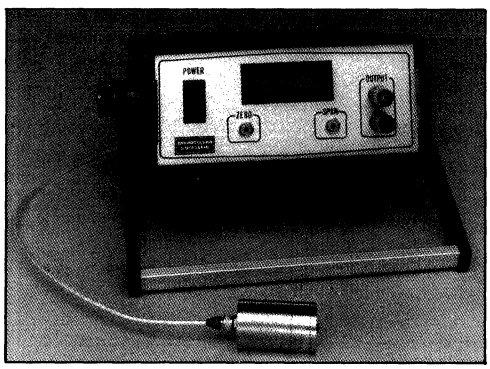
A PRIME TECHNOLOGY COMPANY



LOW RANGE FORCE/WEIGHT TRANSDUCERS

- **Highly repeatable — .02% F.R.**
- **Frictionless sensing**
- **Virtually indestructible**

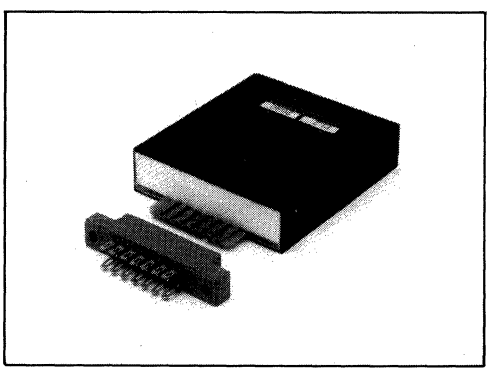
A virtually indestructible frictionless spring-loaded design has been proven in a wide range of applications — from demanding high volume arm flexture gram force calibration for disk drive manufacturers where durability and dependability are required . . . to sophisticated medical laboratory developments where pinpoint accuracy and precise repeatability are a must.



SIGNAL CONDITIONING CONTROL BOXES

- **Push-button Zero**
- **4½ Digit Display**
- **Span Adjustment**
- **AC Power Line Operation**

The CB14 control box is a highly flexible bench-top AC line-operated system. A 4½ digit LCD indicator and standard calibrations give a direct visual representation of measurement in grams of force or inclination related to the sine of the angle. Front panel accessible offset and scale potentiometers allow adjustment of any deviation experienced through mounting.

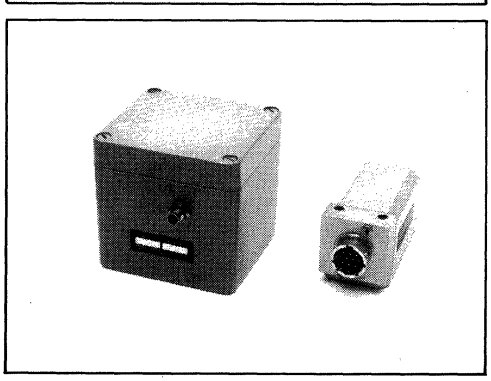


SIGNAL CONDITIONING MODULES

- **Flexible**
- **High resolution output**
- **Designed for use in existing OEM applications.**

These EL Series modules eliminate the need for developments of custom circuitry where DC to DC operation is desired. They provide a carrier-oscillator-demodulator filter and amplifier to provide a sharp, high resolution output. The unique EL2 has provision for remote offset and scale potentiometers as opposed to the more conventional EL3 with on-board adjustments.

Note: AC line, cord-operated, ±15VDC output power modules are available for use with EL2 and EL3 units.



INCLINOMETERS

- **From ±5° to ±90° with 360° axial capability**
- **Resolution of 0.1 arc-second**
- **Fast response, low hysteresis, high stability, high accuracy**

The HO Series of inclinometers utilizes a frictionless assembly for measuring deviation from horizontal, with immediate response, virtually infinite resolution and no cross-axis sensitivity. It is an LVDT-based spring mass system with core material centered on a non-magnetic stainless steel shaft with two mass weights equidistant on either end. The HO-C Series is a more moderately priced alternative to the HO inclinometer that meets the performance standards of most applications.

TRANSDUCERS & SYSTEMS
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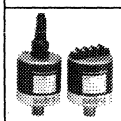
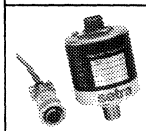
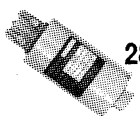
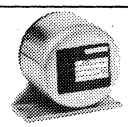
CALL **203 481-5721**

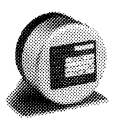
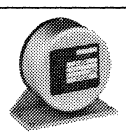
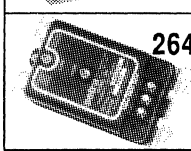
Setra Systems, Inc.

Product Line Summary

Gage - Absolute - Vacuum Transducers

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Thermal Effect ± % FS/100°F	Media Compatability	Output
 204	General Purpose Intrinsically Safe R & D Laboratories Vacuum Systems	Absolute Pressure Gage Pressure Vacuum Pressure	25 to 5000 psia 25 to 10000 psig 0-14.7 psiv	0.11%	0.4 max Zero 0.3 max Span	Gas or liquid compatible with Stainless Steel	**204** 0-5 VDC **C-204** 4-20 mA
 206/207 OEM	Equipment Automation Compressor Control Chillers Paper Converting Hydraulics & Pneumatics	Gage Pressure	25 to 5000 psig	0.13%	1.0 max Zero 1.5 max Span	Gas or liquid compatible with Stainless Steel	**206/207** 0.1-5.1 VDC **C-206/C-207** 4-20 mA
 211	Test & Measurement Engine Test Cells Prototype Analysis Metrology Laboratories Hydraulic Test Equipment	Gage Pressure	25 to 5000 psig	0.13%	0.5 max Zero 0.5 max Span	Gas or liquid compatible with Stainless Steel	**211** 0.1-5.1 VDC **C-211** 4-20 mA
 280E	General Purpose Hydraulics & Pneumatics Process Control P/I Range Level Measurement	Absolute Pressure Gage Pressure Pneumatic Pressure Compound Pressure	15 to 5000 psia 15 to 10000 psig 3-15 psig -14.7 to 35, 50, 100 psig	0.11%	1.0 max Zero 1.5 max Span	Gas or liquid compatible with Stainless Steel	**280E** 0-5 VDC **C-280E** 4-20 mA
 270	Weather Data Systems Laser Interferometers Altimeter Setting Indicators Transfer Pressure Standard	Barometric Pressure Absolute Pressure Gage Pressure	600-1100 mbars 800-1100 mbars 10 to 100 psia 5 to 100 psig	0.05%	0.1 max Zero (0.2 Barometric) 0.1 max Span	Wet or Dry Air	0-5 VDC

Differential Pressure Transducers

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Thermal Effect ± % FS/100°F	Media Compatability	Output
 204D	General Purpose Intrinsically Safe High Differential Pressure	Differential Pressure	10 to 10000 psid	0.11%	1.0 max Zero 1.0 max Span	Gas or liquid compatible with Stainless Steel	0-5 VDC or ± 2.5 VDC
 228-1	Process Control Filter Condition Monitoring Refrigeration Equipment Chillers	Differential Pressure (can be wet both sides)	Low diff. pres. 1 to 100 psid ± 0.5 to 50 psid	Low Ranges 0.15% High Ranges 0.25%	2.0 max Zero 2.0 max Span	Gas or liquid compatible with Stainless Steel (both pressure and reference sides)	**228-1** 0-5 VDC or ± 2.5 VDC **C-228-1** 4-20 mA
 239	HVAC Control Leak Detection Environmental Testing R & D Scientific	Differential Pressure	0.5"WC to 10 psid ± 0.25"WC to ± 5 psid	0.14%	1.0 max Zero 1.0 max Span	Gas compatible with Stainless Steel, Aluminum	**239** 0-5 VDC or ± 2.5 VDC **C-239** 4-20mA
 264	HVAC and VAV Control Energy Management Systems Clean Room Control Medical Instrumentation Filter Condition Monitoring	Very low Differential Pressure	0.1 to 25 in. WC	1.0%	3.3 Zero 3.3 Span	Air or Inert gases	**264** 0-5 VDC **C-264** 4-20mA

setra

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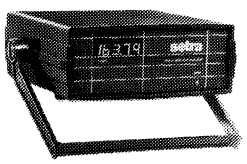
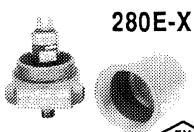
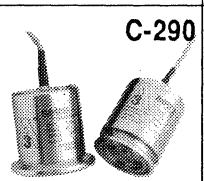
1-800-257-3872, In MA (508) 263-1400
Telex: 4430243, Telefax: (508) 264-0292

Digital Displays and Systems

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Analog Output
 300	Panel Mountable Digital indicators for use with Setra transducers and Transmitters	Gage Pressure Absolute Pressure Differential Pressure Vacuum Barometric Pressure	All Pressure Ranges (4-1/2 digits)	Transducer Accuracy	0 to 5V or 0 to ±2.5V 4-20 mA
 304-1/339-1/350-1	Bench Top Digital Pressure - Manometers R & D Scientific Temporary Field Pressure - Monitoring Transfer Standards	Gage Pressure Absolute Pressure Differential Pressure Barometric Pressure Vacuum Pressure	5 to 100 psig 5 to 100 psia 0.5" to 30" WC ±0.25" to ±15"WC 5 to 100 psid ± 2.5 to ± 50 psid 600-1100 mbar 800-1100 mbar 0-14.7 psiv	± 0.11% (304-1) ± 0.14% (339-1) ± 0.05% (350-1)	0 to 5V or 0 to ±2.5V 6 to 11V (Barometric) 8 to 11V
 360	Panel Mountable or BenchTop - Digital Pressure Gage R & D Scientific	Gage Pressure Absolute Pressure Vacuum Pressure	20 to 2000 psig 20 to 2000 psia 0-14.7 psiv	±0.1%	0 to 5V
 370 240P	Barometric Pressure Monitoring Altimeter Calibration Pressure Switch Setting Laser Interferometers Min/Max Tracking Hi/Lo Alarming Transfer Pressure Standard	Barometric Absolute Pressure	600-1100 mbars 800-1100 mbars 10 to 100 psia	± 0.02%	RS-232

Specialty Application Products

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Thermal Effect ± % FS/100°F	Media Compatability	Output
 280E-XP FM Approved	Explosionproof/Weatherproof Process Instrument Signals Natural Gas Lines Chemical Processing Off-Shore Drilling	Gage Pressure Absolute Pressure Compound Pressure P/I	15 to 10000 psig 25 to 5000 psia -14.7 to 35, 50 100 psig 3-15 psig	0.11%	**280E/C280E** 1.5 max Zero 1.0 max Span	Gas or liquid compatible with Stainless Steel	**280E** 0-5VDC **C-280E** 4-20mA
 C-290	Sanitary Pressure Lines Food & Beverage Processing Tank Level Measurement Pharmaceutical Processing Sanitary Filtration Systems	Gage Pressure	1 to 1000 psig	0.20%	2.0 max Zero 2.0 max Span	Gas or liquid compatible with Stainless Steel	4-20 mA

Accelerometer	Applications	G Ranges (Full Scale Ranges ± G)	Comment
 141	Transportation Equipment Position Sensing Robotics Shock & Vibration Testing	2, 4, 8, 15, 30, 60, 150, 600	Hi Level Output EMI Filter Option

setra
45 Nagog Park, Acton, MA 01720
1-800-257-3872, In MA (508) 263-1400
Telex: 4430243, Telefax: (508) 264-0292

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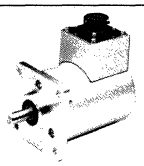
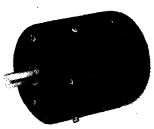
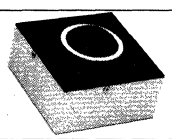
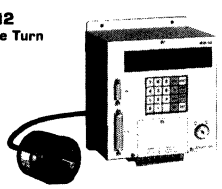
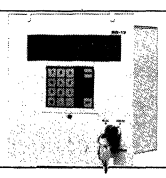
ABSOLUTE POSITION ENCODER

	Resolution	Supply Voltage	Output Code	Output Format	Frequency Response	Outline Dimensions	Shaft Diameter	Features
AE 	2^7 To 2^{13}, 720	5 Vdc	Gray Binary	Open Collector, Positive Or Negative Logic	20 KHZ	2.5" Dia.	3/8"	• Rugged Construction • Sealed Shaft And Connector Against Moisture, Dust And Oil • CW/CCW Rotation Controllable • Square Flange Or Servo Mounting Option • Side Or Rear Mounted MS Connector
 **AT**	360	24 Vdc	BCD	Open Collector, Negative Logic	20 KHZ	2.5" Dia.	3/8"	• Shaft Seal And Rugged Construction For Harsh Environments • TP (Timing Pulse) Output Provided For Positive Position Information • Servo Mounting Eases Position Match-Up With Machine • CW/CCW Option For Increasing Count
AEM **Electronic Multi-Turn** 	2^{24} (2^{11} Primary, 2^{13} Turns)	5 Vdc	Natural Binary	Serial RS-422A	Operating Speed: 4500 RPM	2.95" Dia.	3/8" Hollow Shaft Type	• All Electronic Multi-Turn • Eliminating Gear Life Problem and Back Lash Errors • Surface Mount Technology With Custom Designed LSICS • Auxiliary 2048 PPR Incremental Output • Exclusive Hollow-Shaft With Floating Mounting System And Built-In Bearing

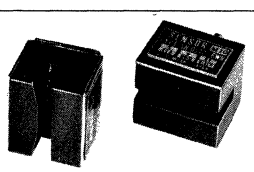
TRACKBALL

	Counts Per Revolution	Supply Voltage	Output	Ball Dia.	Outline Dimensions	Features
 **STB**	170 340 680	5 Vdc	Pulse and Direction	2"	3.35" Square	• Equipped With Non-Contacting Pickups, Providing High Reliability, Long Life And Quick Response • Pulse Outputs For Each Of Four Directions • Smooth Continuous Tracking For Any Direction • Replacement Of Joysticks, Hand Wheels And Other Manual Positioning Devices

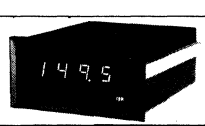
PROGRAMMABLE LIMIT SWITCH

	Number Of Channel	Multiple Program	Resolution	Output Format	Operation Speed	Input Power	Features
SQ-12 **Single Turn** 	24	7	720	Opto-Isolated Open Collector, Negative Logic	2000 RPM Max.	110 Vac 220 Vac	• Gray-Code Absolute Position Input • Teaching Program Capability • Programmable Offset • Built-In Tachometer • Encoder Shaft Speed Display • BCD Position And Pattern No. Output • Multiple Setpoints • Five Switch-Over Functions (RAM/ROM, CW/CCW Directions, Cam Output ON/OFF, High Speed Operation, External Pattern Selection) • Front Or Back Panel Mounting
 **SQ-13** **Multi-Turn**	16	16	10,000	Opto-Isolated Open Collector, Negative Logic	1300 RPM Max.	110 Vac 220 Vac	• Multi-Turn Absolute Position Input • Teaching Program Capability • Programmable Offset • Programmable Decimal Point • External Pattern Selection • Channel Monitor Lamp • CW/CCW Directions Switchable • Error Code Display

SH SERIES PICKUP SENSOR/ROTARY PULSER

	Model Number	Pulses Per Revolution	Supply Voltage	Output Format	Operating Speed	Features
	SH-D 6/6	Per number of teeth of slotted disc.	6 Vdc	Single channel square wave.	5 KHZ Max.	• Non-Contact, Non-Optical And Non-Magnetic • High Frequency Source • Allows Longer Transmission • Impervious To Oil, Dust, Moisture And Vibration • Immersible In Fluids • Compact For Easy Installation • Infinite Life
	SH-D 12/12		12 Vdc		5 KHZ Max.	
	SS18TW		8 Vdc to 24 Vdc		10 KHZ Max	
	SH-DS 12/6WN	Two times of teeth of slotted disc.	12 Vdc		8 KHZ Max.	

DIGITAL TACHOMETER

	Number Of of Digit	Supply Voltage	Gate Time	Frequency Response	Features
PEC-400 	4	AC100V or AC220V	Adjustable from .001 sec. to 9.999 sec.	10 KHZ Max.	• Easily Readable RED LED Display • Adjustable Gate Time • High Noise Immunity • Power For Input Signal Supplied • Miniature Size (3.78 W x 1.89 H x 4.49 D)

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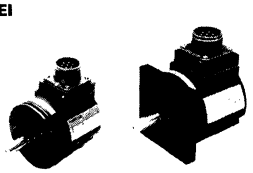
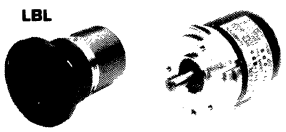
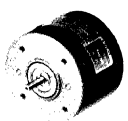
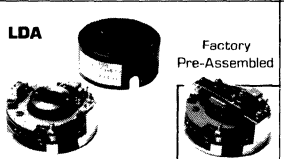
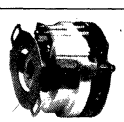
INCREMENTAL SHAFT ENCODER

	Pulses Per Rev.	Supply Voltage	Output Options	Frequency Response	Outline Dimensions	Shaft Diameter	Features
LEI 	Up To 5000 (Direct Read)	5 Vdc 12 Vdc 15 Vdc	Supply Voltage Open Collector Open Collector - Complementary TTL Line Driver CMOS Line Driver	100 KHZ 500 KHZ (Option)	2.5" Dia.	3/8"	• Rugged Construction • Sealed Shaft • Greater Shaft Load Capacity (40 Lbs. Axial, 35 Lbs. Radial) • 100G Shock • Square Flange, 2.50" Or 2.62" Servo Mount Option • Custom Hybrid Circuits • By-Pass Capacitor For Noise Immunity • Side Or Rear Mounted Drip-Proof MS Connector
	Up To 25000 (5X Interpolation)	5 Vdc	TTL Line Driver	750 KHZ			
LFI 	Up To 5000 (Direct Read)	5 Vdc 12 Vdc 15 Vdc	Supply Voltage Open Collector Open Collector - Complementary TTL Line Driver CMOS Line Driver	100 KHZ 500 KHZ (Option)	2.50" Dia.	1/4"	• Expedient, Moderate Cost • Instrument Grade • Compactness (2.5" Dia. X 2.0" L) • 2.62" Servo Mount • 3 Face Mounting Options • Low Starting Torque • Custom Hybrid Circuits
	Up To 25000 (5X Interpolation)	5 Vdc	TTL Line Driver	750 KHZ			
LBL 	Up To 2048	5 Vdc 12 Vdc 15 Vdc	Supply Voltage Open Collector Open Collector Complementary TTL Line Driver	100 KHZ	1.5" Dia.	1/4"	• Compactness (1.5" Dia. x 1.45" L) • Low Inertia, Low Starting Torque • High Resolution Up To 2048 PPR • Custom Hybrid Circuits • Line Driver (AM26LS31M) Option • Motor Mounting Circular Flange Available
LEC 	Up To 5000	5 Vdc 12 Vdc 15 Vdc	Supply Voltage Open Collector TTL Line Driver Sine Wave	100 KHZ	2.6" Dia.	5mm 1/4"	• Expedient, Moderate Cost • Instrument Grade • Low Starting Torque • High Resolution Up To 5000 PPR Without Interpolation • Motor Mounting Circular Flange Available • Shielded Cable Or MS Connector
MG **Manual Pulse Generator** 	100	5 Vdc to 15 Vdc	Supply Voltage Open Collector Open Collector - Complementary TTL Line Driver	5 KHZ	2.68" Dia.	—	• Used As Auxiliary Position Control • Patented Click Stop Mechanism For Accurate Output • Supplied With 4.70" Or 3.54" Square Panel, Or Without Square Panel

INCREMENTAL MODULAR ENCODER

	Pulses Per Rev.	Supply Voltage	Output Options	Frequency Response	Outline Dimensions	Bore Size	Features
LDA Factory Pre-Assembled 	Up To 1800	5 Vdc 12 Vdc 15 Vdc	Supply Voltage Open Collector TTL Line Driver Sine Wave	100 KHZ	2.17" Dia.	1/4" 3/8" 1/2" 8mm 10mm	• Disc is Pre-assembled By Factory • No Need of Adjustment For Air Gap, Disc Eccentricity, Symmetry And Phasing • Allows Greater Shaft End Play • Line Driver (AM26LS31M) • Custom Hybrid Circuits • By-Pass Capacitor For Noise Immunity • Drip-proof Housing
LBK 	Up To 1024	5 Vdc	TTL Open Collector TTL Line Driver	100 KHZ	1.5" Dia.	1/4" 3/8" 6mm 8mm 10mm	• Disc/Hub Assembly Is Pre-assembled In The Housing, Allowing Quick Installation • No Need To Use Test Instrument For Symmetry And Phase Adjustment • Custom Hybrid Circuits • Can Be Mounted to Either Of Two Different Dia. B.C. -1.280" or 1.812" • Compactness, Low Inertia And Low Cost

INCREMENTAL HOLLOW SHAFT ENCODER

	Pulses Per Rev.	Supply Voltage	Output Options	Frequency Response	Outline Dimensions	Shaft Diameter	Features
LHF/LHJ 	Up To 5000	5 Vdc	TTL Compatible Differential Line Driver, With or Without U.V.W. Outputs	200 KHZ	2.68" Dia. X 1.22" L	3/8" 1/2" 8 mm 10 mm	• Designed To Mount Directly On The Motor Shaft, Eliminating Response Lag • Built-In Shielded Bearing • Greater Shaft Deviation And Runout Is Accommodated By Our Exclusive Floating-Mounting System • LHJ, LHB and LHM Provide U.V.W. Outputs For Pole Detection Of Brushless Motor • Low Overall Profile
LHG/LHB 	Up To 2500	5 Vdc		200 KHZ	1.8" Dia. X 1.7" L	1/4" 8 mm	
LHM/LHN 	Up To 1024	5 V		200 KHZ	1.40" Dia. X 1.70" L	1/4" 6 mm	

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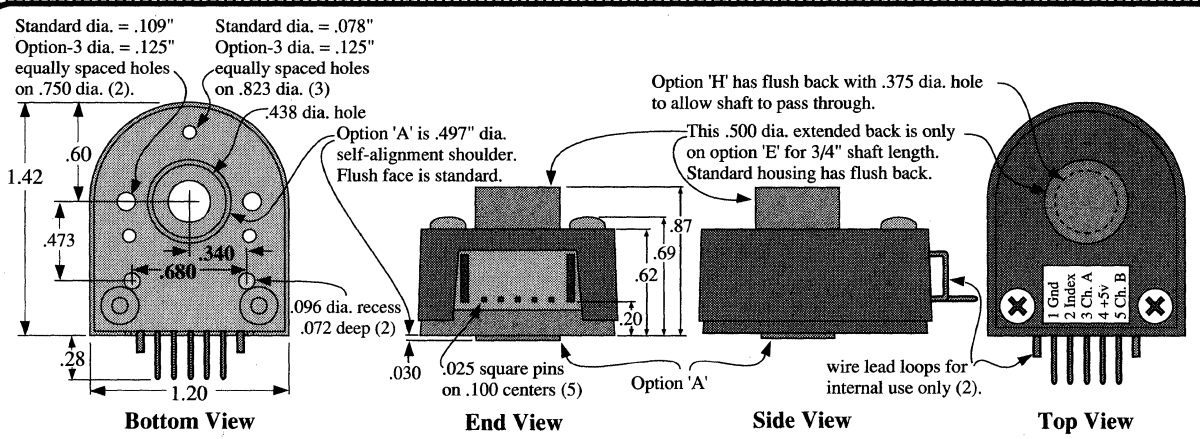
US DIGITAL E2 Quick Assembly Optical Encoder

The E2 optical incremental shaft encoder is a noncontacting rotory to digital position feedback device designed to easily mount to an existing shaft. The internal monolithic module converts realtime shaft angle, speed and direction into TTL-compatible outputs. Simplicity and low cost make the E2 ideal for both high and low volume motion control applications.

Features

- Quick and simple assembly
- Rugged screw-together housing
- Low cost
- Small size
- 100 to 540 cycles/rev.
- 400 to 2160 codes/rev.
- 0 to 35000 RPM
- Tracks from 0 to 100,000 cycles/sec
- 2-channel quadrature TTL squarewave outputs
- 3rd channel **index** option
- -40 to +100°C operating temperature
- Accepts ±.010" axial shaft play
- Compatible with HP HEDS-5500
- Fits .750", .823" or 1.812" bolt circles
- Fits shaft diameters <.316" and lengths >.445"
- Single +5v supply @ 17ma typical, 40ma max.
- Flush back, through shaft hole, or extended back
- Flat or self-aligning base
- Custom mounting adapters available



Ordering Information

Part Number

E2–[ ]–[ ]–[ ]

Resolution Cycles/Rev.

100
200
250
256
360
400
500
512
540

Shaft Diameter in thousanths of an inch

Code	Size
118	3mm
125	1/8"
187	3/16"
237	6mm
250	1/4"
312	5/16"
315	8mm

Options

I = index (3rd-channel)
A adds self-aligningshoulder to base.
H adds hole in housing to allow the shaft to pass through.
E adds an extension to the housing back to allow for a longer shaft.
3 changes the diameter of all five base mounting holes to .125".

- 2 year warranty.
- Next day shipment.
- No minimum

Pricing

$14.00/20,000's
$15.00/10,000's
$16.00/5,000's
$17.00/1,000's
$18.00/500's
$20.00/100's
$22.00/50's
$25.00/10's
$29.00/1's
Add $7.00 for index

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US DIGITAL

SP-500 SP-1000 Softpot Optical Shaft Encoder

The Softpot optical shaft encoder is a noncontacting rotory to digital converter. Useful for position feedback or manual interface, the Softpot converts realtime shaft angle, speed and direction into TTL-compatible outputs. It is a practical solution to the wear, contact bounce and digit bobble problems associated with pots and A/D converters.

The Softpot utilizes an unbreakable disk, metal shaft and bushing, LED light source, monolithic electronics and operates from a single +5 volt supply.

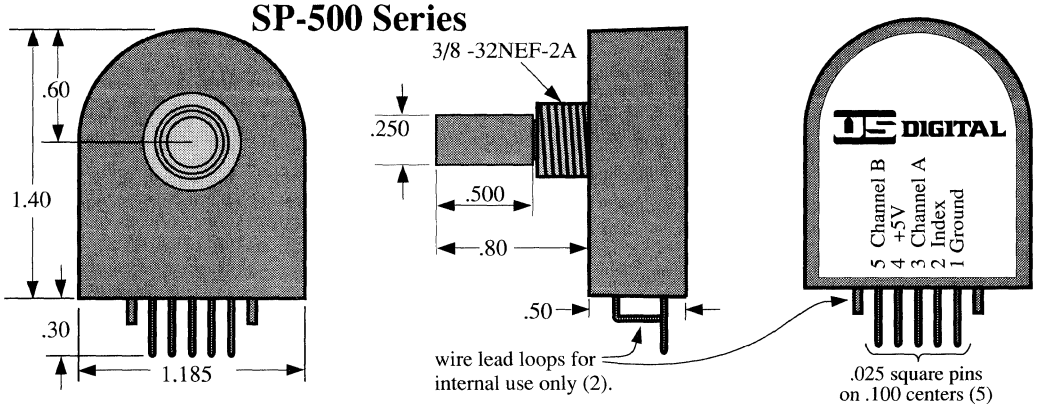
Available with ball bearings for motion control applications or torque-loaded to feel like a potentiometer for front-panel manual interface.

Features
- Small size
- Low cost
- 2-channel quadrature, TTL squarewave outputs
- 3rd channel **index** option
- Tracks from 0 to 100,000 cycles/sec
- Ball bearing option tracks to 10,000 RPM
- -40 to +100°C operating temperature
- Single +5v supply @ 17ma typical, 40ma max.

SP-500 Series
- 100 to 540 cycles/rev.
- 400 to 2160 codes/rev.

SP-1000 Series (2.2" diameter package)
- 1000 or 1024 cycles/rev., 4000 or 4096 codes/rev.

SP-500 Series



Ordering Information

Part Number

SP– ☐ – ☐

Resolution Cycles/Rev.
100, 200, 250, 256, 360, 400, 500, 512, 540

Options
I = Index (3-channel)
B = Ball Bearings
NT = No added Torque

SP-1000 Series **Resolution** Cycles/Rev.
1000, 1024
in 2.2" dia. Package

Pricing

$17.00 /	20,000's
$19.00 /	10,000's
$21.00 /	5,000's
$23.00 /	1,000's
$25.00 /	500's
$27.00 /	100's
$30.00 /	50's
$33.00 /	10's
$39.00 /	1's

Sales Policy
- 2 year warranty
- Next day shipment is normal.
- We have no minimum orders.
- Scheduled shipments are ok.
- We can build to your specification.
- Engineering orders (including special shafts) normally **ship within 24 hours.**

Add
$7.00 for index option.
$7.00 for ball bearing option
$1.00 for SP-1000/1024

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US DIGITAL

SP-16 Softpot

Optical Shaft Encoder

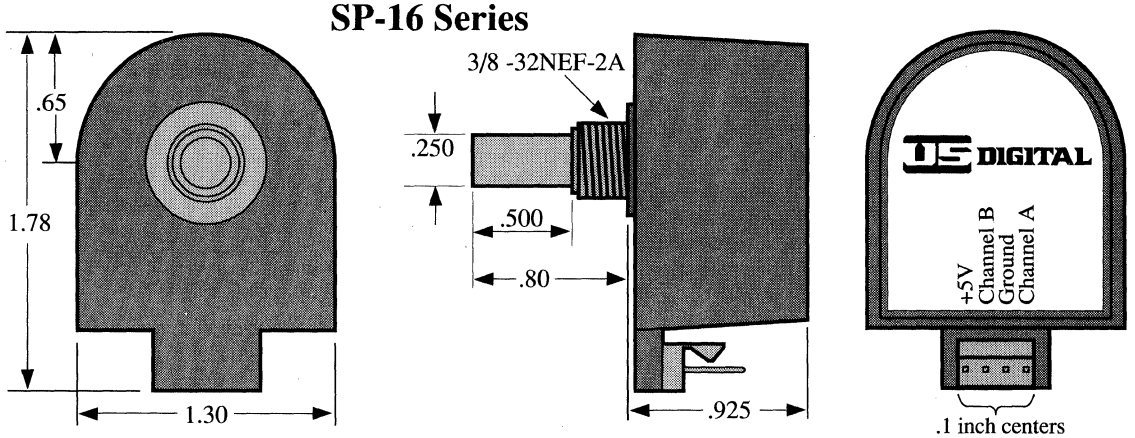
The SP-16 is a very rugged, reliable, low cost optical incremental encoder that converts shaft angle, speed and direction into realtime digital information.

Placed behind a knob on a front panel, the SP-16 offers these advantages over other types of man-to-machine interfaces: Direct rotary to digital conversion with no digit bobble, no contact wear and no mechanical stops. Software limits can be defined by the system designer. No gearing is required for multi-turn operation.

Available with ball bearings for motion control applications or torque-loaded to feel like a potentiometer for front-panel manual interface.

Two quadrature outputs provide 64 codes per revolution (16x4). TTL compatability is achieved by feeding the outputs through an external 74LS244. The internal electronics and LEDs draw less than 27ma from a single +5V supply.

SP-16 Series



Ordering Information

Part Number

SP-16_

Options:
Torque loaded is standard.
NT Specifies no-torque (add $1.00)
B adds ball bearings (add $7.00)

Mating connector part# is SP-16MC.

Pricing

$9.00/20,000's
$10.00/10,000's
$13.00/5,000's
$16.00/1,000's
$18.00/500's
$20.00/100's
$22.00/50's
$25.00/10's
$29.00/1's

Sales Policy

- 2 year warranty on each encoder.
- Next day shipment is normal
- Terms: Net 30 upon approval..
- We have no minimum orders.
- Scheduled shipments are ok.
- We can build to your specification.
- Engineering orders (including special shafts) normally **ship within 24 hours.**

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US DIGITAL A3 Softpot

Absolute Optical Shaft Encoder

Preliminary

This addition to the optical encoder family reports the realtime absolute shaft position. The absolute encoder disk and module is designed to fit into the SP-500, SP-1000 and E2 packages specified on the preceding pages.

Features:

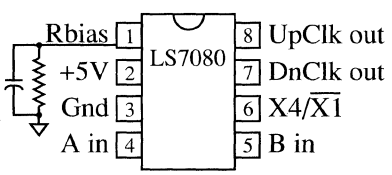
- Absolute position is not lost after power down.
- No need need to "find home".
- Small size
- Low cost
- Tracks from 0 to 50,000 codes/sec
- -40 to +100°C operating temperature
- Single +5v supply
- The absolute position is represented by a parallel binary word which increments for clockwise rotation and decrements for counter-clockwise rotation. The binary code rolls-over for each full revolution.
- Standard resolutions of 100 and 128 CPR are available with a 1 inch wheel, and 100, 128, 200, 256, 360 and 400 CPR with a 2 inch wheel.
- Any special resolution (1-150 cpr with a 1 inch wheel) and (1-400 cpr with a 2 inch wheel) can be provided typically in 1 week.
- Accepts ±.010" axial shaft play

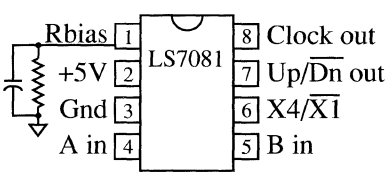
Support Chips

The above absolute encoder eliminates the need for quadrature clock converters and counters. For those applications where an incremental encoder is chosen, two types of quadrature clock converters are available from stock.

Features:

- X4 or X1 mode selection
- TTL and CMOS compatible
- Low power (micro-amps)
- Low cost ($2.00/100's)
- 8-pin DIP package
- No external clocks required
- Drive standard Up/Dn counters

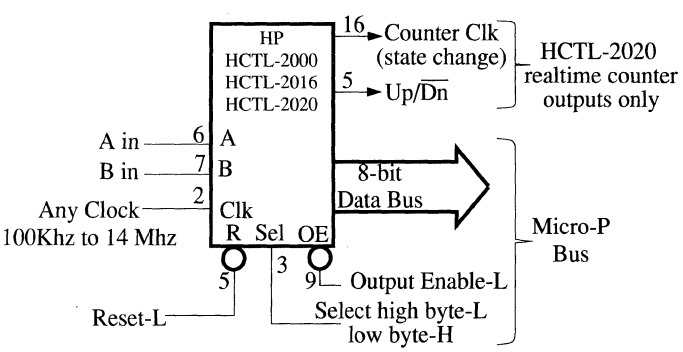




Three types of incremental encoder to micro-processor interface chips are also available from stock.

Features:

- 16 or 20 pin DIP package
- Schmitt trigger inputs
- Digital noise filter
- X4 resolution multiplier
- 8, 12 or 16 binary up/down counter
- HCTL-2020 is 16-bit cascadable
- Latched outputs with inhibit logic
- 8-bit tri-state data bus
- 5 micro-amp quiescent current
- External clock required



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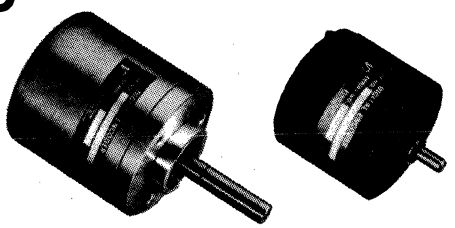
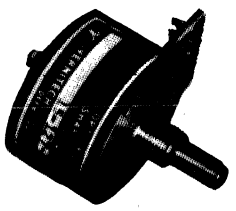
SHAFT ANGLE ENCODERS

SHAFT ENCODERS
CONTACTING AND OPTICAL
INCREMENTAL/ ABSOLUTE



DIAL-CODER™



OPTICAL INCREMENTAL

* Dial-Coder Call Factory For Details

Size	Resolution	Diameter	Length	Features (Optical)	Options
5	To 256 Pulses	0.500	0.85	Only Available in Photo Sensor Output All Solid State Light Source High Reliability TTL, DTL compatible output.	• Sealed* • Index Marker • Quadrature Output • 1X-2X-4X Multiplier* • Extended Temperature Range • Non-Standard Supply Voltage • Photo Sensor Output • HTL Compatible Output* • Open Collector Output* • Rugged Construction* • Line Drivers* • Connectors • Direction Sensing
11	To 1024 Pulses	1.062	1.500		
23	To 1200 Pulses	2.250	1.875		
25	To 3000 Pulses	2.500	2.500		

* Not Available in Size 5

OPTICAL ABSOLUTE

Size	Output Code	Counts/Turn	Least Count Angle	Features	Options
23	Any	Up to 512	0.7°	† Quadrature Output on LSB Available TTL, DTL compatible Counting Speed 30 kHz max. Slew Speed 5000 RPM max. L.E.D. light source Output, parallel non-ambiguous	• Multiturn Available - Size 23 BCD Only - Size 30 - Any Code • Rugged Construction • Extended Temperature Range • 19 Bit Total Count • Other output levels available • Connectors
30	Any	Up to 1024	.18°		

† On Selected Models

CONTACTING ABSOLUTE

Size	Code	Counts/Turn	Revolutions for Full Count	Full Count	Features	Options
11	Gray/Binary	To 256	1 to 64	To 2^{14}	Operating Speed: To 200 RPM DTL/TTL Compatible 5,000,000 Rev. — Life Slew Speed: 1000 RPM Output: Parallel Non-Ambiguous Most units contain internal logic circuits for DTL, TTL compatibility	• Operating Temp.: −55°C to 125°C • Various Output Voltage Ratings • 18 and 19 Bit Total Count • Connectors • Increasing Count — CCW Rotation
	BCD	To 100	1 to 100	To 9999		
18	Gray/Binary	To 512	1 to 2048	To 2^{19}		
23	Binary	To 256	1 to 2048	To 2^{19}		
	BCD	To 400	1 to 100	1 x 10^6 BCD		
31	Gray/Binary	1024	Single Turn	To 2^{10}		

OPTICAL INCREMENTAL MODULAR

Size	Resolution	Light Source	Construction	Features		Options
Unhoused 15 or 23	To 1024 Pulses	LED	Modular	Low Cost	TTL, DTL Compatible 2 Channel Output Index Channel Photo Sensor Output	• Squared Output - Size 15 & 23 • Operating Voltages: 5 to 15 VDC • Photo Sensor Output - Size 15 & 23
5	To 256 Pulses	LED	Modular	Low Cost		

Housed versions also available.

Refer to sections 2440, 3500, 4750 for additional product listings.

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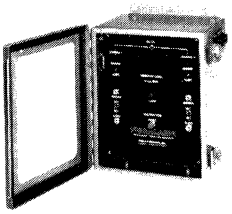
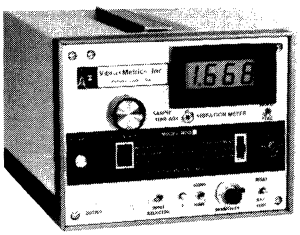
MACHINERY VIBRATION MONITORS



Monitoring Level: 0-1 ips RMS
Frequency Range: 5-3,000 Hz (3db)
Colored LED's: Alert—Amber, Danger—Flashing Red, Channel Status—Green to Red—Auto Guard Transducer malfunction
Trip Accuracy: 5% of setting
Two Trip Levels: Alert, Danger; adjustable front panel set pots
Internally Adjustable Trip Delays: 1-10 seconds—Factory set 8 secs.
Trip Level Calibration/Check via Level Meter
Reset Button (remote contacts available)
Digital RMS Velocity Level Indicating Meter
Channel Selector Switch for Level meter, Calibration & Velocity AC Output
115VAC Input Power (220V option)
Fail-Safe Power Loss Protection (disables Shutdown Relay)
Optional Filters: Low, High or Band Pass
Inputs for (1-6) Accelerometer Signals; rear panel BNC jacks
Outputs: A. AC Signal: 5VAC/ips (peak) BNC jacks (rear), (1) BNC jack (front) B. DC signal: 4VDC/ips RMS (1-6) BNC jacks (rear) C. Two DP/DT relays per channel—3 amps D. Remote Reset (option)

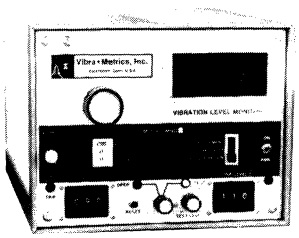
M8D DIGITAL VIBRATION METER [Battery Operated]



Metric scale optional

Functions: Velocity, Acceleration and displacement.
Ranges [Decade]: Velocity-Full scale .02 to 200 in/sec (PK)
Acceleration .002 to 20 g
Displacement to 2000 mils (PP)
Output: 2 Volts (Full scale) AC/DC Recorder option
Frequency Range [3db]:
Accel. 2HZ - 15KHZ
Vel. 5HZ - 3KHZ
Disp. 5HZ - 1KHZ
Accelerometer Power: 2 ma, 15 Volts (DC) from input connector
Filters [Front Panel Selectable]: Plug in optional High pass, low pass or band pass
Accelerometer: 7 - 14 mv/g
70-140 mv/g

M9D VIBRATION METER/MONITOR



Specifications same as M-8D with the following additions

Accelerometer: 100 mv/g

Trip Alarms: One or two

Set Points: Digital 0-200% of Full scale selected.
Outputs: Relay contacts NO/NC BCD (Option)
2 Volts (Full scale) DC Recorder option

VM-350 PREDICTIVE MAINTENANCE VIBRATION METER



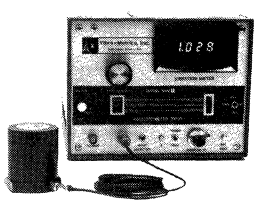
An accurate solid-state instrument for use in predictive maintenance and quality assurance

Velocity Ranges: 0.1 to 30 (I.P.S.)
Frequency Range: 3HZ-5 KHz
Input: Low impedance accelerometer included in vibration probe (VP 300) or individual sensor
Power: Battery
Size: 7" long x 2½" deep x 4" wide

SEISMIC VIBRATION METER SYSTEM

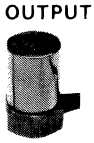
Consists of **M8DSP** Meter and 1030 Seismic Accelerometer

Most Sensitive Full Scale Range:
20 Micro g
200 Micro in/sec
20 Micro in (PP)



VIBRAMITE ACCELEROMETER WITH "BUILT-IN" ELECTRONICS

LOW IMPEDANCE SPECIAL "OEM" DESIGNS

	MICROMITE	MINIATURE	TRIAXIAL	GENERAL PURPOSE	HIGH OUTPUT	INDUSTRIAL	5 VOLTS
							
	0.7 GRAM	1.8 GRAM	10 GRAM			RUGGED	SEISMIC
MODEL	9001	1000/1001	3000	1018/1019	1020/1021	6022	1030
Sensitivity mv/g	7	10	10	10	100	100	5 Volt
Frequency Range [±5%]	5-10K	3-10K	3-10K	3-10K	2-10K	3-5K	.01-200
Noise g(rms)	.004	.0015	.0015	.0015	.00015	.00015	5X 10-6
Iso Shield	NO	YES/NO	YES	YES/NO	YES/NO	YES	YES
Pre-filter Option	NO	NO	NO	NO	YES	YES	YES
Temperature [F]	250	250	250	250	250	250	250
Weight [gms]	0.7	2/1.8	10	15	50	60	485
Dimensions [in]	.25 H x .25D	.4H x .25D	.75H X .5D	.75H x .5D	1.2H x .75D	.2H x .8D	2.5H X 2.5D

MORE THAN 30 MODELS AVAILABLE FROM STOCK. MODELS MEETING API 678 SPECIFICATIONS NOW AVAILABLE!

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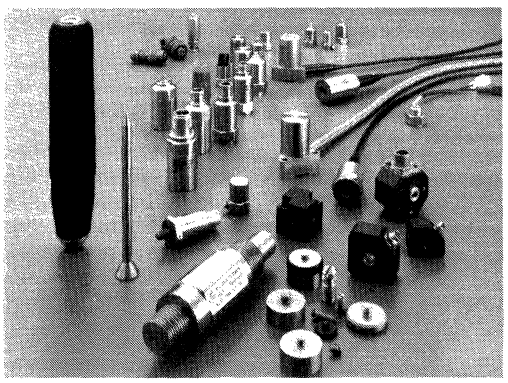
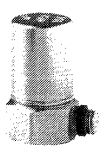
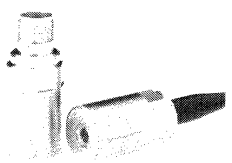
- Complete line of vibration sensors, instruments and accessories

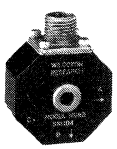


Just a few of over 300 models available from Wilcoxon Research











SPECIAL FEATURES	Miniature Triaxial	Low Mass High Sensitivity	Rugged Industrial	Industrial Low Frequency	Rugged Velocity Output	Industrial Triaxial	Handheld Probe
Model	**733**	**736**	**793**	**793L**	**793V**	**993A**	**HA8**
Sensitivity, mV/g	10	100	100	500	100 mV/in/sec	100	100
Frequency Range, Hz	2 - 4,000	4 - 20,000	2 - 9,000	0.4- 1,000	2.5 - 3,500	2 - 2,000	2 - 500
Ground Isolation	yes	no	yes	yes	yes	yes	yes
Temperature Limit, °C	120	120	120	120	120	120	NA
Weight, grams	24	13	110	135	140	90	150
Dimensions, inches(H x D)	0.75 x 1.35	0.9 x 0.5	2.4 x 1.0	2.4 x 1.0	2.4 x 1.0	1.3 x 2.0	6.5 L x 1.3 D

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FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
Microwave Components, Product Selection Guide **A**•1746
Military Qualified Products List **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide **B**•1233
Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
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Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
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Relays, Product Selection Guide **B**•1397
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Resistors, Product Selection Guide **A**•1835
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SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
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Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
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Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
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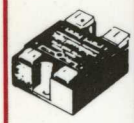

SOLID STATE RELAYS



TERMINAL BLOCKS

CABINETS
- BUD

CIRCUIT BREAKERS
- Airpax
- Aromat
- Heinemann
- Potter & Brumfield

CONNECTORS & SOCKETS
- AMP
- Amphenol
- Aromat
- Curtis
- Custom Connector
- Idec
- Lumberg
- Master Electronics
- Panduit
- Potter & Brumfield
- Souriau
- Vernitron-Beau
- Welcon/Wells

COUNTERS
- Engler
- Hecon
- IVO
- Kessler-Ellis
- Master Electronics
- Omron
- Redington
- Red Lion
- Sodeco/Maxmar
- Stemco
- Veeder-Root

DIODES
- General Instr.

FANS
- Aromat
- U.S. Toyo

FILTERS
- Curtis

RELAYS
- Aleph International
- Allied Controls
- American-Zettler
- Aromat
- AT&T
- Bosch
- C.P. Clare
- Coto
- Crydom Controls
- EAC
- Elec-Trol
- Fujitsu
- Gordos
- Grayhill
- Guardian
- Hi-G
- Idec
- ITT
- Line Electric
- Magnecraft
- Master Electronics
- MEC
- Midtex
- Omron
- Potter & Brumfield
- RBM
- Schrack
- Siemens
- Sigma
- Stantel
- Struthers-Dunn
- Telemecanique
- Theta-J
- Triridge

FUSES
- Bussmann
- Litlelfuse
- Underwriters Safety

KNOBS
- Cosmo/Kurz-Kasch
- Raytheon/Panel Products

INDICATORS, LAMPS & LED
- IDI
- IEE
- JKL
- Leecraft
- Lumex
- Stanley
- Sylvania

SWITCHES
- Acro
- Alco
- American Switch
- AMP
- Aromat
- Arrow Hart
- Carlingswitch
- Cherry Electric
- C&K
- EECO
- Electro-Mech
- Electronic Comp. Group
- Grayhill
- Landis & Gyr
- Linemaster
- Master Specialties
- McGill
- Microswitch
- Omron
- Oslo
- OTTO
- Saia
- Unimax

INDUCTORS
- Jeffers

PHOTOELECTRIC
- Aromat
- Dolan-Jenner
- Omron
- Photoswitch/AB
- Skan-A-Matic

PROXIMITY
- Agastat
- Electro
- Omron

POTS & RESISTORS
- Clarostat
- Ohmite

SOLENOID
- Dormeyer
- Guardian
- Line Electric

TIMERS
- ATC
- Agastat
- Amperite
- Antex
- Crouzet
- Eagle Signal
- Guardian
- Industrial Timer
- Magnecraft
- Master Electronics
- Midtex
- National Controls
- Omron
- Potter & Brumfield
- SSAC
- Struthers-Dunn
- Syracuse Electronics

TERMINAL BLOCKS
- Beau
- Buchanan
- Curtis
- Electrovert
- Kulka
- Magnum
- Marcco
- RDI
- Underwriters Safety
- Vernitron-Beau
- Weldmuller

TRANSFORMERS
- Dormeyer
- Microtran
- Sola
- Stancor
- Thordarson
- Triad
- U.T.C.

WIRE, WIRING DEVICES & HWR.
- Alpha
- Belden
- Buchanan
- Electrovert
- Havey Hubbell
- Iboco
- H.H. Smith
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- Panduit
- Pomona



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